The Story of the
Cape to Cairo Railway & River Route
1887-1922
The Trans-Continental Route.

The present Cape to Cairo Railway and River Route via the Belgian Congo.
THE STORY
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Cape to Cairo
Railway & River Route
from 1887 to 1922.

The Iron Spine and Ribs of Africa.

Volume Four.

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Volume Four.

THE FINANCE, COMMERCE AND INDUSTRY OF THE COUNTRIES SERVED BY THE ROUTE; THEIR GEOLOGICAL FEATURES AND MINERAL PRODUCTION; THE RAILWAYS ON THE ROUTE; AND IRRIGATION WORKS.

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H.M. Secretary of State for the Dominions
THE
Cape to Cairo Route since 1922.
_The Race Between Eastern and Western Arms._

LITTLE actual construction related to the Cape to Cairo route has been in progress since 1922, indeed, the only section that can be regarded as forming part of the trunk north and south system which is actually in hand at the moment is the branch from Tabora northwards to Kahama. This line will be completed to Kahama during 1926 and its extension via Shinyanga to Mwanza has been sanctioned in principle so that within a year or two there will be continuous railway connection between Lake Tanganyika and Lake Victoria. This will eliminate one of the three gaps in the eastern arm of the Cape to Cairo route which cannot yet be traversed by rail or by lake or by river steamer. When the Tabora-Mwanza link is completed there will still remain the motor road from Masindi Port to Butiaba on Lake Albert and the Nimule-Rejaf track.

As a result of a visit of the Ormsby-Gore Commission to East Africa in the autumn of 1924 a programme of new construction is beginning to take shape which will have an important bearing on the problem of through north and south railway communication in the eastern half of the continent. The commission has recommended the early construction of new railways in Tanganyika Territory from Manda (formerly Wiedhafen), on Lake Nyasa, to Ngerengere on the Tanganyika Central Railway and from Dodoma on the Central line via Kondoa Irangi to join the extended Tanga-Moshi line at Arusha. It has also suggested consideration of a new link between the Uganda Railway at Tororo and the Nile, somewhere between Lake Albert and Nimule. Construction of these important trunk routes would provide a continuous if roundabout rail connection between all three of the great lakes and the Upper Nile. In this way the Masindi Port-Butiaba road would be cut out of the Eastern arm of the Cape to Cairo route and only the Nimule-Rejaf track would be left. Unfortunately there seems little immediate prospect of a railway being built between the two last named points and if this awkward gap in the route is to be filled up in the near future it will probably be as the result of developments to the west of the Nile.

At the southern end of the Eastern arm although the bridging of the Zambezi has been decided upon whether the extension from Blantyre to Lake Nyasa will be built within the next five years is more
doubtful. Assuming that this is done and that the new railways in Tanganyika and Tororo-Nile connection are put in hand it should be possible within ten years to travel from Cape Town to Nimule by rail and waterway without recourse to road transport and only the hundred miles or so of track between Nimule and Rejaf would prevent the traverse of the entire route from Cape to Cairo by rail and lake or river steamer. This route, with approximate distances, would be as follows:

<table>
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<tr>
<td>Cape Town to Lake Nyasa (3ft. 6in. rail)</td>
<td>2,535</td>
</tr>
<tr>
<td>Lake Nyasa (steamer)</td>
<td>-</td>
</tr>
<tr>
<td>Manda to Upper Nile via Ngerengere, Dodoma, Arusha, Vio, Nairobi, Eldoret and Tororo (metre gauge rail)</td>
<td>300</td>
</tr>
<tr>
<td>Nile (say Wadelai) to Nimule (steamer)</td>
<td>-</td>
</tr>
<tr>
<td>Nimule to Rejaf (track)</td>
<td>-</td>
</tr>
<tr>
<td>Rejaf to Kosti (steamer)</td>
<td>-</td>
</tr>
<tr>
<td>Kosti to Wadi Halfa (3ft. 6in. rail)</td>
<td>-</td>
</tr>
<tr>
<td>Wadi Halfa to Shellal (steamer)</td>
<td>-</td>
</tr>
<tr>
<td>Shellal to Luxor (3ft. 6in. rail)</td>
<td>-</td>
</tr>
<tr>
<td>Luxor to Port Said (4ft. 8¼in. rail)</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7,465</strong></td>
</tr>
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Turning to the Western route the only progress to record is the work of the survey parties sent out by the Belgians to study possible routes between the Congo and the Nile Valleys. It has not yet been decided whether a railway shall be built from Stanleyville via the Kilo-Moto goldfields to Lake Albert or Rejaf or whether the difficulty of traversing the equatorial forest is so great that a route from some such point such as Panga on the Aruwimi river would be more practicable. In the interests of direct communication it is to be hoped that a line from Stanleyville to Rejaf will eventually be decided upon as this would provide rail and river transport from the Cape to the Mediterranean without any road sections.

It is still an open question whether the Eastern or the Western arm will be the first to provide an all-rail and waterway route from Cape to Cairo, but if the Stanleyville-Rejaf line is adopted the odds will be in favour of the Western arm owing to the lack of traffic inducement to bridge the Nimule-Rejaf section by a railway. It may, however, be pointed out that when the extension from Tororo to the Nile is seriously considered the advantage of carrying the line on to Rejaf instead of taking it to some point south of Nimule should be taken into account since the extra distance would not be great.

In regard to feeders and branch lines having some direct connection with the main arterial route from south to north the areas in which most work has been done during the past three years are the Belgian Congo,
Angola, Kenya and Uganda. In South Africa several hundreds of miles of new branch lines have been built or are under construction, but few of these are of more than local interest. The Cape Central Railway has been acquired by the Union Government, who now own the entire South African railway system. In Southern and Northern Rhodesia railway construction has been at a standstill for more than a decade. The recent appointment of Colonel Hammond to inquire into the railway position in Southern Rhodesia, the decision of the Beit Trustees to send a special mission to Rhodesia to report on the requirements of the country in respect of new transport facilities, and the popular demand in the colony for a programme of new construction to open up areas not served by the existing system will, however, undoubtedly lead to a revival of railway building in the near future.

Tanganyika Territory has also a blank record since the war, with the exception of the recent laying of track between Tabora and Kabalo, which is in part merely a replacement of metals that were removed during the Belgian occupation to complete the Kabalo—Albertville line. In Egypt there is nothing to record, but in the Sudan the completion of the railway to Kassala deserves notice, especially as this line may be extended before long via Gedaref to the Blue Nile, which it will cross via the Makwar dam to a junction with the existing Wadi Halfa—El Obeid line at Sennar. Although nothing has been done to extend the railway southwards from El Obeid it may be said that the discoveries of the Congo Nile divide by Major Christy’s prospectors have increased the likelihood that any future all rail connection between the Sudan and Uganda—that is to say, the Congo-Nile link of the Cape to Cairo route—will cling fairly closely to the watershed between these rivers. Whether this railway will be built and whether it will link up with a Stanleyville—Nile line during the lifetime of the present generation it is still too early to prophesy.

In Angola the Lobito Bay line (Benguella Railway) has crossed the Quanza river, the last engineering obstacle of any consequence between the railhead and the Portuguese Belgian frontier, and reached Camacupa, 520 miles from the port, and it is now certain that work will be carried on continuously until a junction is effected with the main Cape to Cairo Western arm near Tshilongo. The completion of this great undertaking will bring into being the first real Trans-African railway, from Lobito Bay to Beira, which will have a length comparable with that of the North American transcontinental routes.

Recent activities in the Congo have been mainly connected with the Bas Congo—Katanga line from Bukama to Ilebo, upon which work has been in progress from both ends for some time past. The operations at the Ilebo end have been much hampered by the congestion of the narrow gauge Matadi—Kinshasa line. The latter is now being reconstructed and converted to 3ft. 6in. gauge and oil is to be substituted for wood fuel.
on the locomotives; later the electrification of part or the whole of this line is contemplated. The French have also decided to push on with their Pointe Noire—Brazzaville line and this will give Stanley Pool a second railway outlet to the sea. At the Bukama end of the Bas Congo—Katanga line progress has been much more rapid. The permanent bridge over the Lualaba is in hand and track has been laid for more than a hundred miles. It is still hoped to complete the B.C.K. line in 1928, but whether this will be done will depend largely on the conditions which may exist on the Matadi–Kinshasa bottleneck in the intervening years.

In Kenya and Uganda the most important work in progress is the extension of the Uasin Gishu line which is to become the main trunk route from Kilindini to the Uganda cottonfields. Survey parties are now at work on the section between Turbo and Mbulumut, the point of junction with the Busoga Railway and the completion of this extension will bring the Uganda Railway into direct physical connection with the Jinja—Mamasagali link of the Eastern arm of the Cape to Cairo route. Several new feeders are to be thrown off this extension, including branches to Kitale and Mumias. The proposed Tororo—Kumi branch is likely to become the first section of a future trunk line connecting the Uganda railway with the Nile, to which reference has already been made.

Undoubtedly we are on the eve of a new era in connection with transport in Africa. The Ormsby-Gore Commission, whose report is a masterly document, recognises transport as a matter of supreme importance, and their decision has been endorsed by the Imperial Government, which has introduced legislation providing for a loan of £10,000,000 for transport development, as recommended by the Commission. Most of this will no doubt be spent on railway extensions and improvements. It is a recognition that the people of Great Britain are taking a keener interest in the development of these great territories, and that lack of communications should not be a handicap to their productive capacity. It is indeed an excellent sign of the times that the Under-Secretary for the Colonies should personally head a mission of investigation to East and West Africa, thus bringing the Home officials into direct touch with the Dominion areas, and enabling them thereby to have a far clearer understanding of their vital problems.

The construction of the Cape to Cairo route, it is necessary to point out, is not being pursued as an end in itself. Completion of this great transcontinental artery can only come as the result of a gradual piecing together of a number of now isolated systems built for quite other purposes. For this reason the progress of the Cape to Cairo link goes on largely unnoticed but one day the world will discover, with not a little astonishment, that the last link has been forged and that a practicable highway through the length of Africa from the Mediterranean to Cape Town has suddenly come into being.
Major the Hon. Wm. ORMSBY GORE, M.P.
Under Secretary of State for the Colonies, 1926
Section I.

Economic, Commercial and Industrial Development from 1887 to 1924


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THE STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

THE FOUNDER'S VISION.

From Table Mountain to the Nile.
Economic, Commercial and Industrial Development of the Route

From 1887 to 1924.

INTRODUCTION.

The complete history of Africa's trade has never been written, and probably never will be. It begins in a remote antiquity beyond the reach of the keenest research, and even in its comparatively modern chapters there exist wide gaps filled only with the formless obscurity of foggy conjecture. Yet that history is the essential story of Africa itself, the very heart of the age-old romance of the great continent, the unfailing major strand in the long-drawn threads of the oldest story in the world. We turn to Africa for some of the earliest records of human endeavour, and always underlying each revelation of the dim past we discover the motive power of economic necessities, and the influence of commercial rivalries and interactions. We turn also to Africa for the latest and greatest evidence of human engineering skill and persistent organising power, the magnificently conceived Cape-to-Cairo railway project, now so far advanced toward completion, and again we find the underlying essential factor in commerce.

In the main, the story of Africa is neither more nor less than the story of its great trade route from north to south, from Cairo to the Cape, with a separate chapter for each of the tributary routes branching east and west from it, the ribs that spring from the 4,200 miles of spine. From the lost ages when the first pioneers ventured the bold journey that led them from the Asiatic cradle of the human race to tap and traverse the African road of riches, to the days when the fleet of Necho the Egyptian, manned by Phoenicians, circled the Continent, and thence onward to the opening of Portuguese enterprise along the eastern and western ribs that stretch to Mozambique and
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE
Angola respectively, until finally Dutch and English opened up the extreme southern terminus, always the lure was Africa’s wealth of strange merchandise and vast trading opportunities. It was that which made the ancients tread out a route southward as far as Zambezia, and it was equally the magnet which drew European enterprise to the opening of a way northward from the Cape during recent centuries. The building of the Cape-to-Cairo railway represents the latest chapter of an age-long history, an effort to equip the historic route to meet the vaster commercial needs of to-day, but it is a chapter which appeals to the imagination as no other has done, for it covers epoch-making developments during a period in which events have moved more rapidly than in all the unnumbered centuries preceding it.

It is no small task to record a survey of those events in orderly and intelligible fashion. So numerous, so varied and so widely separated are the markets dependent on the road of shining steel which has now almost completely replaced the old desert tracks and bush paths which formerly linked the ends of the Continent, that the story can only be told piece-meal. The miracle of British South Africa’s enormous development in a few short decades, the vicissitudes experienced in building up a modern commercial and industrial edifice worthy of Egypt’s ancient glories, the rescue of huge spaces in Central and West Africa from barbarism for the service of civilisation, the tapping of the rich natural resources of the Belgian Congo, the opening of the fertile Eastern Territories to European colonisation and trade, must each be considered separately, their only connecting factor being the great trade route and its tributaries which serve them all. Ancient history begins at the northern end of the route, where once the chief commercial centre of the world hummed with activity while only the primitive Bushman roamed the unmade garden of the Cape Peninsula. Modern history, however, must reverse the old order by beginning at the southern terminus, where was born the immense commercial movement out of which grew the pressing necessity for the Cape-to-Cairo scheme and where laboured the great statesman who found in the fulfilment of this necessity his life’s true mission.

Therefore we take up the tale of African commerce by picturing the commercial and industrial conditions prevailing, the irresistible economic forces already operating in British South Africa in that momentous year, 1887. Later we shall come to deal individually, and with equal detail, with all those other markets of which the Cape-to-Cairo route is the vital artery, from Mozambique and Angola to Egypt itself; but the roots of our story lie deep and firm in the great southern land of Anglo-Dutch endeavour.
**BRITISH SOUTH AFRICA'S IMPORTS AND EXPORTS, 1887-1923.**

(Not including Government Stores.)

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<th>Exports</th>
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Note.—In the war period 1914-18, the gold export was not included in the official returns.

A Banknote issued by Messrs. Mosenthal Bros. at Capetown in 1887, a series which was freely negotiable by the South African Farmers at the time. There was no financial backing behind the notes apart, of course, from the promise to pay on demand and signed Mosenthal Bros. and Co.
Trading and Industrial Progress of South Africa.

I.—CONDITIONS IN THE 'EIGHTIES.

H I R T Y - F I V E years ago British South Africa lay fallow to enterprise. To-day, it is difficult to realise all that is meant by that bold statement. In 1887 the Transvaal and Orange Free State possessed no railways whatever; the mileage open in the Cape Colony and Natal was severely limited; and Rhodesia was still in the grip of the Matabele to the practical exclusion of white men. Agriculture was the principal industry, though almost universally worked on unprogressive lines; the diamond industry had been in full blast at Kimberley for some 17 years; but gold mining was in its infancy, the "rush" which followed the discovery of the Sheba Reef having occurred during 1886. The total value of the import trade in 1887 was a mere £7,300,000, of which, however Great Britain held a share equal to £6,027,000. The exports were of about the same meagre total value. The white population of all the four territories which now comprise the Union of South Africa was only 620,000, and the coloured population less than 2,600,000.

In those days, in fact, there was no adequate industrial basis on which to support a large volume of trade. Great things were to come, but they were not yet. In place of the one present complex and highly developed commercial system there existed the "Coast houses," then advancing towards their palmiest days, with a thin network of small general stores throughout the country, and an army of peripatetic "traders," carrying miscellaneous stocks from farm to farm by means of the slow-moving ox-wagon. The trade was done mainly by primitive methods of barter, with an enormous multiplication of profits, the farmer giving his produce in exchange for merchandise, while the storekeeper and "trader" paid their debts by passing the produce they collected on to the "Coast houses," who in turn covered their imports by shipping it to London. Thus the "Coast house," the storekeeper and the "trader" each took a first profit on the imported goods which passed through their hands to the farmer, and then duplicated this profit by each putting a margin on the produce with
South Africa's Shipping Pioneer

SIR DONALD CURRIE'S influence in connection with the earlier development of South Africa extended far beyond the mere domain of maritime communication. In the shipping sphere his association with the country commenced in 1872 with the addition of South African ports to the itinerary of the old Castle Line, which he had established some ten years before on the Calcutta route. As an arbiter he likewise served South Africa well, for he received the C.M.G. for his services during the Diamond Fields dispute and received the thanks of the Free State Volksraad.

But he will always be remembered for his management of, first, the Castle Line and later, on its amalgamation with the Union Line, of the joint service which has played so prominent a part in the development of South Africa's trade. Indeed, in the realm of transport, Sir Donald Currie made history, whether it be in the expansion of the Union-Castle shipping services or, for example, his transport arrangements in the Zulu and the first Boer wars, and in recognition of which the K.C.M.G. was conferred upon him in 1881. He was created a G.C.M.G. in 1897 for his Imperial and commercial work in South Africa.

The Union-Castle line as he left it, to be subsequently taken over by the present Lord Kylsant's interests, is the best testimony to Sir Donald's far-sighted courage and business acumen. If any further evidence of the latter were required the sale of his interest in the Kimberley Diamond Fields for half a million sterling would supply it. His many benefactions show how worthily he applied the wealth of his own making, and on the roll of those who have contributed to the country's greatness the name of Sir Donald Currie will for ever remain prominent.
which they paid their debts. It was a crude system, suitable to the prevailing circumstances of the time, but obviously impossible once trade began to develop on any scale. Such is a rough picture of South African commercial conditions at the point where our record begins—a vast and largely undeveloped pastoral and agricultural country, a white population almost negligible in number, a system of trading by barter, few large towns apart from the four or five principal ports, a diamond industry in being at Kimberley, and a gold "rush" beginning in the Transvaal, with Johannesburg no more than a collection of tin shanties on the veld.

Even in those days transport was recognised as the essential factor in the country's progress, and, though railway development was still comparatively small, a regular mail shipping service had been in existence between England and the Cape for exactly 30 years. For 11 years, in fact, the mail contract had been divided equally between the Union line and the Castle line, an arrangement which continued until the amalgamation of the two companies in 1900. Each company dispatched two mail vessels and two "intermediate" steamers a month, the Union boats using Southampton, and the Castle vessels London and Dartmouth, and on the homeward voyage, Plymouth. The Clan line also ran a regular service every three weeks, while cargo boats of these and other companies were dispatched according to requirements.

The principal railways were, in the Cape Colony, the Cape Town-Kimberley line, the Midland line, and the East London-Aliwal North line; and in Natal, the line from Durban to Pietermaritzburg, and thence on to Elandsbaagte. It was not until 1890, or three years after our record begins, that the British lines were carried beyond the Cape and Natal boundaries under agreements with the Transvaal and Orange Free State Republics.

Such is a brief outline of the commercial conditions and facilities existing in 1887 in the several territories which now constitute the Provinces of the Union. But already two important factors were operating to enlarge the scope of industry and trade. On the one hand diamond and gold-mining were beginning to increase the country's wealth on an unprecedented scale; on the other the "Coast houses" were making their influence felt in the direction of stimulating the introduction and development of various industries on which the enlargement of commerce depended. Manufacturing activities were then beyond the scope of their immediate ambitions, but full credit has never been given to the great merchant houses for their incalculable services in pioneering new lines of agricultural and pastoral production which are now South African staples.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

South Africa's Pioneer Merchant Firm.

THE HOUSE OF MOSENTHAL, ESTABLISHED 1839.

The Late Mr. ADOLPH MOSENTHAL.

The Late Mr. JOSEPH MOSENTHAL.

The Late Mr. HARRY MOSENTHAL.
The House of Mosenthal, for example, had already been a force in South African trade and industry for a generation and more when the Cape-to-Cairo Railway became a matter of practical politics, and one of its founders, the late Adolph Mosenthal, father of Mr. William Mosenthal, the present distinguished head of the firm, had for nearly half-a-century been honoured as the founder of the important mohair industry. It was, indeed, his enterprise which led to the introduction of the first Angora rams from Cashmere and Asia Minor in 1838, the ancestors of the modern South African type, which is the result of crossing the pure-bred importations with the white Boer goat. To other members of the firm the diamond industry also owes much, notably to the late Mr. Harry Mosenthal, who was for a lengthy period one of the ablest members of the De Beers directorate.

So with others of the great merchant firms, very unostentatiously, but no less substantially, Mr. Charles Dyer, of Messrs. Dyer and Dyer, Ltd., has done more than most men to encourage the nascent cotton industry in the Cape Province, both by financial and other support; while he and his brothers, Mr. Fred Dyer and the late Mr. Tom Dyer, have played no small part in developing the wool export trade on which the growth of the wool industry has always depended.

It has to be realised that in 1887 the merchant community in South Africa was, for all its vigour and public service, a comparatively small body. The bulk of the £7,300,000 which represented the country’s importations in that year and the similar amount realised for exports of produce passed through the hands of the relatively few “Coast houses,” practically giving them the control of the trade, and making their influence a deciding factor in almost every form of commercial and industrial activity. They may be said collectively to have possessed a great monopoly, but hardly by intent, and certainly not by any sinister design. It arose automatically out of conditions in the market, and the best proof that it was natural and beneficial under the circumstances of the period is shown by the fact that it steadily disappeared as conditions altered and developed with the passing years. While the country remained purely agricultural, the inevitable result was to make the wholesale merchants the dispensers of credit. They were the architects of both the inward and outward trade, organising and financing the far-spread system of distribution and collection. The majority of storekeepers were in reality little more than their tied agents, dependent on them equally for supplies of European goods and for the disposal of the produce which the farmers bartered for those goods. For a lengthy period there would have been little
trade worth the name if the "Coast houses" had not provided the money and the machinery of distribution. Each of the large firms, of course, had its buying office or branch house in London, on whom it indented for supplies of manufactured goods, and to whom it looked to arrange for placing its shipments of South African produce on the English and other European markets.

Yet this era of the "Coast houses" was by no means a stationary one. Although the system was apparently concrete and complete there were in 1887, and had been for years previously, indications of newer and broader developments to come. For example, a certain number of independent importers had come into existence under conditions outside the sphere of the "Coast houses," and there were others who in part fulfilled the functions of the latter while also importing direct for the service of their own retail stores.

Already the "universal provider" was a power in the land, as, indeed, could only be expected. Cartwrights and Fletchers of Capetown, who amalgamated in 1922, had been established since 1836 and 1844 respectively; Morum Bros. had made Queenstown their headquarters since 1861; E. W. Tarry & Co., Ltd., had opened at Kimberley in 1870, the year in which diamonds were discovered and a mining settlement founded; Cuthberts, the great footwear house, were in being at Grahamstown as early as 1883; Jagger & Co. opened at Cape Town in the same year; Champions, Ltd., started in Bloemfontein in 1884; Garlicks. Stuttaford's and other equally well known firms were also running large retail stores before 1887. These, of course, were all independent of the "Coast houses," and it was inevitable that their numbers and influence should increase as important urban centres developed and multiplied inland.

These "universal providers," who have since enormously advanced and consolidated their position in the market, were, perhaps, the most notable portent in 1887; but even then the discerning could discover unmistakable signs of other new phases of trading activity in course of evolution. Here and there in such veld centres as Klerksdorp was before the discovery of gold, existed general stores such as that of Thomas Leask & Co., who since 1872 had possessed a reputation as outfitters of big game hunting and exploring expeditions. Firms of this kind were strong enough to be independent buyers and direct importers, and their independence and financial strength naturally advanced remarkably under the stimulus of the early years of the rise of the great gold industry. Moreover, their numbers were added to rapidly under that stimulus. Not only were new firms started in the
"SPECIALIST" IMPORTING FIRMS

various townships that sprang up along the Witwatersrand and elsewhere, but the whole country was so enriched by this source of wealth that many a "tied" storekeeper experienced such prosperity that he soon found himself able to dispense with the heavy credits on which he had formerly depended from the wholesale firms, and, even though relatively few could embark on direct importing operations, many became free to buy from any source they chose within the borders of South Africa. The result of that, of course, was to bring into existence a number of new wholesale suppliers at both coast and inland towns, and particularly at the quickly expanding mining centres where money was being spent freely and new stores were springing up in shoals. At the same time the "Coast houses" did not stand still. They shared fully in the general prosperity, and many of them promptly opened branch houses at Kimberley, Johannesburg and elsewhere, to cope with the increasing demands made upon them. The new forms of competition did them no injury, but were simply the necessary outcome of the immense and rapid widening of the character and conditions of the South African market as a whole.

The early nineties especially were a period of wonderful expansion, and saw for the first time the creation of what may be called specialist importing firms. On the Witwatersrand, for example, the needs of the gold industry soon induced enterprise in the shape of the establishment of businesses handling only the special types of machinery and materials used on the mines. As early as 1887, indeed, the well known firm of William Hosken & Co., Ltd., was established at Johannesburg, and among other typical concerns of the period were Reid Bros. (S.A.), Ltd., who came into being a year later. From then onward the number of such specialist firms grew, a feature of this class of business being the handling of various makes of machines and tools under territorial agency rights.

Such were the main directions on which the commercial organisation of South Africa was developed in those days of the expansion created by the rise of the diamond and gold mining industries. But with all the widening of the organisation, there occurred no material deviation from the essential method on which the import trade was conducted. South Africa, in fact, has always remained more consistently loyal to that peculiarly British institution—the "confirmed indent" system—than any other market, and its credit and attractiveness to manufacturers and shippers alike has consequently always stood exceptionally high. That happy result is more attributable to the sound and healthy influence of the "Coast houses" than to any other factor. They established the system in the days when
transport was slower and less adequate, when trading facilities were incomplete and clumsy, and when the wholesale system of trading on credit rendered the maintenance of the credit of the market as a whole a matter of sensitive importance to every individual merchant. The system continues to this day with the happiest results, though naturally enough some new features have been grafted upon it. The old merchant firms operated through their own buying offices or associated houses in London, and continue to do so. They passed indents to their representatives in the Metropolis, who placed the orders with manufacturers and took all financial responsibility. The rise of the smaller independent importers, however, called for a modification of this arrangement. They were not always in a position to open a London office of their own, and so were compelled to utilise the services of general shippers who were essentially middlemen like themselves. The more ambitious soon sought to obtain manufacturers’ terms, and this afforded an opportunity for commission buying agents to establish themselves in London, Manchester and elsewhere, while it also drew to the South African market the attention of established agents who were already buying for other countries. Thus the commercial machine grew, and by the end of the nineties it was sufficiently broad-based and adaptable to serve any requirements and to operate successfully under any conditions. But the nineties were in themselves very eventual, and pregnant with future events, and we proceed to a detailed survey of what was occurring between 1887 and 1899 because a complete knowledge of that period is essential to an understanding of the market’s history subsequent to the unhappy South African War.

II.—The Pregnant ’Nineties.

If the nineties saw the shaping of South Africa’s commercial machine, it was even truer that they were the period in which the trade itself assumed a distinctive character and volume. So far as exports were concerned these had, of course, already been in the making for half-a-century or more, and within their well-defined limits, were established on more or less permanent lines. Yet, as we shall show, they were on the verge of revolutionary developments in 1890; while the import trade hitherto of a well-marked and hum-drum character suited to the needs of a pastoral and agricultural country, was destined to experience still more sensational changes. In fact, within the brief period of ten years from 1890 to 1900, oc-
curred the birth of practically all the main features of South Africa’s present-day trade.

It was during that period that British South Africa and the two free Republics, though in political antagonism to an acute extent, jointly laid the foundation of their future as a creditor country. Hitherto, they had maintained an even balance between exports and imports, the figures for both inward and outward trade rising steadily by relatively small amounts from year to year, and always the totals were as nearly equivalents as possible. South Africa was paying its way, but its progress was as uninteresting as respectable solvency usually is. The total imports, including a small quantity entering Rhodesia through Beira, were valued at £7,300,055 in 1887, advancing to £12,973,080 in 1889, while the average exports for the period were about £9,000,000 yearly.

Now we come to the time when the rising gold industry made its first deep impression on the economic life of the country. In 1887 the Transvaal mines produced gold worth only £169,401; in 1890 the output had jumped to £1,869,645; by 1895 it was £8,569,555; while in 1898, the last complete year before the South African War temporarily brought operations almost to a stoppage, the total reached £16,240,630, or practically double. Obviously, this great and rapid accession to the produced wealth of the country was not accomplished without a corresponding expenditure on machinery, stores, wages, food and many other details which went to the building up of an import trade of unforeseen proportions. The mines created new and valuable markets for farm produce, thus stimulating general agriculture; while they led to the building of a chain of townships along the Reef and elsewhere, with growing and enterprising populations who helped to raise the per capita buying power of the country, and eventually proved important factors in making the establishment of certain manufacturing industries possible.

Nor were the gold mines alone in exerting a marked stimulus on trade at this period. Kimberley, with its diamond output of over £4,000,000 per year, was a centre of regulated influence of the utmost importance; and among other mineral activities then contributing to South Africa’s wealth were copper (over £400,000 per annum), coal (2,534,014 tons in 1898), and blue asbestos, which latter was first mined in the Prieska and Hay Districts in 1893 by the Cape Asbestos Co. Coal, of course, had itself felt the benefit of the rise of the diamond and gold industries, both of which provided regular markets for it, and thus led to its production on a substantial scale for the first time. The wool, mohair, skins and ostrich feather industries were also in full swing, and were producing
on a scale more or less equivalent to that of to-day. In Natal, sugar production felt the stimulus in a smaller degree, though it was not until the first decade of the 20th Century that it made any great advance; but the tea industry doubled its productivity during the nineties, the output of dried leaf rising from 690,000 lb. in 1893 to 1,200,000 lb. in 1899.

Yet it took some years for the import and export trade to feel the full benefit of all this new activity. During the first half of the nineties both the incoming and outgoing trades maintained an even balance of roughly £13,000,000 each per annum, as against about £9,000,000 per annum during the late eighties, and it was not until 1895 that the full forward movement began. In that year the imports jumped to £16,983,357, proceeding to £25,238,382 in 1896, reaching their highest point with £26,779,009 in 1897, and then falling back to £23,905,516 in 1898 and £22,122,898 in 1899. The average annual value of the exports during those five busy years was £22,005,457, thus making South Africa, as previously mentioned, a creditor nation with a greatly improved standing in the world of commerce and finance, and with a substantial trading balance on the right side.

Unhappily, the last two years of the decade were overshadowed by political tension and forebodings of fratricidal war, the effect of which was naturally to hinder and curtail business activities. The annual values dropped, as explained above, and then the war-cloud actually broke. It caught the market just as the latter seemed to be well started on the upward path of expansion, when no lesser disaster could have stopped the development of the country's great natural wealth. Even to the business men engaged in the turmoil of those pregnant years the fulness of the future was no mere vision, but a solid certainty. To few great communities is it given to feel and know, as they undoubtedly could feel and know, the greatness of the possibilities immediately beneath their hands. And then came the shattering stroke of war to threaten with destruction the results of all those years of pioneering and building. It certainly meant the end of a social, political and economic chapter, and it might have seen the end of the existing commercial structure.
Mr. Wm. MOSENTHAL,

Senior of
Messrs. Mosenthal, Sons & Co.,
London and South Africa
Commercial Progress since the Boer War.

III.—FROM 1899 ONWARD: THE POST-WAR PERIOD.

Instead of proving a disastrous end to commercial progress, the South African War of 1899-1902 was destined to mark the opening of a still more spacious and expansive era. None of the enterprise that went before was lost; on the contrary its fruits proved a handsome legacy from the pre-war years. There was, of course, a temporary check to trade, yet in its total effect it proved very slight and had been replaced by a great forward impetus in importing activities long before hostilities ceased, while export business took but a little longer also to regain its feet and pass on to new records. This is fully demonstrated by the trade returns of the period. In 1897 a higher point was reached than had ever before been attained, with £26,779,009 as the value of the imports, but in 1898 this figure receded to £23,905,546. Then came the opening year of the war, 1899, when the total fell to £22,122,898, an amount which, in spite of fluctuations, has invariably been exceeded in later years. In fact, in 1900 the total rose once more to £23,700,115, and then for three years in steady progression the figures ascended to new records as follows:

Year 1901 ... £31,594,629
., 1902 ... £47,167,581
,, 1903 ... £52,562,312

The latter represented the peak of a commercial boom which could not be maintained, but it indicated that the market had permanently developed an absorptive capacity out of all proportion to its previous scope. It may be said, in brief, that the South African War marked the attainment of the market’s adult stage.

The export trade made its first substantial advances in 1902, and this, it need hardly be said, was mainly due to the recovery and re-establishment of the gold industry, though wool, mohair and other products contributed in their degree. For the period 1900-1904 the average value of the arrival shipments was £19,159,094, but it is interesting to note that the actual yearly totals showed a wide variation. For example, the amount recorded for 1901 was only £15,511,867, but in the following year it jumped to £23,000,000, again in 1903
Commercial Johannesburg To-day.

1. The New Town Hall.
2. Consolidated Buildings, the Headquarters of the Barnato group.
4. Railway Headquarters, Johannesburg Station.
to £31,303,000, when imports also reached their highest point for the time being.

Interest centres, however, specially in the events of 1902 and 1903. Those two years saw the great boom which followed immediately after peace was declared, the subsequent collapse of which led to a series of commercial disasters which made a deep impression on the trade of the country and the firms engaged in it. They were years which made their influence felt permanently both for good and evil on the commercial life of South Africa, and looking back dispassionately, it is not too much to say that the good far transcended the evil. Money was very free, and was applied lavishly to carrying out ambitious policies, which have been justified in the course of time, but which in numerous cases for some years represented crushing burdens to those who had ventured upon them. The notorious "bricks and mortar" policy provided an outstanding instance of this. The mark of that policy shows boldly to-day in the principal business centres, notably Cape Town and Johannesburg where numerous handsome structures which adorn Adderley Street, or Commissioner, Eloff, Fox, President and Pritchard Streets, bear the names of firms and individuals prominent both then and now in the world of commerce. Indeed, it is sufficient to mention at random Burmester's Buildings, Stuttaford's Chambers, Garlick's Building, Fletcher's Chambers, the Thomson Watson Buildings, Heynes Matthews' Buildings, Cartwright's Building, Jagger's Building, the Union-Castle Co. Buildings in Capetown; or Bain's Buildings, Jooste and Bryant's Buildings, Jeppe Arcade, Parker Wood's Chambers, and Standard Bank Chambers, (Commissioner St.), Store Bros.' Buildings, Chudleigh Bros.' Buildings, Cuthbert's Buildings and Norman Anstey's Buildings (Eloff St.), Beckett's Buildings, Henwood's Arcade and Hulett's Buildings (President St.), Hepworth's Buildings, National Bank Buildings, and Thrupp's Buildings (Pritchard St.), Greenacre's Buildings (Rissik St.), and Tarry's Buildings (Simmond's St.), in Johannesburg. While it would be untrue to suggest that all or any of these were merely products of the great revival of 1902-1904, or that they were in any sense burdens to their owners during the difficult years that followed, it is none the less a fact that the boom did produce a remarkable number of fine structures built out of the temporarily generous resources of various commercial and financial concerns, and that this locking up of capital resulted in wholesale difficulty and many disasters when securities fell in value during the subsequent lean years and the money thus heavily invested was urgently needed to assist in carrying on. To-day, South Africa's chief cities are the richer for the over-bold
policy of twenty years ago, but the memory of the price paid will for many years prevent a repetition of such extreme confidence in unchecked progress. It was a sharp lesson to the business community, and meanwhile the buildings remain as monuments to the great wave of unbounded optimism that swept the country for a period.

It was during those years, too, that South Africa, and particularly the territories which now comprise the Union, sprang into prominence as an important factor in world commerce. Its striking growth and vitality as a buyer of manufactured goods was the primary cause, but many others also assisted. In fact, no country has been more widely advertised than was South Africa then. It was, for example, the cradle of the great Free Trade versus Protection controversy in Great Britain. Mr. Joseph Chamberlain, in his capacity as Colonial Secretary, made his historic tour of South Africa in the early part of 1903, the result of which was that he returned with his new gospel of Imperial Preference and its corollary, Protection, for the Mother Country's industries. It is not necessary here to discuss the merits of that gospel. Suffice it to say that the strong and practical Imperialism of the Cape Colony and Natal, the vision they offered of the enormous potentialities of economic union between the Mother Country and the Dominions, so impressed the great statesman that he devoted the remainder of his life to the advocacy of a principle which has not yet been universally accepted, but which has revolutionised British politics.

That controversy, following the war, seemed to keep South Africa in the eyes of the world, and, in a less happy way, the introduction of Chinese labour on the Rand mines assisted the process. Here also was a matter of wide significance in Imperial politics which kept South Africa in the forefront of public attention, and which, whatever view may be held in regard to the principle, undoubtedly temporarily strengthened the productive power of the mining industry, and thereby enriched the market as a whole. As already stated, the absorptive capacity of South Africa grew beyond all precedent, the imports exceeding £52,000,000 in 1903, and for a period the world became obsessed with the belief that here was the coming El Dorado of commerce, a second United States with even vaster resources and potentialities than the great Republic across the Atlantic possessed.

The consequence was a movement to prepare for the anticipated future on a suitable scale, to provide adequate machinery and means for the anticipated growth of trade and industry. It was a movement which was by no means confined to South African commercial men. They may have had their "bricks and mortar" policy, their scramble for wider shipping and agency
connections, but they were not alone in this sanguine activity. The several Governments of the Cape Colony, Natal, the Transvaal and the Orange River Colony, as it was then called, put in hand ambitious programmes of public works; the larger municipalities bestowed themselves to acquire services of the most up-to-date character; a Customs’ Union Convention was drafted and put into operation; and important schemes for exhibitions were floated, while Messrs. J. W. Jagger and Co., Messrs. Stuttaford and Co., Ltd., and the great mining house of Eckstein were erecting South Africa’s first steel frame buildings at Cape Town and Johannesburg. The Cape Government was also engaged on important harbour improvements at Table Bay, and the Natal authorities were installing a large floating dock at Durban at a cost of £94,000, outranging in capacity anything of the kind ever before seen in South Africa. It was, as previously explained, a period of incorrigible optimism and enterprise. The years 1902, 1903 and 1904 saw every department of public and commercial life humming with activity.

The exhibition schemes of the period alone were sufficient to indicate the abnormal spirit which prevailed. First, within a few months of the declaration of peace in 1902 public attention was drawn to a scheme for a British and Colonial Exhibition to be held at Cape Town in 1904, and simultaneously there was much talk of a Grand International Peace Exhibition at Johannesburg. Durban also had a project of the kind in hand. Eventually the two last were abandoned, but the first, after some vicissitudes, was carried to realisation under the management of a London firm, being opened on January 7th, 1905; its principal feature being the very numerous and representative displays staged by manufacturing firms in the Mother Country. This practical interest shown by British firms in South Africa’s trade opportunities was manifested in many other equally convincing ways. A widespread campaign was inaugurated to capture and hold this well-advertised market which, after all, only possessed a total white population smaller than that of a single first-class industrial centre in England. The 1904 census, in fact, showed that the total number of Europeans in what afterwards became the Union was merely 1,122,400, with 4,650,000 coloured people. That, incredible as it may seem, was the size of the population which in one year could purchase imported goods to the value of over £50,000,000, or at the rate of more than £8 3s. 0d. per head, the rate per European being, of course, enormously higher than that. With a market of such a character, and apparently embarked upon a prolonged course of remarkable expansion, the inducements to commercial enterprise of the boldest kind were too obvious to be missed, and it may be added that British
manufacturers and shippers on the whole cannot be accused of having missed them.

From the moment the South African War ended, in fact, every effort was made to secure the market for the Mother Country, and official and other organised assistance was not lacking. Even before the Peace Declaration in June 1902, three Trade Commissioners were sent out to South Africa under the auspices of a committee organised by Mr. John Lockie, M.P., their object being to investigate the openings for trade. The Commissioners were Mr. T. Nicol Jenkin, Mr. Ben Morgan and Mr. S. W. Whitham, and each produced a voluminous and thorough report which, published in book-form, proved at the time of extreme value to British firms. Scarcely was their mission completed when the Imperial Government decided to send out Mr. Henry Birch- enough as its Special Trade Commissioner. He was admirably qualified for the post, being chairman of the Macclesfield Chamber of Commerce and a member of a well-known firm of silk manufacturers. So well did he acquit himself that when his report appeared at the end of 1903 it proved a real guide and stimulus, and business men generally approved the honour of the Companionship of St. Michael and St. George which was conferred upon him in 1905, to which a knighthood and baronetcy have since been added for more recent public services.

The energetic campaign thus pursued, coupled with the strong feeling of Imperial patriotism among large and influential sections of South Africa’s population, led to the complete consolidation of Great Britain’s position as by far the largest supplier of manufactured goods. In fact, in 1903, when the complete imports were valued at £52,562,312, of which 64 per cent. entered through Cape ports, 28 per cent. through Natal, and about 6 per cent. through Delagoa Bay, Great Britain and British Possessions were supplying 71 per cent. of the total, leaving only 29 per cent. to foreign countries. The principal competitors were the United States, whose shipments amounted to a little more than £6,000,000, and Germany, who secured a total of about £2,240,000. Of the British share, about 9 per cent. stood to the credit of the Dominions, leaving nearly 62 per cent. to

SOUTH AFRICA’S CLASSIFIED IMPORTS IN 1903.

<table>
<thead>
<tr>
<th>Description</th>
<th>£</th>
<th>Description</th>
<th>£</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Materials ...</td>
<td>2,873,700</td>
<td>Iron and Steel ...</td>
<td>868,500</td>
</tr>
<tr>
<td>Domestic Goods ...</td>
<td>2,986,850</td>
<td>Leather Goods ...</td>
<td>364,500</td>
</tr>
<tr>
<td>Drugs and Chemicals</td>
<td>592,200</td>
<td>Machinery ...</td>
<td>2,442,600</td>
</tr>
<tr>
<td>Electrical Supplies ...</td>
<td>90,780</td>
<td>Paper, etc. ...</td>
<td>1,209,930</td>
</tr>
<tr>
<td>Explosives, Arms, etc.</td>
<td>264,600</td>
<td>Textiles, etc. ...</td>
<td>11,143,870</td>
</tr>
<tr>
<td>Food and Drink ...</td>
<td>10,181,000</td>
<td>Vehicles ...</td>
<td>824,200</td>
</tr>
<tr>
<td>Hardware, Cutlery, etc.</td>
<td>3,079,970</td>
<td>Other Imports ...</td>
<td>15,339,600</td>
</tr>
</tbody>
</table>
A DIFFICULT PERIOD

the Mother Country, which latter figure has been reduced to 54.2 per cent. in the course of the last eighteen years. Of the general character of the trade a broad idea may be gained by studying the figures given in the appended table of classified imports in 1903. Textiles and goods for personal use make the largest class of Manufactures in demand, followed closely by food and drink. Hardware and cutlery, building materials, domestic goods and machinery were the other principal classifications.

While this great trade was being rapidly built up, it has to be realised that the South African market was being confronted with various minor problems of its own, and in respect of two important matters provided a battle-ground of Imperial, if not wide-world, interest. The first of these was its fiscal policy and the Imperial preference, which to this day, indeed, remain subjects of keen controversy. The bringing together of the whole of South Africa under one flag naturally forced the question into prominence at once, and in 1903 the Union Customs Convention was formed and adopted by a conference which met at Bloemfontein on March 10th. The second outstanding subject of controversy and disturbance was the freight war occasioned by the successful attempt of the Houston Line to enter the South African Steam Lines Conference in 1902, and subsequent struggles to secure the abolition of the shipping commission or rebate system then in vogue on the routes, and abandoned by Sir Owen Philipps, G.C.M.G., (now Lord Kylsant), in 1913 within a year after he took over the control of the Union-Castle Line.

The post-war boom was, however, over by the end of 1903, and from 1904 till the great event of Union in 1910 there was a trying period of trade decline and stern readjustment that tested the staying power of industrialists and merchants to the utmost. A whole series of bankruptcies occurred during the first year or two, and more than one name honoured for several generations disappeared from the list of South Africa's merchant houses. Imports fell year by year from £52,000,000 to little more than £27,000,000 in 1909, and many firms, particularly in the United States, who had established connections in the market retired in disgust. Yet through it all the industrialists of the country gave steady proof that prosperity would eventually be re-captured. Refusing to be discouraged they added yearly to their resources and power of production, steadily building up an export trade that offered a happy contrast to the movement of imports. Shipments of minerals, agricultural and pastoral products rose steadily from £44,000,000 in 1906, to £48,400,000 in 1907, to more than £51,000,000 in 1909, until in 1910 they
## BRITISH SOUTH AFRICA'S CLASSIFIED IMPORTS, 1910-1923.

<table>
<thead>
<tr>
<th>Class of Goods</th>
<th>1910</th>
<th>1922</th>
<th>1923</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Animals</strong></td>
<td>£143,482</td>
<td>£45,416</td>
<td>£56,518</td>
</tr>
<tr>
<td><strong>Agricultural Supplies</strong></td>
<td>£659,949</td>
<td>£630,934</td>
<td>£1,037,492</td>
</tr>
<tr>
<td><strong>Food and Drink</strong></td>
<td>£6,119,291</td>
<td>£5,769,973</td>
<td>£7,067,505</td>
</tr>
<tr>
<td><strong>Raw Materials:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metals, Minerals, etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>£1,610,456</td>
<td>£3,036,752</td>
<td>£2,199,266</td>
</tr>
<tr>
<td><strong>Manufactured Articles:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Furniture, etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machinery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metal Goods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oilman's Stores</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Textiles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Government Stores</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>£37,909,173</td>
<td>£53,866,680</td>
<td>£58,697,362</td>
</tr>
</tbody>
</table>

## BRITISH SOUTH AFRICA'S EXPORTS, 1910-1922.

<table>
<thead>
<tr>
<th>Articles</th>
<th>1910</th>
<th>1922</th>
<th>1910</th>
<th>1922</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aloes</strong></td>
<td>£7,526</td>
<td>£3,675</td>
<td>£34,322,136</td>
<td>£31,932,812</td>
</tr>
<tr>
<td>Animals</td>
<td>42,731</td>
<td>121,098</td>
<td>903,177</td>
<td>1,152,980</td>
</tr>
<tr>
<td>Asbestos</td>
<td>28,093</td>
<td>404,167</td>
<td>1,287,649</td>
<td>1,962,893</td>
</tr>
<tr>
<td>Bark</td>
<td>219,433</td>
<td>1,003,139</td>
<td>10,416</td>
<td>22,704</td>
</tr>
<tr>
<td>Blasting Compounds</td>
<td>24,530</td>
<td>111,038</td>
<td>848</td>
<td>-</td>
</tr>
<tr>
<td>Buchu leaves</td>
<td>24,428</td>
<td>15,763</td>
<td>1,162</td>
<td>-</td>
</tr>
<tr>
<td>Candles</td>
<td>4,571</td>
<td>5,022</td>
<td>1,325</td>
<td>-</td>
</tr>
<tr>
<td>Coal, Coke, etc.</td>
<td>986,005</td>
<td>1,104,469</td>
<td>4759</td>
<td>6,335</td>
</tr>
<tr>
<td>Copper, Ore, etc.</td>
<td>486,980</td>
<td>824,393</td>
<td>2,287</td>
<td>-</td>
</tr>
<tr>
<td>Cotton, raw</td>
<td>1,529</td>
<td>72,411</td>
<td>61,043</td>
<td>447,833</td>
</tr>
<tr>
<td>Curiosities</td>
<td>2,547</td>
<td>695</td>
<td>292,909</td>
<td>454,708</td>
</tr>
<tr>
<td>Diamonds</td>
<td>8,480,875</td>
<td>4731,754</td>
<td>43,999</td>
<td>92,669</td>
</tr>
<tr>
<td>Feathers</td>
<td>2,272,846</td>
<td>394,048</td>
<td>5,572</td>
<td>-</td>
</tr>
<tr>
<td>Flowers, dried</td>
<td>7,547</td>
<td>2,715</td>
<td>3,830,903</td>
<td>11,001,684</td>
</tr>
<tr>
<td>Fodder &amp; Forage</td>
<td>45,356</td>
<td>33,496</td>
<td>209,262</td>
<td>792,200</td>
</tr>
<tr>
<td>Food &amp; Drink</td>
<td>919,038</td>
<td>4,078,422</td>
<td>209,262</td>
<td>792,200</td>
</tr>
<tr>
<td>Glycerine</td>
<td>5,843</td>
<td>9</td>
<td>54,509,280</td>
<td>60,779,567</td>
</tr>
</tbody>
</table>

**Total**
stood at the handsome amount of £55,300,000, or £20,000,000 higher than the same year's imports. With a trade balance so much on the right side it was obvious that the tide must turn, and turn it did in 1910, maintaining vigorous progress until the outbreak of the Great War in 1914. As the imminence of this revival became apparent there was, of course, a renewal of commercial interest in the market throughout the world, and some time before Union was consummated the Imperial Government showed its recognition of this by appointing for the first time a permanent Trade Commissioner in South Africa, the first occupant of the post being Mr. (now Sir) R. Sothern Holland, who did admirable work in the interests of manufacturers in the Mother Country.

One feature of outstanding importance which came into existence in 1910 as a direct result of the confidence created by the realisation of Union, was the appearance in South Africa of great industrial firms whose headquarters were in Great Britain. Hitherto they had entered the market simply as salesmen of the goods which they manufactured in England and desired to ship abroad, but now they began to come in as domiciled factory owners, erecting works on the spot, and in some cases even seeking to make of South Africa their producing and distributing headquarters for the entire Southern Hemisphere. Messrs. Kynoch Ltd., pioneered this movement with their great explosive works at Umbogintwini, Natal, and they were closely followed by Messrs. Lever Bros., Ltd., of soap fame, who had been contemplating the erection of works near Cape Town, but eventually decided also to transfer their project to Durban, Natal. There were already, of course, numerous manufacturing industries established in the country, such as boot-making in the Eastern Province of the Cape Province, wagon-building, milling, etc.,

SOUTH AFRICA'S MANUFACTURING INDUSTRIES, 1921-22.

<table>
<thead>
<tr>
<th>Industry</th>
<th>No. of Factories</th>
<th>Value of Output (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Material</td>
<td>105</td>
<td>1,353,297</td>
</tr>
<tr>
<td>Stone, Clay, etc.</td>
<td>324</td>
<td>2,136,126</td>
</tr>
<tr>
<td>Wood</td>
<td>231</td>
<td>2,003,447</td>
</tr>
<tr>
<td>Metals, Engineering, etc.</td>
<td>868</td>
<td>16,657,712</td>
</tr>
<tr>
<td>Food, Drink, etc.</td>
<td>1,877</td>
<td>25,891,060</td>
</tr>
<tr>
<td>Clothing Textiles, etc.</td>
<td>799</td>
<td>2,914,850</td>
</tr>
<tr>
<td>Books, Printing, etc.</td>
<td>307</td>
<td>4,073,138</td>
</tr>
<tr>
<td>Vehicles</td>
<td>866</td>
<td>1,696,030</td>
</tr>
<tr>
<td>Ship-building</td>
<td>11</td>
<td>63,131</td>
</tr>
<tr>
<td>Furniture, etc.</td>
<td>211</td>
<td>1,347,225</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7,055</strong></td>
<td><strong>79,445,169</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Industry</th>
<th>No. of Factories</th>
<th>Value of Output (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemicals, etc.</td>
<td>121</td>
<td>5,614,871</td>
</tr>
<tr>
<td>Surgical Instruments, etc.</td>
<td>20</td>
<td>47,752</td>
</tr>
<tr>
<td>Jewellery, etc.</td>
<td>49</td>
<td>107,699</td>
</tr>
<tr>
<td>Heat, Light and Power</td>
<td>215</td>
<td>5,504,038</td>
</tr>
<tr>
<td>Leather and Leatherware</td>
<td>262</td>
<td>2,237,693</td>
</tr>
<tr>
<td>Building and Contracting</td>
<td>664</td>
<td>7,469,345</td>
</tr>
<tr>
<td>Other Industries</td>
<td>45</td>
<td>327,755</td>
</tr>
</tbody>
</table>

**Total** | **7,055** | **79,445,169**
but the appearance of these industrial giants from the Mother Country marked the beginning of a new chapter of industrialism in South Africa, and during the Great War, when output was urgently needed and the competition of imports was seriously weakened, this industrial movement received a further impetus. The result is that, according to the latest available statistics, those for 1921-22, there are now at least 7,055 factories of various kinds in operation in the Union alone, with an annual output of nearly £80,000,000. This industrial advance is, indeed, the most striking feature of South African development during the past ten years, affecting every phase of the country’s general life and trade, and particularly colouring its fiscal policy.

Another important effect of Union has been the stimulation of Government activity in fostering trade and industry. One of the first moves of this kind was the creation of a Department of Commerce and Industries in 1910, with Mr. F. R. Moor, ex-Premier of Natal, as the responsible Minister, but this was abolished in 1912 after accomplishing little or nothing. A more effectual line of action was the appointment of a Trade Commissioner in London in 1910. The first occupant of the post was Mr. C. du P. Chiappini, but the office was actually opened and organised in the latter’s absence by Mr. C. W. Francis Harrison, who had for some years served as Commercial Agent for Natal. Mr. Chiappini retired in 1918, and was succeeded by Mr. Arthur Canham, who, however, retired at the close of 1924 and was succeeded by Mr. J. H. Dimond. All these officials have served the Union well, each in turn making himself exceedingly popular in business circles, while very efficiently opening up new markets for South African produce. Mr. C. W. Francis Harrison, by the way, was the Special Commissioner for the Federation of British Industries when, in 1919, that important organisation decided upon a thorough investigation of the market’s possibilities. The Union Trade Commissioner Service has since been extended by the appointment in 1921 of Mr. K. Spilhaus as Commissioner of
Commerce for the Continent. He resigned in 1924 and Mr. Charles Pienaar was appointed to the position.

The general revival in South Africa's trade immediately preceding 1914 was naturally checked by the outbreak of the Great War, yet increased internal activity went far to compensate for the disorganisation of the country's external trade. Nor did the latter suffer so badly as might have been expected. The imports especially were well maintained, though under difficulties, for in 1916 they reached a total of £40,401,647, or more than in any previous year in the market's history; and again in 1918 a further record was created with a total of £48,956,320. This was nearly doubled in the post-war boom of 1920, when the imports reached the enormous figure of £94,863,530. That was undoubtedly a year of overstocking and over-trading, and it was followed by an inevitable and prompt reaction of 1921 and 1922, but even then the imports only fell to £53,010,869 and £49,595,462 respectively, rising once more to £55,332,547 in 1923. The export trade has a more chequered record in recent years, but, after severe apparent curtailment during the war—it is doubtful how far the shortfall was real, as statistics of gold shipments were not published at the time—the total of exports jumped to no less than £103,347,163. It must be remembered, however, that these post-war figures were swollen by the high prices and values of the inflation period.

Reviewed broadly, the Great War was responsible for a period of notable productive activity in the Union, in which the foundations of new manufacturing industries were laid, but it also led to over-inflation and subsequent depression. The worldwide demand for foodstuffs and raw material stimulated production and additional land was placed under cultivation. The high prices fetched by wool, maize, sugar, meat and so on, made the farmers more prosperous than they had been for many years. At the same time the supply of many manufactured articles, including all sorts of mining and railway machinery and stores, was largely cut off. Europe and America were too engrossed in war production to bother about Africa's needs. So the Union set to work to make a great many articles it once purchased abroad. Factories and workshops sprang up on all sides.

Thus, South Africa not only weathered the war period well, but entered upon the peace doing more trade and earning more money than it had done for many years. Indeed, one of its troubles was that many of its merchants expected the conditions of 1918-19 to last and imported more and more freely as soon as imports were obtainable. Goods poured into the Union in vast quantities,
and later on it was found that the country was overstocked. Property sold at marvellous prices. The banks lent money more freely. The farmers were getting record returns, but instead of paying off old mortgages or purchasing machinery, acquired still more land and often borrowed again to get it.

But then came the slump. Prices fell all round. The banks applied the brake severely, and curtailed credit with a rough hand. Many of the small factories which paid well in the war period went under when a flood of imported articles poured in again. Drought and locusts and a great strike on the Rand ending in the terrible Red Revolt of March, 1922, added to South Africa's troubles and intensified the general depression.

By the end of 1924 the worst seemed to be over, and indeed, signs of the approach of better days were not wanting. Wool prices improved, and, helped by the farmers, capitalists began to take a keen interest in cotton. The gold output was increased, while the post-strike conditions on the Rand placed the whole mining industry on a sounder basis. The factories and workshops in the Union which had survived the severe test of the slump began to show fresh strength, while the enhanced value of property in a number of centres revealed evidence of returning confidence. The Government tackled the country's finances boldly and effected economies.

There is good ground for expecting a period of steady recovery. Another "boom" is not to be looked for; nor does South Africa want it. Business is apt to fluctuate violently, but there is no reason to regard its future with anxiety. The country is sound. It has very large resources, both in mining, industries and agriculture, and it is in a position to-day from which a steady and sustained advance can be made. The Government is erecting a large number of grain elevators all over the Union, which will enable maize to be handled in bulk as in America and Canada, and will save the farmer the cost of bags while also enabling him to draw against his maize crop and so obtain cash at an earlier date than he could under the old system. Railway rates have been lowered, and the facilities for exporting agricultural products of all kinds have been improved. An extension of the grading plan, and the provision of additional cold storage accommodation on trains and ships have brightened the prospects of the export business generally. An effort has been made to encourage the exportation of the Union's deposits of iron ore, and a notable advance in this direction is probable. Increased state activity plus private enterprise should soon hasten the speed of national development and open a new era.
South Africa’s Export Trade

IV.—WHAT THE CUSTOMS RETURNS REVEAL.

By O. ZACHARIAH

(Late Publicity Agent in London for the Union of South Africa.)

Of the radical, world-wide changes during the last hundred years, none has been more remarkable, or more important, than the change in the general attitude towards trade. To be "a nation of shopkeepers" is no longer a reproach; on the contrary, it is what every nation is trying to be, for trade is at last recognised as the foremost factor in determining the status and well-being of a nation.

Hence the modern importance of Customs returns. They have become a sort of national ledger, reflecting as they do the imports and exports, or in other words the international debits and credits of the State. Such returns have this main drawback, that they are generally voluminous. They must, moreover, be arranged in various forms, and be examined from many angles, before their significance transpires. So arranged, with mass after mass of statistics impinging one on the other, Customs returns are apt rather to weary than to interest all but the resolute investigator, and they are, therefore, not studied so generally as in the national interest they might be. In examining the export trade of the Union of South Africa, which is the purpose of this article, and taking the 1921 exports as a basis, and examining what those exports signify, the way will be clear for reviewing the subject by easy stages from 1887, and for drawing a few general conclusions from such a review.

The volume of exports from the Union of South Africa was larger in 1921 than in any previous year, the tonnage shipped being thirty per cent. in excess of that for 1920. But in 1921 the world-wide deflation of wholesale prices, especially for farm produce, was so rapid and considerable that though the volume of exports for 1921 was the largest on record the value was the lowest for a decade. Even so, it amounted to £65,819,130; all but an insignificant percentage of the exports were South African products.

That was equivalent to about one-twelfth the export trade of Britain for the same period; and if we take the 1920 figures, the Union export for that year is
The expeditious generally adopted is to premise that as a producer and consumer, and, therefore, as a contributor to the trade of the Union, four coloured people, remembering the large proportion of Bantu, are equivalent to one European. That is a rough computation unavoidably so in the circumstances; but it is sufficiently near the mark for the present purpose.

On that basis the population of the Union may, for the purpose of this comparison, be computed as 23\(\frac{1}{4}\) millions, compared with Australia's 5\(\frac{1}{2}\) millions, Canada's 8\(\frac{3}{4}\) millions, and the 47 millions of the United Kingdom. Thus, the value of exports per unit of population is in the Union the same as, when not higher than, in the other Dominions; and higher in the Union than in the United Kingdom, for whereas in 1921 the latter country had sixteen times the population, it had only twelve times the export trade of the Union.

When Union exports, per head of population, are thus compared with the exports of other countries, one begins to see the reason why the Union as a whole is in so sound a financial position in even these adverse times. And if the comparison is carried further, and one examines the respective imports, expenditure, and debt of the several countries, it becomes apparent also why taxation in the Union, though much higher than it was a decade ago, is low when compared with that of other countries.
This, as far as it goes, is heartening. But though the population of the Union is relatively small, and though the value of exports per head of population compares favourably with the other Dominions, the fact remains that there is considerable, though decreasing, unemployment in the Union. So far as they go, the comparisons given above throw no light on unemployment, give no explanation of the distress among some classes in the Union. The comparisons must, therefore, be pushed further; one must look at the exports from another aspect to ascertain what present and prospective development they imply.

To gauge national development from exports, it is necessary to take into account not only market value per unit of population, but the nature of the exports. And when so examined by categories, it transpires that of the Union exports more than half, in value, consisted of gold.

That is the fly in the ointment. Gold worth a million sterling is, of course, as valuable monetarily as a million sterling worth of wool, fruit or maize. But its production and distribution do not entail such widespread employment and general development as the production of the bulkier, low-priced commodities.

Hence, although per head of population the Union exports compare favourably on a monetary basis with the exports of other countries, the development behind the respective exports is very different. Behind the Union exports the general development is not nearly as great as that behind exports of similar monetary value from the other countries compared. That is a defect to which I shall revert.

When Customs returns are thus analysed, it will be seen they serve a useful purpose in demonstrating what is too often overlooked, namely, why the financial position of the Union is on the whole so sound, and why taxation is comparatively so low; while at the same time explaining why the Union has not a larger population, and why among the population it has there is unemployment. In short, Customs returns, as a commentary on general affairs, enable one to deduce many helpful maxims, and lend themselves to the drawing of many morals. Space permits me to deal with only one of those, namely, the defect pointed out above.

It can be remedied only by increasing the quantity of general commodities shipped in proportion of raw gold. That is the paramount need, and should be the paramount aim, of the Union. The mining and export of gold has clearly been the financial salvation of the country, a consummation for which one cannot be too devoutly grateful. But, equally clearly, more export of farm produce and other commodities entailing a greater amount of employment in proportion to price that the
mining of gold entails, is necessary to increase the country's capacity better to support its present unemployed and indigent, and to support a future larger population. And, therefore, every prospective farmer with capital who arrives in the Union, being a potential developer of latent resources, is a boon to the country and to those in it who are indigent.

What then, is the prospect of increasing the general development behind the exports? To find an answer to that question, one must examine the period and circumstances in which the exports were developed, and the tendencies during that development. And so there arises another aspect from which to examine the Customs returns.

Prior to 1887 there was little output except on the diamond fields and in such limited farming areas as sufficed to cater for the needs of the small scattered population. There was, moreover, only little railway development, and consequently little access to shipping for exporting farm produce.

With the development of gold mining, in the early nineties, the position changed. In addition to the railway from Capetown to Kimberley, that from Port Elizabeth and East London was extended to the Witwatersrand, as was the Natal Railway; and soon after the railway from Delagoa Bay to the Transvaal was also completed. That gave an impetus to general development, insomuch that the larger population directly or indirectly supported by the increased mining, created a larger local market for produce and incentive for farming; and the construction of railways gave to an increased portion of the country an access to the ports which facilitated export of any farm surplus.

The export trade of the Union has, therefore, been developed practically all in the last thirty-five years, and mainly in the last twenty years—an important fact to bear in mind when trying to estimate the nature and dimensions of that trade in future. Prior to the middle eighties, the export trade remained almost stationary, wool, skins and diamonds being the only important items. In 1887 the exports were one-eighth what they are to-day; in 1899, two-fifths—1900 was a year of war; and in 1910, four-fifths the present exports, increasing consistently during the next decade until in 1919 they were one and two-thirds times the value of those in 1921.

These, in round figures, are the main periods and degrees of the export development. The circumstances in which the development occurred will not take long to recount.

Although, as has been shewn, considerable railway development took place, in fact all the main lines were laid by the early nineties; though the gold mining, which thereafter considerably increased, created a local market warranting the develop-
ment of farming, and though the comparatively large railway mileage enabled a great area to be tapped for the exportation of surplus produce, the exports still consisted of gold, diamonds, wool, skins and feathers, though more of these because of the larger area tapped. The country produced more of what it had previously produced, though not as much more as might have been expected; but it produced no new lines, at least for export. The explanation is that organisation, research, and time are necessary to turn a country from pastoral to varied agricultural production. Under the most favourable auspices, the conversion cannot be rapid. In South Africa, during the later 'nineties, the auspices were not favourable. Political unrest and uncertainty retarded agricultural organisation and research, as well as the development of gold mining, and culminated, in 1899, in the Anglo-Boer War. The set back caused by that war is apparent from the 1900/1 figures. But it cleared the way for more settled conditions. Confidence became established, organisation and research were undertaken with vigour immediately after the war, there was a beginning in manufacturing, more and more country was opened up by the railways, and mining throve as never before. So really only twenty years have passed since the people of the Union settled down to make the country variedly productive, a work that was greatly facilitated in 1910 by the unification of the Free State, Transvaal, Natal and Cape of Good Hope under one Parliament. The balance of trade was very favourable to the Union, exports consistently showing a satisfactory wide margin over imports; the country was prosperous, and what was more important, it was prosperously developing a varied agricultural production, when the world-wide depression, that commenced in 1920 and became a débâcle in 1921, gave to the Union, as to most countries, perhaps the severest set-back, economically, that it has had. Production had attained such dimensions that, as previously mentioned, the volume of exports in 1921 was greater than ever, and the quality much improved, but owing to stagnant markets and abnormally poor prices, the monetary value of those exports was the lowest for a decade. Still, and this is a vital point, the development is there; most of the main obstacles which in the past delayed it have been overcome. All is in train for a much greater development as soon as international markets are more normal, and there will be every reason then for supposing that the exports of the Union will in the future develop even faster than in the past; and that not only in monetary value, per head of population, but in the general widespread development behind those exports, giving sustenance to a larger and more fully employed population, they will compare favourably with the
exports of other Dominions, not from one or two of the aspects, but from all the aspects examined in this article.

Competing for overseas trade, the Union is likely to be one of the first of the countries to make up leeway. Its prospects are as good as those of any of the Dominions.

Except rubber, coffee and palm oil, there is nothing that cannot be produced in the Union as well as, or better than, elsewhere in Africa. Nowhere else in the whole of huge Africa, along its length of 5,000 miles from North to South, or along its maximum breadth of 4,600 miles from East to West, is there a country so well organised for production, or so well equipped climatically and socially for European homes.

Of the Union it may therefore be said, that beyond comparison it is the most advanced, and the most promising territory in Africa; the country that has set the pace and the example in African development, whether agricultural, mining or manufacturing.
The Trade History of South-West Africa.

1.—FACTS AND FIGURES.

The trade history of South-West Africa may be set down in very few words, and even fewer figures. There is the closed chapter of the past, when German rule restricted commerce selfishly, and when progress and development were unworthy of the territory's possibilities. Then came the interlude of war in 1914, the change of ownership in 1915, followed by the halting opening sentences of a new chapter.

Prior to 1914 the market was simply a German preserve. The bulk of the imports came from Germany, and practically all the exports were sent thither. German merchant houses controlled what trade was done. They had their branch establishments in each of the principal towns, with smaller branches and agencies in the remoter districts. Foreigners were not encouraged, though a few of the more enterprising merchant firms in the Union of South Africa, such as Jagger's, Wilson's, Daniel Mills, etc., did some business with the country by means of resident agents or travellers, and there was, of course, a certain element of Colonial Dutch farmers in the population. The annual imports ranged between £1,700,000 and £2,300,000, and the exports, mainly diamonds and copper ore, reached their highest point in 1913 with a total of £3,515,140. The requirements of the market were mainly native goods, for the white population numbered only 14,830 in 1913, and of these 12,292 were Germans. The population affected by the census returns had been reduced to about 79,000 in 1913, but a further 160,000 in Ovamboland must be added to this total. Entirely lacking manufacturing industries, the imports were naturally fairly wide in scope and variety, if small in actual quantity. Clothing and articles of food and drink represented by far the largest items, while mining and farming machinery stood for a fairly substantial amount in the returns during the later years of German administration.

The extent to which the trade, both inward and outward, was
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

a monopoly of Germany, is shown in the following percentage returns for the years 1910-1912:

<table>
<thead>
<tr>
<th>Country</th>
<th>Imports from</th>
<th>Exports to</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1910</td>
<td>1911</td>
</tr>
<tr>
<td>Germany</td>
<td>77.6</td>
<td>82.2</td>
</tr>
<tr>
<td>Union of South Africa</td>
<td>14.8</td>
<td>13.6</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1.8</td>
<td>1.3</td>
</tr>
<tr>
<td>France</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>United States</td>
<td>0.2</td>
<td>0.6</td>
</tr>
<tr>
<td>Other Countries</td>
<td>5.5</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Apart from Germany, it is clear from the above figures that the neighbouring Union of South Africa was the only supplying country worth noting, and, of course, a certain proportion of what it supplied consisted of re-exports of United Kingdom origin. As evidence of the active policy of the Germans in discouraging trade with foreign countries it is only necessary to mention that prohibitive taxes were imposed on non-resident commercial travellers and representatives of foreign firms.

The territory came definitely under German control in 1885, but twelve years later the annual imports had not grown beyond £244,000, nor the exports beyond £62,400. Military operations against the natives during the period 1900 to 1908 led to large imports of war equipment, thus making more imposing totals in the yearly returns, and then in 1908 came the discovery of diamonds and a consequent increase in the country's spending power, which lasted with fluctuations until 1914. Such is, in brief, the commercial history of South-West Africa under the German régime.

The story takes a new turn in 1915, when the territory came under the administration of the Union of South Africa, an arrangement confirmed by

SOUTH-WEST AFRICA'S IMPORTS, 1897-1921.

<table>
<thead>
<tr>
<th>Year</th>
<th>Imports</th>
<th>Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1897</td>
<td>£244,365</td>
<td>£62,390</td>
</tr>
<tr>
<td>1904</td>
<td>£2,360,000</td>
<td>£1,480,000</td>
</tr>
<tr>
<td>1907</td>
<td>£1,619,795</td>
<td>£80,783</td>
</tr>
<tr>
<td>1909</td>
<td>£1,735,620</td>
<td>£1,103,545</td>
</tr>
<tr>
<td>1910</td>
<td>£2,217,215</td>
<td>£1,734,570</td>
</tr>
<tr>
<td>1911</td>
<td>£2,265,100</td>
<td>£1,428,660</td>
</tr>
<tr>
<td>1912</td>
<td>£1,624,945</td>
<td>£1,951,770</td>
</tr>
<tr>
<td>1913</td>
<td>£2,171,230</td>
<td>£3,515,140</td>
</tr>
<tr>
<td>1914</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Imports</th>
<th>Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1915</td>
<td>£435,485</td>
<td>—</td>
</tr>
<tr>
<td>1916</td>
<td>—</td>
<td>£943,660</td>
</tr>
<tr>
<td>1917</td>
<td>—</td>
<td>£1,061,125</td>
</tr>
<tr>
<td>1918</td>
<td>—</td>
<td>£1,031,535</td>
</tr>
<tr>
<td>1919</td>
<td>—</td>
<td>£1,152,205</td>
</tr>
<tr>
<td>1920</td>
<td>£2,129,250</td>
<td>£5,401,000</td>
</tr>
<tr>
<td>1921</td>
<td>£1,100,135</td>
<td>£1,587,300</td>
</tr>
<tr>
<td>1922</td>
<td>£1,021,428</td>
<td>£1,217,729</td>
</tr>
<tr>
<td>1923</td>
<td>£1,160,000</td>
<td>£2,670,000</td>
</tr>
</tbody>
</table>
THE STOCK-RAISING INDUSTRY

the Mandate of 1920. During the war period the imports were entirely from the Union of South Africa, owing to lack of steamship communication with Europe and America; and no exports were made at all. In 1919, however, trade was restored almost to normal dimensions, with exports in excess of imports. In 1920 a greatly increased output of diamonds enlarged the exports to the unprecedented total of £5,401,000, while the imports rose to £2,129,250. Then came the world-wide depression in 1921, with the severe slump in the diamond market, and the import total reverted to £1,100,135, and the exports to £1,587,300.

At the present time there are signs that commercial progress is restarting, and new industrial activity on a limited scale is coming into being. The latter factor is especially important. The country has many valuable resources which can be made the basis of successful industries, such as mining, agriculture, ranching, cold stores, meat and fish carrying, etc., but it also has many problems of exceptional difficulty to overcome if development of this kind is to proceed on an adequate scale. The future alone will show what the full destiny of the market is to be.

Chief among the known natural resources of South-West Africa, though by no means the most efficiently cultivated hitherto, must be reckoned its wide tracts of grazing lands. In fact, it has been described by at least one authority as destined to become "one of the finest ranching countries in the world." A German estimate immediately before the war placed the pasture available at sufficient to support 3,000,000 head of cattle and 2,000,000 goats and sheep. The dry climate and patchy growth of forage, however, makes it necessary to allow between 25 and 45 acres per head for cattle, and anything up to 5 acres for sheep. In spite of this drawback animals thrive in a wonderful way, and not only can stock-raising be made to pay, but it will do so increasingly when cold storage facilities are provided on an adequate scale, and an export trade in foreign meat is organized. Fortunately the prospect of the installation of cold storage works is not altogether remote. The Administration has a scheme in hand for attracting private enterprise, and during 1922 invited tenders for an installation at Walvis Bay, the advantages offered being an exclusive licence covering a period of years, or a bonus on exports, coupled with the provision of a site, a railway connection and harbour facilities. The result of enterprise of this kind has yet to make itself felt, but it cannot fail eventually to add materially to the country's assets.

Before coming under German control the midland and northern districts of South-West Africa were famous for the wealth of
livestock owned by the native population, and especially by the Hereros or Cattle Damars, but naturally heavy depletion occurred as a result of the war of extermination which the Germans started in 1904. How rapidly restoration followed, however, is rendered clear by the following statement for the years 1910 to 1913:

<table>
<thead>
<tr>
<th>ANIMALS</th>
<th>1910</th>
<th>1911</th>
<th>1912</th>
<th>1913</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>121,139</td>
<td>144,445</td>
<td>171,784</td>
<td>205,643</td>
</tr>
<tr>
<td>Merinos</td>
<td>20,261</td>
<td>32,209</td>
<td>46,901</td>
<td>53,691</td>
</tr>
<tr>
<td>Sheep, Persian</td>
<td>—</td>
<td>—</td>
<td>12,588</td>
<td>17,171</td>
</tr>
<tr>
<td>Sheep, Karakul</td>
<td>—</td>
<td>427</td>
<td>341</td>
<td>776</td>
</tr>
<tr>
<td>&quot; (half-bred)</td>
<td>—</td>
<td>—</td>
<td>3,753</td>
<td>10,418</td>
</tr>
<tr>
<td>Sheep, African</td>
<td>343,989</td>
<td>381,240</td>
<td>422,481</td>
<td>472,585</td>
</tr>
<tr>
<td>Angora Goats</td>
<td>—</td>
<td>—</td>
<td>10,044</td>
<td>13,340</td>
</tr>
<tr>
<td>&quot; (half-bred)</td>
<td>8,095</td>
<td>10,257</td>
<td>10,387</td>
<td>18,163</td>
</tr>
<tr>
<td>Goats</td>
<td>319,000</td>
<td>384,986</td>
<td>448,279</td>
<td>485,401</td>
</tr>
<tr>
<td>Horses</td>
<td>10,661</td>
<td>11,633</td>
<td>13,340</td>
<td>15,916</td>
</tr>
<tr>
<td>Mules and Donkeys</td>
<td>12,693</td>
<td>9,994</td>
<td>11,894</td>
<td>13,618</td>
</tr>
<tr>
<td>Pigs</td>
<td>5,208</td>
<td>7,761</td>
<td>7,195</td>
<td>7,772</td>
</tr>
<tr>
<td>Camels</td>
<td>954</td>
<td>847</td>
<td>789</td>
<td>709</td>
</tr>
<tr>
<td>Ostriches</td>
<td>334</td>
<td>642</td>
<td>1,277</td>
<td>1,507</td>
</tr>
</tbody>
</table>

By the beginning of 1921 it is estimated that the totals stood at 464,000 head of large stock and 1,076,000 head of sheep and small stock. Between 1,400 and 1,500 farms are occupied, mainly by Germans with a small minority of Dutch Africans, and these, with the natives, are therefore carrying only from one-seventh to one-fifth the quantity of cattle and barely one-sixteenth the number of small stock of which the country is capable. There is room for multiplying the number of occupied farms by four, but before this can be accomplished extensive water-boring operations and irrigation schemes will have to be undertaken, and the supply of labour improved. Even under present circumstances, as demonstrated above, substantial progress is being made, the herds and flocks are increasing rapidly, and exports of livestock and their products are growing. In 1913, for example, cattle and small stock were shipped to the value of £15,760, but this had risen to £208,140 in 1919; horns, hides and skins jumped from £31,415 to £58,212; and wool from £6,814 to £6,868. Incidentally, co-operative farming is making headway, societies having been formed in most districts, with a Union having its headquarters at Windhuk.

Dairy-farming is carried out on a moderate scale in the Windhuk and Kalkveld districts, but it is not possible in many parts of the country. General farming is retarded by difficult conditions, particularly the uncertain rainfall, and in many districts has proved a disastrous
failure. It is impossible to say what may eventually be accomplished by means of irrigation and scientific methods, but agriculture cannot be expected to add greatly to the wealth of the country for years to come. Nevertheless, maize, lucerne, tobacco and certain fruits are grown successfully in some districts.

Hitherto, of course, the most profitable asset of the territory has been its natural wealth of diamonds, first discovered in 1908. The output of these rose from £845,000 in 1909 to £2,698,500 in 1913, and to £4,250,000 in 1920, falling to only £493,000 in 1921. Since the industry was established it has been the largest contributor to the export trade. The deposits are patchy, and confined to the strip of coast, some 270 miles in length, from the Orange River southwards. No further recent discoveries have been made and the life of the deposits is not expected to extend over many years. In fact, the German estimate was only 15 years. The mines employ over 300 Europeans and some 4,000 natives.

Second to diamonds in importance to-day, but probably destined to remain a permanent and increasingly valuable asset, is the copper industry. The mines are situated in the neighbourhood of Otavi and Tsumeb, and near the Khan River, while ore exists in considerable quantities in the mountainous country some 50 miles north-west of the Otavi Railway. The value of the exports in the period 1910-13 and in 1921 was as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Carats</th>
<th>Value</th>
<th>Year</th>
<th>Carats</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1909</td>
<td>566,280</td>
<td>£845,000</td>
<td>1916</td>
<td>144,920</td>
<td>£328,225</td>
</tr>
<tr>
<td>1910</td>
<td>798,865</td>
<td>1,069,000</td>
<td>1917</td>
<td>364,761</td>
<td>834,315</td>
</tr>
<tr>
<td>1911</td>
<td>816,296</td>
<td>1,045,000</td>
<td>1918</td>
<td>372,139</td>
<td>749,000</td>
</tr>
<tr>
<td>1912</td>
<td>902,137</td>
<td>1,324,500</td>
<td>1919</td>
<td>462,180</td>
<td>2,081,000</td>
</tr>
<tr>
<td>1913</td>
<td>1,284,727</td>
<td>2,698,500</td>
<td>1920</td>
<td>606,423</td>
<td>4,250,000</td>
</tr>
<tr>
<td>1914</td>
<td>Nil</td>
<td>Nil</td>
<td>1921</td>
<td>171,188</td>
<td>493,000</td>
</tr>
<tr>
<td>1915</td>
<td>13,409</td>
<td>34,030</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

South-West Africa's Diamond Output, 1909—1921.

Valuable deposits of marble are being worked near Karibib.
on the Otavi Railway, coal has been located near Keetmanshoop, large deposits of iron have been found in the Kaokoveld, tin is being mined round the Eyonga Mountains, and asbestos, zinc and numerous other minerals are known to exist in various parts of the country.

It is evident, then, that South-West Africa possesses all the elements on which to found a great industrial future as money and labour become available under a sympathetic Administration. With the growth of industrial activity the import and export trade will assuredly expand in exact ratio, and an important commercial field will be added to the South African group of markets.
II.—A TRAVELLER’S IMPRESSIONS OF THE COUNTRY.

THE first impression one gets on visiting the country known until recently as German South-West Africa is that it is so essentially South African. One cannot escape the typically South African atmosphere, the singing of the cicada which breaks the stillness of the starlit night and the warm sweet smell of the earth after a day of blazing heat! The lasting impression is one of sand and bush and desert, and yet, strange to say, it is not the unpleasant feeling which this expresses. As in all South Africa, there is a strange fascination even in the desert, that dry and limitless waste of sand dunes and broad stretches which runs right up to the coast line and invades the hinterland for from five to a hundred miles. It is known geographically as the Namib Desert. It has extracted its toll of human life, like our own Kalahari, and many men have gone out never to return—lost in a maze of circles which always return to the starting-point, maddened with thirst, to find eventually a winding sheet of ever-shifting sand. And yet it has a fascination all its own. Its immensity, its very appearance of cruelty, has just that fascination which belongs to the sea. For sheer beauty I have rarely seen anything to equal it. In the early morning the dunes are tipped with gold, while below there are shadows of dark translucent blue shading to purple. At sunset there is a riot of colour, and after the sun has dipped below the horizon there follows a quick succession of the most delicate tones imaginable, changing, almost as you look, through every gradation of tone from crimson to darkest purple.

It is curious that in this desert there should be diamonds. While geologists may wrangle as to the nature of their incidence, the artist will rest content with his own fancy that this prodigality of light and colour has not been wasted but imprisoned in the precious little stones. But I am getting away from my impressions of the country.

From De Aar to the old border station at Nakob was uninteresting save for the splendid new bridge which has been built across the Orange River at Upington. From Nakob to Kalkfontein, the terminus of the German system, one had nothing

* From an article by Seals Wood in the B.S.A. Annual, 1915-16.
but admiration for our railway engineers. The line was laid very quickly, but is smooth running and true. The country through which it passes is dry and unfertile.

From Kalkfontein to Seeheim, the junction for Luederitzbucht and Windhuk, the country appeared to be much the same, and the only interest was caused by deviations in the line which gave an excellent view of the bridges blown up by the Germans as they retreated. Along the line, too, (but more continuous and noticeable from Luederitzbucht to Keetmanshoop), were numbers of twisted fragments of the iron rails.

Seeheim boasts a station, an hotel, and a small store, and beyond that—nothing. Here we took train for Luederitzbucht. After leaving Seeheim and passing across the two fine bridges over the Fish River, which the Germans were fortunately prevented from blowing up, we arrived at Aus early the next morning, just four days after leaving Cape Town. I had known Aus in its early days (it was here I met that brave spirit, Kep de Meillon, who lies in a hero’s grave close by). At the time of this visit it was a place of utter desolation.

It was a matter of no small surprise that I heard during the campaign of the German evacuation of Aus. I was more than ever surprised when I saw the wonderful series of entrenchments which, added to its wonderful natural advantages for defence, ought to have made it almost impregnable. It is probable that the Germans would have made a stand here but for the wonderful performance of our eastern forces. German soldiers with whom I afterwards conversed assured me that it was due more to the incompetence of their own commander, Major Francke. The rank and file had a deep respect for Von Heydebreck and sustained a severe loss in his death. After him they placed their confidence in Hauptmann Veck. He, too, died, after falling from his horse, and the phrase “Veck ist aus, und Aus ist weg” (a pun on the similar pronunciation of the words and meaning “Now Veck is gone, Aus is gone”) became an often-repeated catch in the ranks. At Garub, a few miles from Aus, is the first water-hole from Luederitzbucht, and here we had a great camp during the advance from that town. Our men must have had an awful time there, for it is just a flat expanse of sand—dry, windy, and fly-ridden. From Garub the desert is for the most part flat and uninteresting in the heat of the day or, as is generally the case, when the wind is blowing. Passing across it on a brilliant moonlit night, however, is an experience never to be forgotten—it is a sea of silver. Some few miles before Kolmanskop the sand dunes become more frequent and it is here that Germans and English alike have had such difficulty in keeping the sand off the rails. Despite
a small army of natives who are employed continually in shovelling the sand off the lines, it has been found necessary to cover many of the dunes with tarpaulins. Kolmanskop has grown enormously with the advent of diamonds and a goodly area is given up to the shops that house the machinery. Beautiful houses, too, were built to accommodate officials of the Koloniale Bergbau Gesellschaft, the largest and most important of the companies which operated there. The Kolmanskop Diamond Mining Company, of Cape Town, has its plant and buildings on the other side of the railway line in the Charlottenthal. It was in this neighbourhood in April, 1908, that diamonds were first discovered by a Cape boy while working on the Luederitzbucht-Keetmanshoop railway. At first people were sceptical, but experts soon pronounced the stones to be real diamonds. The diamondiferous gravel extends from Conception Bay to Angras Juntas, nearly three hundred miles, though it is not by any means continuous, and the best deposits are found in certain valleys formed by the dunes. There has been much discussion over the "life" of the fields, and a conservative estimate is placed at 100,000 carats per month for from five to eight years. The stones are very small, but there appears to be an excellent market for this small stuff for cheap jewellery. The value of the output has risen from £845,000 in 1909-10 to £2,000,000 in 1919.

The tax on diamonds yielded £330,000 for the financial year 1913-14. In 1909 the German local Government formed a "Diamond Regie," and the necessary ordinance was passed giving them the right to restrict the output to certain specified maximum sales for each company.

Luederitzbucht is only a few miles from Kolmanskop and an hour's journey past more dunes and sand-bag block houses brought us a view of the sea and, presently, through a rock cutting in the hill which flanks it, right into the town itself.

The town takes its name from a German called Luederitz who, in 1884, obtained protection from the German Government in terms of the following historic telegram dated April 24th of that year:

"In consequence of information received from Mr. Luederitz that the Colonial Office is in doubt whether his acquisitions north of the Orange River have a claim on German protection, please declare officially that he and his settlement are under the protection of the German Empire. (Signed) Bismarck."

For many years after this the town consisted of the Luederitz store and the police station, but during the war with the Hottentots troops passed through and a few wood-and-iron buildings sprung up. With the introduction of the diamond industry and the increased population caused thereby, more houses and shops came to be built. About this
1. Sand dunes near Luderitzbucht in which Diamonds are found. A railway train can be discerned in the distance.

2. Government Buildings at Windhuk, and the Monument erected to the memory of German troops killed in the Herero War. 

time (to be correct in 1909) a municipal council was formed, and one of the first things that council set about doing was the abolition of the wood-and-iron buildings and the introduction of compulsory building regulations so that all houses should be of brick or stone. Prior to this there had been several disastrous fires, and as all water was either imported or condensed, the danger to the town was obvious. It is due to this that there are so many fine stone buildings in Luederitzbucht to-day. Indeed, architecturally and generally speaking, it compares favourably with any town of its size in South Africa. The town runs up from the beach to the top of the low hills behind it. The streets are of sand. On the site where the imposing railway station now is, and in fact in most other places a couple of hundred yards from the beach, blasting was essential to clear away the rock and obtain a level. Along each street runs a light railway for mule traction, and each store has what might be called its “private branch line” running into the yard. Before this, a mule wagon coming down the street was a terrible thing—alike for the mules and the good “hausfrau” who had just finished dusting!

The population of Luederitzbucht is about two thousand whites, and there are some well-furnished and quite modern stores and shops. At present, and for some time to come, the prosperity of the town is bound up in the diamond industry.

After a stay in Luederitzbucht of a few days, I bought provisions to last for or five days and booked through to Windhuk.

We passed Aus during the night and the next morning brought us to Kuibis, where poor Sir George Farrar met his unfortunate death. The country gradually assumed an appearance of fertility as we got farther inland, and we passed through tracts of fairly good veld-bush and dry veld-grass. In the evening we arrived at Keetmanshoop (a typical South African town about the size of Upington), which, it is thought, should now attain to more importance in view of the fact that the two railway systems are joined.

During the German régime Keetmanshoop was an important railway and military centre, and it is understood that a great amount of military equipment was found there—far more than was necessary for the two thousand regular troops stationed in the colony. Entraining the same night, we got through to Gibeon at noon the following day and, as the station is some distance from the settlement, there was nothing to see but the station building. There was a pathetic interest, however, in the graves of the men who fell there in the war. They are neatly outlined with stones and over each is a small wooden cross, with each man’s name and rank. Their resting place is opposite the station, over across the railway line, out in the open under the blue
sky. For miles around there is nothing but the illimitable veld unbroken by hill or kopje. Through the night we passed Rehoboth and district, which is excellent cattle country and mainly in the hands of the Bastards. It is not generally known that the Germans had severe fighting with this tribe and that their losses in killed alone were nearly a hundred men. Early the following morning brought us to the mountain passes south of Windhuk, where we disturbed great droves of birds similar to the English pheasant. The scenery was very beautiful and the vegetation more luxuriant than any we had yet seen. The line winds around the mountain slopes at a steep incline until far down below are seen the five towers of the celebrated wireless station a few miles outside of the town. Windhuk itself is a town of practically one long straggling street. It is five thousand five hundred feet above sea-level so the climate is similar to that of the high veld in the Transvaal; its distinctive landmarks are the church and Government Buildings, which are perched on the top of a hill overlooking the town. To the Germans the building has always been known as the “Tinte Palast” or “Ink Palace.”

The population of Windhuk is about three thousand five hundred whites, and as it is situated in the centre of the best farming district (Klein Windhuk is the only place in the colony which may be said to be agricultural) and is the seat of government, it is quite a busy place. I stayed at the “Rheinischer Hof” Hotel.

After a stay of a few days at Windhuk we left for Swakopmund. Ordinarily the journey should take twelve hours, but it took us nearly three days. The country through which we passed, along this northern section of the line, gave the appearance of being much more fertile than that in the southern districts. After leaving Karibib, however, which is the junction for the Tsumeb and Grootfontein termini in the north, we passed through the desert belt once more. Here, in the north, it is sandy, but the barrenness is somewhat relieved by a profusion of melkbosch such as grows in Namaqualand. From Karibib to Usakos an entirely new line has been built, shortening the distance, and on this section three lines have been laid so that either the narrow or the broad gauge trains may use it. From Karibib to Swakopmund the line has been relaid by our engineers so that the line from Swakop to Windhuk is now the uniform Cape gauge. At Karibib is situated the marble quarry which turns out very beautiful stone much after the Italian marble.

After leaving Usakos there is little of interest save at Trekkopjes, where, again quite close to the railway line, are the graves of those who fell at this engagement. There is also a pathetic mound surmounted by
a cross which tells that here lie several Germans names unknown. After countless delays, due to the engine breaking down, we duly arrived at Swakopmund in the small hours of the morning. Prior to the war Swakopmund was quite an important place, boasting many handsome buildings, a wireless station, lighthouse, hospital and magnificent school buildings. The pier, too, though incomplete, is a fine structure and cost many thousands of pounds. It was the intention of the Germans to carry it out sufficiently far to sea to enable lighters to be worked even when the Atlantic came rolling in with more than ordinary force. That plan will probably remain for ever incomplete as it is certain that Walvis Bay will now be the port for the north. Walvis Bay is formed by a long spit of sand running out to sea, and is so large that it could accommodate a whole fleet of ships. Already a line has been built along the beach from Walvis to Swakopmund and all cargo is landed at the former place. It is difficult therefore to foresee any future for Swakopmund other than that of a residential quarter. Its climate is temperate, and in summer the hottest day is cooled by the inevitable sea mist morning and evening.

The streets are well laid out and the pavements have been put down in wood. Swakopmund boasts a park in which stands a very fine monument to those who fell during the Herero war.

In general, one feels that the country has possibilities in the way of development both of mining and stock-farming.

At the same time, it must be remembered that the best farming districts have, for the most part, been taken up by German settlers. According to the Taschenbuch (1914), published under the aegis of the German Colonial Office, Crown Land could be had for one shilling and sixpence per hectare (about two morgen) in the northern parts of the colony, with the exception of Outjo and Gobabis, where the rate fell to about one shilling and threepence. In the Rehoboth, Gibeon, and Maltahoehe districts the rate was also in the neighbourhood of one shilling and three pence per hectare, while in the more southerly districts it fell to about nine pence. It is an excellent criticism of the value of the land for farming in the different districts. It is further stated that the average size of a farm in the northern districts, and also in the better parts of the middle districts, was about five thousand hectares. In the south the average size was just about double. These are very large farms compared to the average of those in the Union, but the difference is explained by a note to the effect that the land required per head of cattle is about fifteen hectares or for small stock two hectares. Intending settlers were
further advised that the amount of capital required should be from two to three thousand sterling.

The Protectorate has an area of about 322,200 square miles, or about three-fourths the area of the Union of South Africa. The estimated white population (1913) is about 15,000. The native population, excluding the Caprivi Zipfel and Ovamboland, was estimated for 1913 at 78,810. The population of the Caprivi Zipfel and Ovamboland has been variously estimated at between 150,000 and 200,000.

While one’s final impression of the country may not be tinged with that enthusiasm which every Colonial feels for his own province in the Union, and for South Africa as a whole, one realises that it has vast possibilities. South Africa is a country of surprises and the Protectorate may have another and a richer surprise in store than the discovery of diamonds in the sands of the Namib desert. Already there has been taken from her gold (from Karibib), lead and copper (from Otavi), as well as diamonds from the Luederitzbucht and Pomona districts.

But, rich in mineral wealth though it may be, the Protectorate will ever have the greater riches in its association with one of the greatest figures in the history of South Africa; with those great principles of honour and duty which he so nobly held and so faithfully followed.

Whatever its eventual name, whatever its final destiny, the conquest of the Protectorate will ever remain a monument to General Botha, to the nobility of his character and to his loyal devotion to duty.
The Trade History of Southern Rhodesia.

Southern Rhodesia may be said to have commenced with the influx of traders with loaded wagons in 1894—the far-sighted, plucky men who made for the new market as soon as it was opened to them by the first defeat and death of Lo Bengula. For years before that, of course, pioneer traders had penetrated far into the country north of Limpopo and the Hunter's Road, selling Kaffir truck to the natives, and often less legitimate merchandise than Kaffir truck. They and the missionaries were the scattered advance guard of civilization in the eighties, but it was only in 1894 that European settlement provided the beginnings of the market as we know it to-day.

The opening up of the country by the Chartered Company after the victorious military operations against the Matabeles was an opportunity which was promptly grasped by a goodly company of merchant-adventurers from what was then the Cape Colony. Prominent among, and typical of, those pioneers were such men as Mr. W. H. Haddon, now widely known as one of the founders and partners of the important firm of Haddon & Sly at Bulawayo. He was in the service of a Port Elizabeth merchant house in 1894, but threw up his post and, with his wife, made for the new field that was opening. He was able to get as far as Mafeking by train, and at that centre he loaded several wagons with general goods likely to be of service to a young community. An adventurous trek of nine weeks to Bulawayo followed, and there he opened a store in a small tin shanty. Six years later he was not only a prosperous merchant, but was Mayor of Bulawayo and a Member of the Legislative Council of Southern Rhodesia. His experiences, as we have said, were typical of those of the men who laid the foundations of the present market.

No account can do full justice to the difficulties those early traders faced and overcame. They formed part of a small white community surrounded by a large and warlike native population which for some years caused constant unrest, endangering the lengthy and slow communications with the settled territories to the south and actually rising in re-
billion in 1896. Three years after the settlement of that disaster came the tragedy of the Boer War, which naturally had a seriously disorganising effect on Southern Rhodesia's trade and industries. Malaria, tsetse fly, cattle diseases, drought and other troubles also afflicted large areas of the country from time to time, but in spite of all these difficulties progress was continuous and substantial.

Throughout their brief history also, the people of Rhodesia have devoted themselves to the building up of something more than mere material progress—they have developed an imperial tradition unsurpassed throughout the rest of the Empire. Nowhere else exists a market so intensely British, for, with practical patriotism, the Rhodesians have translated their tradition into business terms as well as idealistic sentiments. The consequence is that British goods are welcomed before all others, and are given the substantial preference of popular feeling in addition to the special concessions provided for in the Rhodes' clause of the Customs Convention. This was as active a factor in the difficult early days to which we have referred as it is at the present moment. In fact, for years past fully three-quarters of the imports have originated in the Mother Country and other parts of the Empire.

The trade of Southern Rhodesia has, of course, progressed in exact ratio with the growth of European settlement. In 1895 the imports were worth only £353,317, and there were no exports of any note. By 1900 the imports had reached a value of £1,221,968, leaping to as much as £1,858,569 in the boom of 1902. After a less favourable interval the latter figure was again reached and passed in 1909 with a total of £2,195,167, and continued expansion carried it to no less than £3,018,204 in 1913. Meanwhile, exports had for a considerable period been even larger than the imports, a healthy state of affairs on which the Administration and the settlers deserved hearty congratulations. With the outbreak of the Great War there naturally came a change, for though imports (partly on account of military needs) were maintained during the first two years of hostilities, there was a falling away of exports, followed, however, by an equally marked recovery. The boom year of 1920 saw both imports and exports pass the £5,000,000 mark, but in 1921 exports dropped by nearly £1,000,000, owing to the slump in European markets for raw materials. A small further decline was apparent in both imports and exports during the first half of 1922, but by the end of that year indications of a turn in the tendency were becoming visible. In 1923 imports were £3,505,710 and exports £4,916,121.

On the whole, the foregoing statistical summary of Southern Rhodesia's trade history shows a
great total expansion of the market, in spite of periodical setbacks due to well-defined causes. The character of the trade, as distinct from its volume, has also shown steady development since the days of the pioneers, though along natural and easily comprehended lines. Mining and agriculture have for most of the period been the twin staves of the country industrially, and the two forms of activity have shared in shaping both the principal output and the requirements. Agriculture has, moreover, attracted a class of settler of good social standing in the main, and this has had its effect in raising the standard of personal and domestic imports. To the white market has also been added a valuable native demand with special features of its own.

In the import trade textiles and clothing form by far the largest department, amounting to over £858,000 in 1923, and so far as European requirements are concerned these are mainly for articles of similar fashion and quality to those in vogue in England, though naturally of lighter weight as a rule. Articles of food and drink take second place, their value in 1923 being nearly £516,920, an important item being canned meats, fish and fruit. Machinery is, of course in substantial demand, and comes almost entirely from Great Britain. In the year quoted the mines and general industries bought equipment to the value of about £213,156, while farming requirements, including implements, tools and all agricultural supplies, amounted to £106,048. Furniture is another line which is always in strong demand, knocked-down English and cheap American articles being in keen competition. Metals, metalware, and raw industrial materials are the principal classes among the large quantity of miscellaneous imports. Incidentally, it is interesting to note that while Beira is the natural port for Southern Rhodesia, only 45 per cent. of the imports enter the country through it, while nearly 55 per cent. are landed at Union ports and are carried north on the main Cape-to-Cairo railway.

Although Southern Rhodesia is so preponderantly a British market, it must be confessed that foreign competition makes itself felt in certain directions. For instance, in light agricultural implements, motor tractors, motor cars, and some classes of hardware, especially enamelled goods, the United States of America have made considerable progress since the war. Germany has also "come back" to some extent in the supply of hardware, while Japan, after making a successful effort to meet the demand for cheap cotton goods and Kaffir truck, has for some time been losing ground heavily.

Raw gold represents a little more than half of Southern Rhodesia’s present exports of nearly five million sterling, and such minerals as chrome ore, coal, copper, asbestos, lead, etc., stand for well over another
million sterling per annum. The balance is made up by cattle, hides and skins, tobacco, maize, cement, etc.

As in other parts of Africa, the future growth of Southern Rhodesia's trade depends upon the development of its exporting industries. It cannot be regarded as a manufacturing country, nor is it likely to become such in the near future. It will be years before its great mineral, agricultural and pastoral resources are in full process of development, and it is to these that capital and labour will be most usefully applied.

Taking minerals first, gold must for long occupy the premier position. For a period during the war the output was raised to nearly £4,000,000 per year, and, although this figure was not maintained, there is no valid reason why it should not again be
reached and exceeded. The output during twelve years is shown below:—

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1910</td>
<td>609,955</td>
<td>£2,566,198</td>
<td>1917</td>
<td>834,230</td>
<td>£3,495,391</td>
</tr>
<tr>
<td>1911</td>
<td>628,521</td>
<td>2,647,894</td>
<td>1918</td>
<td>631,558</td>
<td>2,653,260</td>
</tr>
<tr>
<td>1912</td>
<td>642,807</td>
<td>2,707,369</td>
<td>1919</td>
<td>593,222</td>
<td>2,499,498</td>
</tr>
<tr>
<td>1913</td>
<td>689,954</td>
<td>2,903,268</td>
<td>1920</td>
<td>552,798</td>
<td>3,056,549</td>
</tr>
<tr>
<td>1914</td>
<td>854,479</td>
<td>3,580,209</td>
<td>1921</td>
<td>—</td>
<td>3,217,275</td>
</tr>
<tr>
<td>1915</td>
<td>705,029</td>
<td>3,823,168</td>
<td>1922</td>
<td>—</td>
<td>3,140,459</td>
</tr>
<tr>
<td>1916</td>
<td>930,356</td>
<td>3,895,311</td>
<td>1923</td>
<td>—</td>
<td>2,909,159</td>
</tr>
</tbody>
</table>

A feature of the Rhodesian gold industry is that the nature of the quartz reefs favours the operations of small individual capitalists working their own properties or, as in many cases, as "tributors." These small men are responsible for fully one-third of the total annual yield, and provide a special market for machinery suited to their conditions, such as a combination of five or more stamps with a cyanide plant.

Among other metals produced on a commercial scale is copper, which is being mined in the Gwelo, Lomagundi and Victoria districts. In the same districts, and also Belingwe, important deposits of crysolite asbestos have been found, and the output has steadily risen from 290 tons, worth £5,224, in 1913, to nearly 20,000 tons, valued at about £500,000, at the present time. Lead, silver, zinc, iron, tungsten, salt, soapstone, verdite, antimony and fluor spar are also among the mineral resources of Southern Rhodesia, and their wider working will eventually add to the wealth of the country while extending the market for machinery. This territory, by the way, supplies more than half the entire world's demand for chrome iron ore, an annual output of 100,000 tons and more having been reached since the war.

The coal industry of Rhodesia has reached very important proportions, and it is known that vast quantities still remain to be developed. The Wankie steam coal is, of course, well known, and coal-bearing strata exist throughout a belt reaching from the Zambesi to nearly 150 miles south. At Tuli, Sengwe and elsewhere valuable deposits also exist. Southern Rhodesia's output of coal since 1906 has been as follows:—

<table>
<thead>
<tr>
<th>Year</th>
<th>Tons.</th>
<th>Year</th>
<th>Tons.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1906</td>
<td>103,803</td>
<td>1918</td>
<td>491,268</td>
</tr>
<tr>
<td>1908</td>
<td>164,114</td>
<td>1919</td>
<td>510,040</td>
</tr>
<tr>
<td>1910</td>
<td>180,068</td>
<td>1920</td>
<td>578,492</td>
</tr>
<tr>
<td>1913</td>
<td>243,328</td>
<td>1921</td>
<td>574,753</td>
</tr>
<tr>
<td>1914</td>
<td>349,959</td>
<td>1922</td>
<td>515,650</td>
</tr>
<tr>
<td>1915</td>
<td>409,763</td>
<td>1923</td>
<td>617,297</td>
</tr>
<tr>
<td>1916</td>
<td>491,582</td>
<td>1924</td>
<td>652,049</td>
</tr>
<tr>
<td>1917</td>
<td>548,954</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The coal mines are capable of a much greater output. The
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

SOUTHERN RHODESIA'S IMPORTS, 1913-1923.

<table>
<thead>
<tr>
<th>Articles for use in Agriculture</th>
<th>Year 1913</th>
<th>Year 1923</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>£58,673</td>
<td>£106,048</td>
</tr>
<tr>
<td>Articles of Food and Drink</td>
<td>£633,032</td>
<td>£516,920</td>
</tr>
<tr>
<td>Raw Materials</td>
<td>£55,354</td>
<td>£72,772</td>
</tr>
<tr>
<td>(Other than Metals for manufactures)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Manufactured Articles:

| Furniture                  | £54,346  |
| Machintry (not Tools)      | 422,163  |
| Metals and Metal Manufactures | 221,231  |
| Oilman's Stores            | 102,566  |
| Textiles and Wearing Apparel | 677,319  |
| Miscellaneous              | 862,700  |
| Government Stores          | 51,806   |

TOTAL: £2,939,190

By COUNTRIES OF ORIGIN.

<table>
<thead>
<tr>
<th>Country</th>
<th>Year 1913</th>
<th>Year 1922</th>
<th>Year 1923</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>£1,636,137</td>
<td>£1,819,714</td>
<td>£1,501,487</td>
</tr>
<tr>
<td>British Possessions</td>
<td>439,534</td>
<td>497,753</td>
<td>273,766</td>
</tr>
<tr>
<td>Foreign Countries</td>
<td>548,886</td>
<td>864,014</td>
<td>738,521</td>
</tr>
</tbody>
</table>

ADD: South African Produce |

<table>
<thead>
<tr>
<th>Year 1922</th>
<th>Year 1923</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,314,554</td>
<td>2,881,483</td>
</tr>
<tr>
<td>542,830</td>
<td>882,677</td>
</tr>
</tbody>
</table>

ADD: Government Stores |

<table>
<thead>
<tr>
<th>Year 1922</th>
<th>Year 1923</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,887,384</td>
<td>3,764,160</td>
</tr>
<tr>
<td>51,806</td>
<td>57,257</td>
</tr>
</tbody>
</table>

GRAND TOTAL (Excluding Specie) £2,939,190 £3,555,710

SOUTHERN RHODESIA'S EXPORTS, 1913-1923.

<table>
<thead>
<tr>
<th>Principal Articles (S.A. Products)</th>
<th>Year 1913</th>
<th>Year 1923</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, raw</td>
<td>837,865 ozs.</td>
<td>£2,887,201</td>
</tr>
<tr>
<td>Chrome Ore</td>
<td>62,899 tons</td>
<td>141,594</td>
</tr>
<tr>
<td>Copper (Blister)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Asbestos, raw</td>
<td>497,577 lbs.</td>
<td>2,496</td>
</tr>
<tr>
<td>Coal</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Coke</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Cattle (for slaughter)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Hides and Skins</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Cement</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Tobacco</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Maize</td>
<td>7,792,714 lbs.</td>
<td>24,014</td>
</tr>
<tr>
<td>Maize Meal</td>
<td>1,651,178 lbs.</td>
<td>7,234</td>
</tr>
<tr>
<td>Other Products</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

TOTAL: £3,297,099

TOTAL: £4,916,121
RANCHING PROSPECTS

Wankie coalfield is one of the largest in the world and is capable of meeting almost unlimited demands.

During Rhodesia's brief history down to the end of 1923 it had produced gold to the value of £57,522,241, silver £456,293, base metals and precious stones £11,681,393, or a total mineral production of nearly £70,000,000.

Even greater than its mineral wealth are the agricultural and pastoral potentialities of Southern Rhodesia. To make actualities of these the essential necessities are more settlers of the right type and more capital. If these can be found to an increasing extent under Responsible Government the future of the country is assured, and there is every reason to hope that, with the shaping of their destiny more completely in their own hands than ever before, Rhodesians will be guiltless of any narrow policy aimed at shutting out new-comers. Such a policy would be against all their traditions, and is not in the least likely to be adopted. On the contrary, they are more likely to revitalise the efforts hitherto conducted by the Chartered Company to induce settlers and industrialists to turn their attention to the great opportunities which their country offers to enterprise.

Out of the entire area of Southern Rhodesia—some 148,600 square miles—fully 100,000 square miles lie above 3,000 ft. higher than sea level, and this large area is on the whole suitable for European occupation. It may roughly be described as extensive grass plains, bush country, and broken and hilly tracts. There is no finer ranching country in the world than those portions of Southern Rhodesia which come under the first heading; under the third may be included most of the land occupied by natives. There are over 1,500,000 head of cattle, of which roughly half are owned by Europeans. Sheep are less numerous and their numbers are declining, the conditions and pasturage being much more favourable to the maintenance of larger stock. The Chartered Company have developed ranches carrying a great many head of cattle, and Liebigs and other important concerns have for a number of years interested themselves in the industry. In connection with cattle-raising, it is interesting to note that the Rhodesian Canning Factory, Ltd., erected extensive packing works at Umtali but the drop in world prices has handicapped the development of such enterprises in recent years. Dairy-farming and bacon producing are both well established in the country, and much is expected of them in the future.

Coming to cereals, there are some 5,000 acres under wheat, a yield of three bags to the acre being obtained; and a considerable milling industry has grown up. A restricting influence, however, is the prevalence of "rust" in the rainy season. Maize is
the principal crop, something like nine-tenths of the land cultivated by Europeans being devoted to it. Mashonaland is specially suitable for this crop, and will undoubtedly be the field of much greater future developments. The output of maize nearly reached the million-bag mark in several years during the war, and has since actually passed it. Meanwhile, a scheme is afoot for providing the country with a system of grain elevators, with a large port elevator at Beira.

Tobacco, cotton, citrus fruits, sisal and other fibre plants, oil seeds and nuts, and many vegetables flourish on Rhodesian soil, and will eventually provide all local requirements and a large surplus for export, as, in fact, some of the products mentioned are already doing.

It is, as already stated, on this solid industrial basis that the existing large trade of the country rests, and on which its future depends. Railway construction, and particularly the existence of the main Cape-to-Cairo line, has been the key to much of the progress achieved, and will be increasingly so in years to come. The question of population is no less vital. Roughly, there are at present some 34,000 whites and 862,000 natives in Southern Rhodesia, with about 3,200 Asiatics. There is room for many times that number of Europeans, and everything depends upon a progressive influx of new settlers of the right sort. If that influx is provided—as no doubt it will be—the future of the country and its trade is assured. Its exports can easily be expanded to a far higher level, and the growth of the import trade will correspond. It is a simple sum in arithmetic to take the known fact that a white population of 34,000 is importing goods to a value of between £4,000,000 and £5,000,000 per year, and on that basis to calculate what the imports should be when the number of Europeans reaches any given higher figure.

<table>
<thead>
<tr>
<th>Year</th>
<th>Imports.</th>
<th>Exports.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1895</td>
<td>£353,317</td>
<td>—</td>
</tr>
<tr>
<td>1896</td>
<td>£483,382</td>
<td>—</td>
</tr>
<tr>
<td>1897</td>
<td>£622,422</td>
<td>—</td>
</tr>
<tr>
<td>1898</td>
<td>£721,319</td>
<td>—</td>
</tr>
<tr>
<td>1899</td>
<td>£556,170</td>
<td>—</td>
</tr>
<tr>
<td>1900</td>
<td>£1,221,968</td>
<td>—</td>
</tr>
<tr>
<td>1901</td>
<td>£1,443,653</td>
<td>—</td>
</tr>
<tr>
<td>1902</td>
<td>£1,858,569</td>
<td>—</td>
</tr>
<tr>
<td>1903</td>
<td>£1,576,619</td>
<td>—</td>
</tr>
<tr>
<td>1904</td>
<td>£951,698</td>
<td>—</td>
</tr>
<tr>
<td>1905</td>
<td>£1,213,776</td>
<td>—</td>
</tr>
<tr>
<td>1906</td>
<td>£1,351,828</td>
<td>£2,081,957</td>
</tr>
<tr>
<td>1907</td>
<td>£1,487,841</td>
<td>£2,319,250</td>
</tr>
<tr>
<td>1908</td>
<td>£1,801,163</td>
<td>£2,614,496</td>
</tr>
<tr>
<td>1909</td>
<td>£2,195,167</td>
<td>£2,805,607</td>
</tr>
<tr>
<td>1910</td>
<td>£2,601,464</td>
<td>£2,812,037</td>
</tr>
<tr>
<td>1911</td>
<td>£2,973,112</td>
<td>£2,880,762</td>
</tr>
<tr>
<td>1912</td>
<td>£2,969,958</td>
<td>£2,975,100</td>
</tr>
<tr>
<td>1913</td>
<td>£3,018,204</td>
<td>£3,297,099</td>
</tr>
<tr>
<td>1914</td>
<td>£2,765,854</td>
<td>£2,760,084</td>
</tr>
<tr>
<td>1915</td>
<td>£2,143,373</td>
<td>£827,283</td>
</tr>
<tr>
<td>1916</td>
<td>£2,453,795</td>
<td>£4,311,246</td>
</tr>
<tr>
<td>1917</td>
<td>£2,515,243</td>
<td>£4,487,086</td>
</tr>
<tr>
<td>1918</td>
<td>£3,021,579</td>
<td>£3,801,564</td>
</tr>
<tr>
<td>1919</td>
<td>£3,254,462</td>
<td>£4,116,181</td>
</tr>
<tr>
<td>1920</td>
<td>£5,252,318</td>
<td>£5,158,890</td>
</tr>
<tr>
<td>1921</td>
<td>£5,243,123</td>
<td>£4,298,912</td>
</tr>
<tr>
<td>1922</td>
<td>£2,348,978</td>
<td>£2,570,883</td>
</tr>
<tr>
<td>1923</td>
<td>£3,505,710</td>
<td>£4,916,121</td>
</tr>
</tbody>
</table>
The Trade History of Northern Rhodesia.

With an area of 296,000 square miles, a native population of nearly 1,000,000, and not more than 3,700 white inhabitants, it is evident that the trade of Northern Rhodesia cannot be commensurate with its natural resources—in other words, it can only be in the earliest stages of its development, and it is not likely to possess much commercial history. Yet the builders of Northern Rhodesia have some very substantial results to show for their efforts. They have toiled neither slowly nor in vain.

For practical purposes it is scarcely worth while to look back to an earlier date than 1911, when the former North-Western and North-Eastern Territories became one for administrative purposes, and the present title of Northern Rhodesia was adopted to cover both. At that time there were not more than some 45 farms, covering less than a quarter of a million acres, in the whole of the vast area, double the size of Southern Rhodesia; ten years later the number of farms occupied was in the neighbourhood of 300, and covered about 2,000,000 acres. That progress was achieved in spite of the war-stricken years, and the fact that in the public eye the country was overshadowed by its southern and more accessible neighbour.

In studying the record of Northern Rhodesia's material progress it is not incorrect to decide that each new phase coincided with the completion of a chapter in the development of the main railway line from south to north. The administrative unification of the country in 1910 immediately followed the arrival of the railhead at the Katanga border, thus traversing the territory entirely from Southern Rhodesia northwards. Previous to that, the arrival of the line at Broken Hill in 1906 had given a similar impetus to industry and trade. These two railway events, then, may be taken as economic landmarks in the history of the country. Each was accompanied by similar phenomena, as will be seen on reference to the table of imports and exports for the period 1906 to 1922. In the former year both imports and exports reached the relatively high figures of £180,890 and £109,326 respectively figures.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

A Great Rhodesian Industry.

AT BROKEN HILL.

A general view at the Broken Hill lead mines. The circle drawn on the photograph near the slip-way indicates the spot where the famous Broken Hill fossil skull was discovered.
AN ANALYSIS OF EXPORTS

NORTHERN RHODESIA'S TRADE, 1906-1922.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>IMPORTS</th>
<th>EXPORTS</th>
<th>YEAR</th>
<th>IMPORTS</th>
<th>EXPORTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1906</td>
<td>180,890</td>
<td>109,326</td>
<td>1915</td>
<td>174,314</td>
<td>121,065</td>
</tr>
<tr>
<td>1907</td>
<td>113,674</td>
<td>89,200</td>
<td>1916</td>
<td>283,917</td>
<td>146,952</td>
</tr>
<tr>
<td>1908</td>
<td>119,035</td>
<td>90,926</td>
<td>1917</td>
<td>297,104</td>
<td>213,313</td>
</tr>
<tr>
<td>1909</td>
<td>356,917</td>
<td>100,495</td>
<td>1918</td>
<td>355,752</td>
<td>343,338</td>
</tr>
<tr>
<td>1910</td>
<td>218,124</td>
<td>105,326</td>
<td>1919</td>
<td>434,345</td>
<td>434,366</td>
</tr>
<tr>
<td>1911</td>
<td>153,481</td>
<td>108,558</td>
<td>1920</td>
<td>649,728</td>
<td>536,194</td>
</tr>
<tr>
<td>1912</td>
<td>197,105</td>
<td>74,956</td>
<td>1921</td>
<td>725,285</td>
<td>565,401</td>
</tr>
<tr>
<td>1913</td>
<td>255,194</td>
<td>202,877</td>
<td>1922</td>
<td>522,110</td>
<td>427,875</td>
</tr>
<tr>
<td>1914</td>
<td>207,073</td>
<td>158,187</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Exclusive of Gold

which reflected the heavy requirements of material for the construction and equipment of the permanent way, as well as the impetus given to mineral production and to the export of accumulated products. Then for a year or two trade fell back to its normal standard, and even below it, to revive once more under the repeated stimulus of 1909, when imports rose to the record figure of £356,917, and exports also advanced considerably. Again came the inevitable reaction, the lowest point being touched in 1911 and 1912, after which progress on a larger scale altogether made itself apparent, and continued throughout the years of war and after, so that in 1921 the imports stood at £725,285, and the exports at £565,401, a total annual trade of £1,290,686. The effects of the world depression became apparent in 1922, when imports were only £498,346 and exports £616,083; but in 1923 imports rose again to £522,110, though exports only amounted to £463,585.

Northern Rhodesia is, of course, subject to the universal rule that a country's prosperity and entire economic activities are influenced by, and dependent upon its productivity. To understand its character and position as a market, then, it is necessary to study the table of its exports. These are limited in number, but their nature is of extreme interest and importance.

NORTHERN RHODESIA'S EXPORTS, 1921.

<table>
<thead>
<tr>
<th>ARTICLE</th>
<th>VALUE</th>
<th>ARTICLE</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animals, living</td>
<td>94,112</td>
<td>Lead</td>
<td>306,697</td>
</tr>
<tr>
<td>Cotton, raw</td>
<td>1,288</td>
<td>Lime</td>
<td>1,662</td>
</tr>
<tr>
<td>Food and Drink</td>
<td>54,342</td>
<td>Ores and Minerals</td>
<td>5,878</td>
</tr>
<tr>
<td>Gold, raw</td>
<td>6,015</td>
<td>Tobacco</td>
<td>48,706</td>
</tr>
<tr>
<td>Hides and Skins</td>
<td>8,119</td>
<td>Wood</td>
<td>5,197</td>
</tr>
<tr>
<td>Horns</td>
<td>287</td>
<td>Other</td>
<td>26,016</td>
</tr>
<tr>
<td>Ivory</td>
<td>6,752</td>
<td>Total</td>
<td>565,401</td>
</tr>
</tbody>
</table>

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Lead is, by a very large margin, the chief product for sale outside the boundaries of the country. This industry is centred at Broken Hill, where the Rhodesia Broken Hill Development Co., Ltd., have for a number of years successfully worked the lead-zinc deposits. Some 35 square miles of mineralised country are known to exist, but the district has not been fully prospected, though new outcrops are discovered at intervals. Up-to-date Northern Rhodesia has produced about 100,000 tons, worth well over £1,000,000, or ten times as much as Southern Rhodesia's total production. Yet in Northern Rhodesia the industry is a comparatively young one, only a small experimental furnace being in use up to 1917, when two larger blast furnaces were installed, bringing the monthly production up to 1,200 tons per month. This plant was doubled during 1919-20, with a corresponding effect on output. In fact, enough has been discovered and accomplished to render certain that the deposits of ore are of such extent as to become eventually assets of Imperial not to say world, importance. Meantime, the annual exports of lead have reached a value of over £353,773 in 1922, falling, however, to £190,000 in 1923, and their production employs a growing industrial population, both white and coloured.

After lead-mining the principal exporting industries are agricultural and pastoral. It is no small feat for such a country to have developed herds amounting to over 400,000 head, seven-eighths being native-owned, and to have produced for export livestock to a value of nearly £100,000 in 1921, of which amount over £70,000 represented slaughter cattle. The total values fell to just over £60,000 in the two succeeding years, due mainly to low prices, the number of animals exported actually increasing. As a ranching country, indeed, Northern Rhodesia possesses great possibilities, particularly on the Batoka Plateau, which is healthy for white settlement, and carries excellent grass and cultivable land. Maize, tobacco and cotton are the principal crops, the two former figuring largely in the exports.

Such is the industrial basis on which the future has to be built. The changes which may be anticipated are probably such as will affect the quantity of output and imports rather than their character. As a market for manufactured and other goods Northern Rhodesia already offers more variety and scope than many people realise.

Naturally, with a large native population, to say nothing of the European demand in view of the climatic conditions, cotton goods, with a total of £76,753, represent by a considerable margin the heaviest item in requirement. Then the comparatively limited range of agricultural products also renders necessary heavy imports of foodstuffs and
beverages, though these, standing at over £90,076, are more than might be expected. Canned foods and alcoholic liquors are, of course, considerable items. Apparel and slops (£18,816), furniture (£5,984), haberdashery and millinery (£8,637), leather goods (£9,426), stationery and books (£9,390), tobacco (£14,125), soap (£6,577), and in a less degree woollen goods (£970), and linen goods (£1,081), represent other personal requirements of both the white and coloured sections of the population. An interesting feature is the comparatively large quantity of bioscope films (£25,066) imported.

Taken in bulk, the demand for industrial materials and equipment is no less valuable. Coal and coke, almost entirely of South African origin, amount to £21,370, machinery to £20,695, implements and tools to £8,019, iron and steel goods to £11,210, railway and tramway material to £14,473, hardware and cutlery to £17,114, lubricating and other oils to £11,146, and cement to £5,882. In addition, the Administration consumes stores to the value of £20,108; while the imports of motor vehicles and cycles (£9,238) include a large proportion of lorries, etc., for the service of commerce and industry.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

The huge ore-handling plant at the La Pampa Copper Mines in the Katanga.
The Belgian Congo.

I.—THE TRADE OF THE KATANGA

The Katanga is commercially, in an unusual position. Politically and for administrative purposes it is essentially a part of the Belgian Congo, yet in practice it is as distinctly one of the chain of South African markets. It obtains the bulk of its supplies from the south; its store-keepers buy largely from wholesale houses in Rhodesia; and its chief product, copper, is railed south for export. Its trading activities stretch but lightly in the direction of the Congo and the West Coast, and it is significant that in their official statistical returns the Belgian authorities treat it as having a separate commercial identity. The development of the main Cape-to-Cairo line of railway naturally increases this tendency, though it may be assured that as that route develops lateral lines to either coast more fully, there will be a corresponding movement of trade to the west, if not to the east. In fact, there is reason to anticipate that the Katanga may eventually become the hub of the African railway network, a junction of importance equalled by none in the world. That, however, is a matter of the still distant future, though the amount of work already accomplished in bridging the 800 miles to Lobito Bay in Angola is of the highest augury.

To-day, to speak of the Katanga is to think of copper. It was the country's extraordinary wealth of that metal which led to the Cape-to-Cairo route being deflected from its original direction in order to tap this promising field, and it is on the mining operations which have been pursued for nearly twenty years that the opening-up of the territory has depended. There is much other mineral wealth waiting to be exploited—who can say how much?—but hitherto has been done except in regard to the remarkable deposits of copper ore. Coal has been found near Lake Tanganyika to the south of Bukama; gold and diamonds are known to exist in more than one locality and have been exported to a small extent, notably from the Kilo district, of which great hopes are entertained; and deposits of tin have also been discovered and worked, producing well over 1,000 tons per annum, though their ultimate value cannot yet be estimated.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

KATANGA'S IMPORTS via SOUTHERN RHODESIA, 1923.

<table>
<thead>
<tr>
<th>ARTICLE</th>
<th>1923</th>
</tr>
</thead>
<tbody>
<tr>
<td>£</td>
<td></td>
</tr>
<tr>
<td>Animals, living:</td>
<td></td>
</tr>
<tr>
<td>Cattle for Slaughter</td>
<td>£1,790</td>
</tr>
<tr>
<td>Cows and Calves</td>
<td>£6,199</td>
</tr>
<tr>
<td>Donkeys, etc.</td>
<td>£70</td>
</tr>
<tr>
<td>Horses</td>
<td>£243</td>
</tr>
<tr>
<td>Sheep</td>
<td>£1,497</td>
</tr>
<tr>
<td>Other</td>
<td>£1,644</td>
</tr>
<tr>
<td>Apparel and Tops</td>
<td>£700</td>
</tr>
<tr>
<td>Arms and Ammunition:</td>
<td></td>
</tr>
<tr>
<td>Detonators</td>
<td>£318</td>
</tr>
<tr>
<td>Fuse</td>
<td>£2,436</td>
</tr>
<tr>
<td>Other</td>
<td>£117</td>
</tr>
<tr>
<td>Beads, Kaffir</td>
<td>£149</td>
</tr>
<tr>
<td>Biscopes and Films</td>
<td>£10,587</td>
</tr>
<tr>
<td>Canvas and Duck</td>
<td>£177</td>
</tr>
<tr>
<td>Cement</td>
<td>£17,815</td>
</tr>
<tr>
<td>Coal</td>
<td>£21,896</td>
</tr>
<tr>
<td>Coke and Patent Fuel</td>
<td>£133,698</td>
</tr>
<tr>
<td>Cotton Goods:</td>
<td></td>
</tr>
<tr>
<td>Piece Goods</td>
<td>£1,749</td>
</tr>
<tr>
<td>Blankets and Rugs</td>
<td>£658</td>
</tr>
<tr>
<td>Hosiers, etc.</td>
<td>£1,054</td>
</tr>
<tr>
<td>Other</td>
<td>£420</td>
</tr>
<tr>
<td>Drugs and Chemicals</td>
<td>£249</td>
</tr>
<tr>
<td>Earthenware and Chinaware</td>
<td>£2,274</td>
</tr>
<tr>
<td>Electrical Fittings</td>
<td>£60</td>
</tr>
<tr>
<td>Enamel Ware</td>
<td>£27</td>
</tr>
<tr>
<td>Foodstuffs and Drink</td>
<td>£25,528</td>
</tr>
<tr>
<td>Furniture</td>
<td>£903</td>
</tr>
<tr>
<td>Glass</td>
<td>£61</td>
</tr>
<tr>
<td>Haberdashery</td>
<td>£248</td>
</tr>
<tr>
<td>Hardware and Cutlery</td>
<td>£1,935</td>
</tr>
<tr>
<td>£</td>
<td></td>
</tr>
<tr>
<td>Hats and Caps</td>
<td>£52</td>
</tr>
<tr>
<td>Implements and Tools:</td>
<td></td>
</tr>
<tr>
<td>Agricultural</td>
<td>£734</td>
</tr>
<tr>
<td>Mechanics'</td>
<td>£40</td>
</tr>
<tr>
<td>Other</td>
<td>£71</td>
</tr>
<tr>
<td>Iron &amp; Steel Manufactures:</td>
<td></td>
</tr>
<tr>
<td>Castings</td>
<td>£462</td>
</tr>
<tr>
<td>Chains</td>
<td>£62</td>
</tr>
<tr>
<td>Girders, Beams, etc.</td>
<td>£20</td>
</tr>
<tr>
<td>Pipes and Piping</td>
<td>£1,666</td>
</tr>
<tr>
<td>Galvanised</td>
<td>£666</td>
</tr>
<tr>
<td>Other</td>
<td>£2,973</td>
</tr>
<tr>
<td>Leather &amp; Leather Goods:</td>
<td></td>
</tr>
<tr>
<td>Boots and Shoes</td>
<td>£177</td>
</tr>
<tr>
<td>Saddlery and Harness</td>
<td>£61</td>
</tr>
<tr>
<td>Other</td>
<td>£52</td>
</tr>
<tr>
<td>Machinery:</td>
<td></td>
</tr>
<tr>
<td>Mining</td>
<td>£678</td>
</tr>
<tr>
<td>Pumps</td>
<td>£470</td>
</tr>
<tr>
<td>Other</td>
<td>£1,808</td>
</tr>
<tr>
<td>Oilman's Stores</td>
<td>£49</td>
</tr>
<tr>
<td>Oils</td>
<td>£322</td>
</tr>
<tr>
<td>Ores, Chrome Iron</td>
<td>£170</td>
</tr>
<tr>
<td>Paints and Painter's Goods</td>
<td>£67</td>
</tr>
<tr>
<td>Railroad Material</td>
<td>£107</td>
</tr>
<tr>
<td>Stationery and Books</td>
<td>£33</td>
</tr>
<tr>
<td>Tobacco, etc.</td>
<td>£67</td>
</tr>
<tr>
<td>Vehicles: Carts &amp; Carriages</td>
<td>£390</td>
</tr>
<tr>
<td>Motor</td>
<td>£1,342</td>
</tr>
<tr>
<td>Other</td>
<td>£38</td>
</tr>
<tr>
<td>Wood and Timber</td>
<td>£947</td>
</tr>
<tr>
<td>Other</td>
<td>£9,499</td>
</tr>
<tr>
<td>Total</td>
<td>£257,525</td>
</tr>
</tbody>
</table>

THE KATANGA'S COPPER OUTPUT, 1911-1924.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>TONS</th>
<th>YEAR</th>
<th>TONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1911</td>
<td>997</td>
<td>1918</td>
<td>20,237</td>
</tr>
<tr>
<td>1912</td>
<td>2,492</td>
<td>1919</td>
<td>22,366</td>
</tr>
<tr>
<td>1913</td>
<td>7,408</td>
<td>1920</td>
<td>18,961</td>
</tr>
<tr>
<td>1914</td>
<td>10,722</td>
<td>1921</td>
<td>30,464</td>
</tr>
<tr>
<td>1915</td>
<td>14,054</td>
<td>1922</td>
<td>43,362</td>
</tr>
<tr>
<td>1916</td>
<td>22,149</td>
<td>1923</td>
<td>56,886</td>
</tr>
<tr>
<td>1917</td>
<td>27,462</td>
<td>1924</td>
<td>85,379</td>
</tr>
</tbody>
</table>

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RESULTS OF COPPER PRODUCTION

But, indefinite as our knowledge may be of the Katanga's mineral resources in general, there is no shadow of a doubt about the enormous value of the copper deposits in the Kambove "Star of the Congo" and Likasi districts, which are being mined by the Union Minière du Haut Katanga and its associate, the Tanganyika Concessions, Ltd., of which Mr. Robert Williams is the controlling genius. Previous to 1921 production had never quite reached the 30,000 tons per annum mark, though this was almost attained in 1917. Shortage of native labour was always the restricting influence, little more than half the requirements of the mines being met for a long period, while enterprising extensions of plant have to a serious extent been stultified. Such conditions, however, are in course of improvement, and during 1924 the output has been triumphantly carried beyond the 85,379 tons mark. In fact, an annual production of 100,000 tons is confidently anticipated in the near future.

Agriculturally, it must be confessed, the Katanga does not offer great prospects. The soil is not of a highly productive character except in some of the more unhealthy lowlands, the natives are not industrious, and fly is common. It is on its mineral output that its future appears to depend, and its resources of this character are undoubtedly far beyond present estimation.

In the meantime its white population of less than 5,000 is dependent directly or indirectly on the progressive mining activities already in existence. Nearly one-half of that population is centred at the former capital, Elizabethville, which was founded in 1910. Since that date, coincident with the start of the copper industry, the market has been steadily built-up, its imports rising from 10,640,015 frs. in 1911 to 97,359,949 frs. in 1922, and its exports from 2,902,300 frs. to 144,407,655 frs.

As might be expected, the imports are mainly made up of manufactured goods. In fact, they constitute over 60 per cent. of the total. Nearly 20 per cent. in addition consists of foodstuffs and liquors, chiefly from Rhodesia and the Union

Principal Destinations of Katanga Exports, 1920–1922. (Values in Belgian Francs)

<table>
<thead>
<tr>
<th>Country</th>
<th>1920</th>
<th>1921</th>
<th>1922</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Britain</td>
<td>63,920,091</td>
<td>85,780,083</td>
<td>24,811,285</td>
</tr>
<tr>
<td>Belgium</td>
<td>3,534,087</td>
<td>416,888</td>
<td>720,952</td>
</tr>
<tr>
<td>Rhodesia</td>
<td>2,705,784</td>
<td>377,302</td>
<td>19,372,241</td>
</tr>
<tr>
<td>Mozambique</td>
<td>1,024,782</td>
<td>1,129,662</td>
<td>95,752,255</td>
</tr>
<tr>
<td>Union South Africa</td>
<td>1,427,449</td>
<td>431,377</td>
<td>738,523</td>
</tr>
<tr>
<td>Angola</td>
<td>356,632</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>4,341,396</td>
<td>2,566,956</td>
<td>2,412,399</td>
</tr>
<tr>
<td>Total</td>
<td>77,010,171</td>
<td>90,702,268</td>
<td>144,407,655</td>
</tr>
</tbody>
</table>

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The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

GREAT BRITAIN’S MAIN PURCHASES
(in Belgian francs) were:

<table>
<thead>
<tr>
<th>Year</th>
<th>Copper.</th>
<th>Palm Oil.</th>
<th>Palm Kernels.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1919</td>
<td>56,096,871</td>
<td>8,734,821</td>
<td>9,883,147</td>
</tr>
<tr>
<td>1920</td>
<td>61,215,572</td>
<td>7,353,926</td>
<td>4,396,219</td>
</tr>
<tr>
<td>1921</td>
<td>84,939,529</td>
<td>5,631,400</td>
<td>4,306,958</td>
</tr>
<tr>
<td>1922</td>
<td>24,260,173</td>
<td>3,435,572</td>
<td>1,884,371</td>
</tr>
</tbody>
</table>

PRINCIPAL CLASSES OF KATANGA IMPORTS, 1920-22.
(Values given in Belgian francs):

<table>
<thead>
<tr>
<th>Country</th>
<th>1920</th>
<th>1921</th>
<th>1922</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Britain</td>
<td>9,723,784</td>
<td>8,659,800</td>
<td>11,804,480</td>
</tr>
<tr>
<td>Belgium</td>
<td>9,801,559</td>
<td>35,288,319</td>
<td>39,932,624</td>
</tr>
<tr>
<td>United States</td>
<td>2,983,825</td>
<td>6,666,511</td>
<td>2,611,241</td>
</tr>
<tr>
<td>France</td>
<td>626,353</td>
<td>1,149,102</td>
<td>1,207,429</td>
</tr>
<tr>
<td>Germany</td>
<td>302,407</td>
<td>319,239</td>
<td>666,136</td>
</tr>
<tr>
<td>Angola</td>
<td>4,256</td>
<td>43,960</td>
<td>104</td>
</tr>
<tr>
<td>Rhodesia</td>
<td>19,466,307</td>
<td>37,581,893</td>
<td>19,869,472</td>
</tr>
<tr>
<td>Union of South Africa</td>
<td>21,908,406</td>
<td>20,894,175</td>
<td>15,808,918</td>
</tr>
<tr>
<td>Tanganvika</td>
<td>—</td>
<td>4,307,074</td>
<td>2,583,181</td>
</tr>
<tr>
<td>Other British Empire</td>
<td>280,174</td>
<td>518,886</td>
<td>574,682</td>
</tr>
<tr>
<td>Others</td>
<td>4,791,988</td>
<td>2,641,817</td>
<td>2,471,682</td>
</tr>
<tr>
<td>Total</td>
<td>69,559,289</td>
<td>118,043,763</td>
<td>97,559,959</td>
</tr>
</tbody>
</table>

of South Africa, the local production, for the reasons explained, being much below the requirements. Naturally, Rhodesia, being the main door of entry, is a large supplier of its own products, and is also officially credited with the origin of

TRADE OF KATANGA, 1911-1922.

<table>
<thead>
<tr>
<th>Year</th>
<th>IMPORTS</th>
<th>EXPORTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kgs.</td>
<td>Frs.</td>
</tr>
<tr>
<td>1911</td>
<td>—</td>
<td>10,640,015</td>
</tr>
<tr>
<td>1912</td>
<td>—</td>
<td>13,485,840</td>
</tr>
<tr>
<td>1913</td>
<td>43,268,299</td>
<td>12,788,206</td>
</tr>
<tr>
<td>1914</td>
<td>83,043,616</td>
<td>14,545,232</td>
</tr>
<tr>
<td>1915</td>
<td>67,127,802</td>
<td>9,802,496</td>
</tr>
<tr>
<td>1916</td>
<td>104,965,752</td>
<td>15,306,145</td>
</tr>
<tr>
<td>1917</td>
<td>118,526,700</td>
<td>24,491,509</td>
</tr>
<tr>
<td>1918</td>
<td>117,825,341</td>
<td>37,206,307</td>
</tr>
<tr>
<td>1919</td>
<td>141,922,232</td>
<td>35,530,801</td>
</tr>
<tr>
<td>1920</td>
<td>128,063,346</td>
<td>69,519,028</td>
</tr>
<tr>
<td>1921</td>
<td>171,311,403</td>
<td>118,043,763</td>
</tr>
<tr>
<td>1922</td>
<td>149,933,546</td>
<td>97,559,959</td>
</tr>
</tbody>
</table>

144,407,655
a considerable portion of the imports which actually come from other countries. In a smaller degree this is also true of the Union of South Africa.

Hitherto there has not been much scope for keen international competition for the Katanga’s trade. Belgium and Great Britain alone being directly credited with any considerable shares of the imports. To Great Britain, as explained, must also be attributed an important share in the goods arriving from the Union of South Africa and Rhodesia, many of which are of course, re-exports from these countries.

The Katanga’s exports are, as might be supposed, almost entirely to the extent of over 93 per cent.—composed of the mineral and other natural products of the country.

As regards the future of the market, it is sufficient to say that the Katanga is an actual present, and potentially still greater. copper Rand. But it has also other possibilities. Diamonds are found in the Lomamî district and the production was 1,049 carats in 1921, and 22,533 carats in 1922. Uranium and cobalt-bearing minerals are being worked, the latter being treated by the Union Minière in electric ovens at Luishia, in the Katanga. The total coal production in the province in 1923 amounted to 55,835 tons, but the local output is not yet sufficient for its industries and there is a large importation of coal and coke from Rhodesia.

The extent of the industrial and agricultural enterprises in the Katanga is shown by the fact that in 1922 there were 35,373 labourers engaged in them, while thousands of native porters were also in constant employment. Indeed, the demand for labour is so great that in 1921 the Union Minière alone received 4,137 native recruits from Rhodesia, while in 1922 the Bourse du Travail du Katanga recruited 8,683 natives.

About 1912 when the Government really began to occupy the Katanga intensively, the outlook for cattle was most disheartening. The tse-tse fly was found almost everywhere and the cattle died off rapidly. In recent years, however, the scourge has greatly lessened near the towns and there are now some 10,000 head of cattle in the province, and there are constant imports from Northern Rhodesia.

With more and cheaper railway facilities the Katanga will develop rapidly. It is probable that the Union Minière will instal hydro-electric plants in connection with its mines and that the mineral output will be greatly increased with due advantage to all the activities of the district.
Katanga’s Copper Wealth

The Great Reduction Works at La Panda Copper Mines, Katanga.

Ore-handling at the Kambove (Katanga) Copper Mines.
The Belgian Congo’s History.

II.—WHAT TRANSPORT HAS ACHIEVED

IN 1912, when proposing a toast in honour of General Wangermee, Vice-Governor of the Katanga, Mr. Gibb, a well-known South African and brother-in-law of Mr. Robert Williams, said:—

"Your country is the finest copper country in the world. Under your direction this country will make extraordinary progress."

Mr. Gibb will now have seen his prophecy realised. Under Vice-Governor Wangermee, then under General Tombeur, celebrated for his campaign in East Africa, Katanga has developed with unexampled rapidity. The Belgian Minister of Colonies, M. Renkin and his successors, M. Louis Franck and M. Carton, have not ceased to encourage missions and do everything possible to facilitate the country’s rapid development.

The King, himself, at the time of his visit to the Colonies, wished to commence with Katanga. To him, to his Ministry, to Belgian commercial men and to the Englishmen who have supported their efforts, Katanga owes its rapid development. Railways have been built, copper mines opened up, motor roads have become numerous, the existence of Europeans made thoroughly pleasant, the medical service perfected, European and native agriculture encouraged—in brief, in this Congo province till then unknown was seen in a short time a prosperity and activity which did honour to Belgian colonisation.

Two great routes of penetration were completed during the war.

(a) The 400 kilometre line from Elizabethville, the chief town of Katanga, to Bukama on the Congo River was finished on June 1, 1918. Elizabethville has been linked since 1911 with the South African Railways system. It is now possible in eight days to travel from Cape Town to Bukama on the Congo River, and to reach the heart of Africa along that river. To reach Stanleyville or Boma, the Belgian Atlantic port, it is no longer necessary to prepare a caravan or carry a tent. The railway from the Cape to the River on the one sector, and the Congo River on the other with its railway branches over the non-navigable areas, allow one to reach quickly all the chief Belgian posts. Brazzaville also, the chief town of French Equatorial Africa, may be reached rapidly by the same route. The time
taken by this route from Cape Town to Boma or Brazzaville is approximately five weeks.

The economic consequences of the construction of this railway are of considerable importance. Katanga is now linked up with the rest of the Congo and the Upper River. Rice from the eastern province (Stanleyville), maize and manioc from the Upper Katanga (Kongolo), cattle from Kivu and the eastern shores of Tanganyika, may be quickly transported to South Katanga to feed the natives employed in the mining industry. Natives from the north who are afraid of long journeys on foot to the South where employment is to be had need no longer hesitate, and the difficult problem of finding native labour for the mines is in course of being solved. The occupation of the land will therefore present fewer difficulties.

Lastly, by this same route, traders from South Africa will find an easier method of transporting the goods and merchandise intended for the native peoples of North Katanga. It is noteworthy that if the war had not broken out these same people would have been supplied with goods by the German East African line. Such, at least, was the intention of the Germans, and it had a great possibility of being realised.

(b) The Great Lakes Company had finished in 1915 the 270 kilometre line from Lake Tanganyika to Kabalo on the Upper Congo and during the whole of the East African campaign this railway was of undoubted usefulness. Not only were troops and supplies carried by this route, but it was used by Commander Simson to launch on the lake his armoured motor boats which caused the destruction of the German flotilla, and by Colonel Moulaert to fit out the port of Albertville and launch the 500-ton steamer "Baron Dhanis." From the day it was completed General Tombeur was able to use his troops and abandon the defensive for the offensive. It was by this same line that warworn officers who were engaged in the campaign to the East were enabled to return to Europe via Boma. They were able in August, 1917, to make the journey from Dar-es-Salaam on the Indian Ocean to the Atlantic at Boma in 32 days without once camping under tents or traversing the caravan road for a single day—an easy and often comfortable journey of astonishing rapidity when it is compared with the three years which Stanley took to cross Central Africa.

This line should also attract the attention of South African exporters. Along it merchandise may easily be brought into the country east and west of Lake Tanganyika and the whole country between that Lake and the Victoria Nyanza. To Belgians it will allow the transport of cattle from the region of the Ubría, where tse-tse fly is absent, to mining centres. Equally it will serve for the
transport of coal and tin, of which there are numerous deposits.

Two other lines are projected to facilitate access to Katanga and the carriage of its mineral products:

1. A line starting from Kambove on the Katanga Railway to join the Portuguese line now under construction from Benguela to Dilolo. The Portuguese line had reached kilometre 630 in December, 1924. About 640 kilometres have yet to be built to reach the Belgian frontier at Dilolo. The Belgian section of about 665 kilometres is under construction.

2. A line from Katanga to the Lower Congo intended to link the mining district of Katanga with Leopoldville on the Matadi line at Stanley Pool. The construction of the line conceded in 1906 to the Katanga-Bas Congo Railway is proceeding and a third line of less interest to Katanga, from Stanleyville to Lake Albert, is also under construction. It is conceded to the Grand Lakes Company and is of great importance to the eastern province.

There are in actual operation 2150 kilometres of railway in the Colony, of which 970 kilometres are in the Katanga province.

In a speech delivered in London, Mr. Robert Williams strikingly described the difficulties encountered in Katanga by the early prospectors, as well as by the agents of the "Tanganyika Concessions" and "L'Union Minière du Haut Katanga," and the figures are given on page 64. These tables shew that their difficulties have been definitely overcome and that Katanga will shortly be one of the largest producers of copper in the world.

The battery of seven furnaces installed at Elizabethville, and having a productive capacity of 40,000 tons annually, was completed early in 1913, but principally owing to lack of fuel of prime necessity for smelting, and to other difficulties, it was not possible to maintain in activity more than four furnaces for the greater part of 1918. Production is now increasing rapidly.

The work of tin exploitation has begun upon a portion of the concessions of L'Union Minière.

On the western frontier of Katanga a company which has large American interests is exploiting diamond mines with success. In 1922 the production was over 22,500 carats. In other parts of Belgian Congo the alluvial diamond mines produced in 1923 over 300,000 carats, and the prospects in the Katanga, as elsewhere in the Belgian territory, are regarded as excellent.

The coal mines of Albertville are in course of development. It is hoped to use the fuel from this source on the long route which crosses Tanganyika Territory from Kigoma to Dar-es-Salaam.

In 1911 and 1912 Belgian planters were established along the railways between Sakania and Elizabethville. By Govern-
Road Transport in the Belgian Congo

SKETCH MAP showing the Motor Roads in the BELGIAN CONGO.

The Nile-Congo Motor Roads from Rejaf to Stanleyville.

Headquarters of the Belgo-Katanga Société Anonyme at Elizabethville.
ment aid vast stretches of forest were cleared, and smart wooden dwellings erected at the edge of the fields. The initial attempts gave only mediocre results. Sites had not always been well chosen and the methods of culture, as well as the methods of assistance to the planters left much to be desired. These first experiments, nevertheless, bore fruit. An experimental station under the direction of M. Rommalaere was established at Munama and all kinds of products were tested. On the spot Belgian and foreign planters are now able to study the practical tests of various products instead of making costly ventures on their own account. Some South African farmers have recently joined these Belgian planters. The opinion prevails that high farming in South Katanga is only possible in certain fertile valleys of the Lualaba and the Kapiri. The farmers on the outskirts of Elizabethville sell vegetables, fruit, eggs, milk and poultry. They have given up cultivation on a large scale, being convinced that the North which is richer in fertile land and in labour will be able to supply the markets of Elizabethville more cheaply than themselves. It is to be noticed that the agricultural colonists of Katanga recently formed a syndicate with the object of founding a co-operative society for sales and purchases.

In the North watered by the Lualaba (the native name of the River Congo for that part of its course) the land is fertile and large fields of maize and manioc surround the villages. Up to the present the Belgian planters have hesitated to settle there because means of communication are lacking and consequently there are no markets. The railway from Bukama, finished in June, 1918, has opened this region and made possible the despatch of foodstuffs to Elizabethville. A good future is predicted for those who settle here for the purpose of cultivating the maize, manioc and sorghum required for the support of the native labourers on the mines in the South. We may note in passing that the rearing of cattle which had once to be abandoned everywhere on account of the presence of the tse-tse fly is now making considerable progress, the pest having abated in a number of districts.

A series of motor roads having Elizabethville as their starting point run from:—

(1) Elizabethville to Katanga Luapula 150 kilos.
(2) Elizabethville to Kambove.
(3) Elizabethville to Kan-shanshi (N. Rhodesia).
(4) Elizabethville to Dilolo.

The maintenance cost of these roads, which falls on the Government is, however, high. Where native villages are numerous the chiefs are responsible for maintaining the portion of each road in the territory under their authority while the same regulation is in force in Rhodesia and in many other
colonies. The absence of native population in the mining area obliges the Government to bear the cost of maintaining the greater part of these routes.

The climatic conditions of South Katanga approach very closely those of North Africa. The dry season lasts from April to October. The rains begin in October-November and the maximum fall is reached in February-March. During eight months of the year there is a mild temperature of 25 degrees to 26 degrees C., by day and 10 degrees to 12 degrees C., by night. In the northern portion the climate approximates to the equatorial region.

Elizabethville, formerly the Capital and the chief mining centre, enjoys an excellent reputation. It is the Nairobi of Katanga. The white population numbers about 1,880 souls and the black population about 10,000. The officials, the principal agents of L’Union Minière, and the merchants dwell in attractive brick houses, surrounded by gardens. Amusements are numerous—tennis, golf, football are played, and there is also a cinema. The club—Cercle Albert Elizabeth—is one of the finest buildings in the town and is very well managed. More than 200 motors—not counting motor cycles—are owned in the town. Electric light has been installed and there is also a good water supply.

The attention of the Government, which wishes to encourage Belgians to settle in the town, is directed to the question of children’s education. A girls’ school has been opened by the Sisters of Charity. The Silesian Fathers have also opened a boys’ school. In this way colonial children are under no educational disabilities. Schools for the natives under the same direction have been successfully opened.
Near the Rhodesian frontier natives are few. Each village consists only of about 10 huts and one may march for two days on the road from Dilolo without meeting a soul. A chief's authority rarely extends over more than one village. Those natives who exhibit no hostility to the whites, only take up with difficulty work as porters or in the mines. Portage has very much decreased since the construction of the railway, but, where it is necessary it is principally performed by natives from Angola, engaged freely for the purpose by contractors. Labour for mines and copper smelting is supplied partly from Rhodesia and from North Katanga where they are more numerous and of better physique. At first the natives so recruited who had accepted three years' contracts abandoned the work in great numbers and returned to their homes in small bodies. Often the return route was fatal to them. Food, though sufficient was badly selected, the houses were unsuitable, and the

**Trade of the Belgian Congo.**

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The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

acts of certain head men of different race coupled with disease and the rigours of the climate all contributed to induce desertion. At one time it appeared as if native labour would fail entirely and it would be necessary to have recourse to Chinese workmen. Little by little the state of affairs improved. Improved working conditions, more palatable diet, and the absolute prohibition of corporal punishment, had the desired effect. Numerous natives after several months' rest in their villages signed new contracts. The ravages of Spanish influenza at the end of 1918 were severe. At one time the mining company had partially to suspend operations, but there is no longer any doubt that the difficult problem of labour will be solved from local sources.

The Balubas, who furnish the largest percentage of the native labour, are grouped in large villages in the north and centre of Katanga. Their villages are under the authority of a single chief and their occupations are hunting and fishing. Only the women work in the plantations. The authority of Belgian administrators is completely established and traders of all nationalities may travel freely.

The English and American Protestant missions and the Belgian Catholic missions have extended their activities amongst these populations with most satisfactory results. We may note in passing that the mission at Baudouinville in the North Katanga on the Tanganyika comprises 30,000 monogamous indigenes. The riverside population of the Lualaba has been ravaged for the past twenty years by sleeping sickness and hundreds of villages have disappeared. The medical department has now delimited the fly-infected areas and the natives in many places have been allowed to return to their former plantations.

By reason of its situation in Central Africa; of its richness in copper, tin, coal and diamonds; of the railways of which it is the junction; of its privileged climate, Katanga is assured of an exceptional future. A vast field is opened to international activity. Belgium having turned the invader out of her territories in Europe and Africa will now consecrate herself with greater ardour than ever to the fulfilment of her colonial aspirations. No doubt her friends in England and South Africa will follow the realisation of these efforts with sympathy.
The Belgian Congo Administration.

III.—THE SYSTEM DESCRIBED.

The essential rules of the administration of the territories constituting the Belgian Colony of the Congo are laid down in the primary act of 18th October, 1908, which deals with the Government of the Belgian Congo. It contains the acknowledgment of the rights enjoyed in the Congo by Belgians, foreigners and natives and in matters of common law these rights are very liberal and similar to those granted to nationals by the Belgian Constitution in the Mother Country.

So far as the civil law is concerned, Belgians, Congolese registered in the colony, and foreigners enjoy all the rights allowed by the laws of the Belgian Congo, and by their customs, so far as these are contrary neither to statute nor public order, unregistered natives of neighbouring colonies are assimilated to them.

Legislative power is exercised by the King through decrees except in matters which are covered by the law. The latter is supreme in every way. In cases of urgency the Governor-General of the Colony and the Vice Governors-General of the Provinces are invested with legislative power.

The Colonial Minister is appointed and discharged by the King and is a member of the Cabinet Council. The Colonial Council, composed of the Minister for the Colonies as President and 14 Councillors, deliberates on all subjects submitted to it by the King, the Council principally giving advice upon all projected decrees as well as upon every decree of an urgent character.

The King is represented in the Colony by a Governor-General assisted by one or more vice Governors-General. Under the terms of the Royal Warrant of July 28th, 1914, the Governor-General is the executive power in the Colony subject to the stipulations defined by law, by decrees and Royal Warrants and he is the head of all administrative and military services in the Colony. He has an administrative assistant, a Vice Governor-General, a Secretary-General, and the heads of the Public Services, (Justice, Treasury, Public Works, Economic Affairs, Agriculture and Lands, Police and Public Health), and an official council whose work is of a purely consultative nature. It includes the vice-Gov-
The Governor, the Procureur General and the high officers of the local administration and is presided over by the Governor-General. Notable Belgians resident in the colony may become associate members of the council.

The colony is sub-divided into four provinces, to which, since the Great War, have been added the mandated territories of Ruanda and Urundi, formerly part of German East Africa. Each province is under the supreme direction of a vice Governor-General who is responsible for its administration and represents the Governor-General in his area. In each province under the presidency of the Vice-Governor-General is installed a regional Committee, exclusively consultative, composed of the chief judicial and administrative authorities of the Province. The Vice-Governor is empowered to summon to the meetings of the Regional Council one or more private persons of Belgian nationality resident in the province.

Each province comprises a certain number of districts of which there are 21 in the whole colony. These territorial divisions are placed under the authority of a District Commissary, who is charged with the direction of all services in his district and who assumes the responsibility for the management of the region under his authority. These functions, as far as they do not result from decrees and resolutions, are regulated by orders from the Governor-General.

The districts, in their turn, are sub-divided into 181 territories, administered by territorial administrators assisted by territorial agents, and the territories again are sub-divided under native chiefs.

This organisation produces effective decentralisation. It leaves to local authorities, who are better informed of the actual circumstances, the initiative for decisions, according to principles laid down by the Central Power, on the chief question of colonial policy and grants them power to act in consequence.

Justice in the Congo is entirely independent of the administrative authority. The latter cannot prevent, stay or suspend the action of the courts and tribunals. Sometimes the King, and in urgent cases with certain reservations, the Governor-General and the Vice-Governors of the Provinces can, for reasons of the public safety, suspend in a territory and for a definite period the civil courts and tribunals and substitute military jurisdiction. The judicial organisation comprises police tribunals, territorial tribunals, tribunals of the first instance, tribunals of appeal, war councils and appellate war councils.

In each territory there is a police tribunal, the seat of which is usually at the chief administrative centre. The territorial administrator is judge of the police tribunal. His powers are limited to hearing breaches of the law by natives, which
may be punished by not more than seven days’ imprisonment and a fine of two hundred francs. The seat of the territorial tribunals is generally the capital of the district. Within their purview are all breaches of the law by natives, and as regards non-natives to such as are punishable by imprisonment not exceeding five years. There are in the Colony seven tribunals of the first instance, having their principal seats at Boma, Leopoldville, Coquilhatville, Stanleyville, Buta, Lusambo, and Elizabethville respectively; and two appellate tribunals at Boma and Leopoldville. It is laid down that the Procureur-General and all the officials of the public service must exercise special protection over the blacks, whether indigenous or emigrant.

Authority is supported by an armed force—the personnel of which is fixed annually by decree. Up to 1914 the character of this body was exclusively that of a police force charged with the maintenance of order amongst people sometimes restive under the action of authority which, naturally, in certain matters comes into contact with an ancient barbarous system. The war brought about the transformation of this police force into a veritable army and the successes it has gained in the course of three campaigns are well-known. The return of peace has modified its character, but, profiting by experience, these forces will, henceforth, have a mixed organisation, one portion being concentrated in battalions; the other scattered about in smaller units, undertakes the duty of policing the territory.

It is in the following terms taken from Article 6 of the Berlin Act— that the Colonial Charter gives the active programme of the Governor-General with regard to the indigenous populations:

"The Governor-General guards the welfare of the indigenous peoples and the amelioration of their moral and material conditions of existence. He favours the expansion of individual liberty, the progressive abandonment of polygamy, and the development of property rights. He protects and encourages without distinction of nationality or culture, all institutions and religions, scientific or enterprises created and organised to this end, or tending to instruct the natives and making them understand and appreciate the advantages of civilisation."

The charter foresees the institution of a permanent commission charged with watching over the protection of the natives and the amelioration of their moral and material conditions of existence throughout the whole territory of the colony. Presided over by the Procureur-General or the Appellate-General of the capital, its members are appointed by the King from among the residents in the colony, who by the nature of their duties or occupation appear specially qualified to fullfil this protective mission. Every year the commission furnishes a report to the King on the measures taken in favour of the natives. This the Colonial Charter
shews clearly — what otherwise the discussions in the Belgian Chamber at the time of the annexation of the Congo to Belgium had sufficiently brought to light the wish of the Belgian people to do, above all, the work of civilisation in Africa and eliminate all traces of the mistrust, and, indeed, the hostility which the administration of the Congo Independent State had created round its colonial work.

The main grievances of the detractors of the old administration were directed to the economic and fiscal regime applied to the Congo territory which, making the State the exploiter of its vast domain, gave to its administrative actions a character primarily commercial. However dependable the tests were their practical application did not prevent abuses. Belgium decided to put an end completely to this system and to M. Renkin belongs the honour of having proposed and effected the measures which substituted free commerce for State exploitation of the state domain.

A year and a half after the State annexation a law promulgated on 22nd March, 1910, put an end by three stages to the State exploitation of the vegetable products of Government lands and determined the conditions under which the natives and non-natives could henceforth collect or acquire these products. One of the main features of this new policy was the modification of the tax imposed on the native populations. For merely this tax was discharged by labour, the native being required to devote a certain number of hours, either to the work of the harvesting of products of the domain, or to cultivating land or to canoe porterage. The State, suspending the collection of forest products for its direct profit, fixed instead, a money tax on the natives, calculated according to the resources and stage of development of the districts concerned. In order to earn the necessary money for payment of the tax the native may enter European employment, or sell his cultivated products, or natural products collected in the State forests. Traders as well as natives benefit from this system which gives to the Colonial Treasury an annual receipt of about 27,000,000 francs from native taxation.

Since the annexation, the administration has paid particular attention to questions affecting native policy with a view to their satisfactory solution. The general census of natives has been initiated by the registration of every adult at the chief towns in each territory and the delivery to each of them of an identity certificate, the necessity of holding an administrative authority in case of change of residence preventing chance removals. Native groups are progressively organised by chiefships. European administration recognises the customary organisation and leaves the natives to be governed by their own hierarchies. These act always under
the control and according to the directions of the territorial authority. The ordinance governing the chiefships imposes on the natives various obligations, hygienic and economic: cleansing of villages, prophylactic measures against sleeping-sickness, the fixing of burial grounds, clearances of bush, maintenance of tracks, cultivation of food products such as bananas and rice or exportable products such as palms, cotton, etc. Each chief receives payment in proportion to the numerical importance of his group and according to the manner in which the taxes are paid and their different duties performed. The arrangements relative to labour contracts guarantee to the native respect for his rights and interests. The employer cannot inflict corporal punishment on his labourer. He is required to pay him his wages without deduction and give him suitable and sufficient board and lodging. The duration of the engagement is limited and the obligation is on the employer to repatriate the labourer to the place from which he was recruited.

Liberal regulations are also in force regarding the allotment of land to natives. Lands in native occupation are recognised and local usages and customs are supported with regard to lands on which natives dwell, or which they cultivate or exploit. There may be assigned to natives, either for cultivation by their own methods or in order to encourage new methods of culture, stretches of land three times as large as those actually occupied. These extensions may even exceed this quantity if necessary. Moreover, there is recognised to the native the right sui generis that he possesses over lands which are not legally considered to be native lands. He may fish in the rivers, streams and lakes and pools, and hunt in the State lands and forests subject to certain regulations. They may, moreover, continue to practise on their own account the development of minerals on lands in their own occupation.

The general instructions given to the personnel charged with the administration of native populations are directed that it is the desire of the Government to respect native rights and to govern them justly, humanely, and kindly. They prescribe, in effect, equitable treatment for natives, their security, respect for such of their customs as are in accord with public order, and are so designed that the obligations imposed collectively or individually do not become harassing by their operation. The moral and material evolution of black peoples should be accelerated as much as possible, but not by coercive methods. The sole action should be persuasion. Polygamy and fetishism, the superstitions and the prejudices which oppose the rational development of the individual, the family, and society should be combated with energy.

The natives are given every encouragement to develop the
natural products, to increase their herds and to introduce new strains; to build hygienic dwellings of durable materials; to take prophylactic measures against infectious disease; to interest themselves in the economic progress of their group and district by the development and maintenance of ways of communication; and to intensify commercial relations by the creation of and frequent attendance at markets for agricultural products.

The excellence of these methods is clearly demonstrated by the peace which actually reigns in the vast regions formerly in constant disturbance, notably in Mongala, and in part of the Equator district formerly exploited by the L'Abir Co. Without doubt the task is an enormous one and uniformly similar results cannot be expected in all districts inhabited by populations so diverse. The excellence of the method can, on the other hand, sometimes be checked by the ignorant and brutal Government official. The efforts of the Government accordingly are constantly directed towards the improvement of the moral and professional value of the personnel. For this reason the actual staff of the territorial administration, to whom is entrusted the delicate work of administering indigenous populations, comprises besides a certain number of officers—doctors of law, engineers and holders of other University and consular diplomas. The number of officials attached to the territorial service charged with the administration and care of the natives is twenty-two chiefs of districts, twenty-two assistant chiefs, 160 territorial administrators, and 400 territorial agents.

Should one desire to judge at a glance the results of the Belgian administration of the Congo one cannot do better than quote what Sir Harry Johnston said on the 28th March, 1923, at the meeting of the African Society: "One really bright spot—and it is a very large spot—is the present condition of the Belgian Congo, with every reason to suppose that its present will be its future condition. Here there are contented natives and here there is free trade for every peaceful nation."
Portuguese West Africa.

THE TRADE HISTORY OF ANGOLA.

PORTUGUESE West Africa, or to use its official name, "Provincia de Angola" covers an area of about 485,000 square miles between the 4th and 18th degree south of the equator on the West Coast of Africa. It is divided into a large main block and the small northern "exclave," Cabindu, by the corridor through which the Belgian Congo obtains access to the Atlantic. The coast-line of the main block extends about 870 miles from the mouth of the Congo in the North to the Cunene River in the South; inland it is bordered by the Belgian Congo to the North and North-East, by Rhodesia to the East, and by South West African Protectorate to the South. While the demarcation of the boundary lines is based on a series of international agreements of comparatively recent date—starting with the Berlin Conference of 1885—the colonisation by the Portuguese dates back several centuries and was inaugurated so far back as 1482 by the discovery of the Congo mouth by Diego Cao. Angola's political status is that of a province, administered by a Resident Governor-General at Loanda and divided into districts, sub-districts and counties, while three municipalities, Loanda, Ambriz and Novo Redondo enjoy a privileged autonomy under the Governor-General direct.

The number of inhabitants is not statistically recorded; estimates for the total vary from 4 to 12 millions, but it is doubtful whether even the lower figure is reached. Of these only about 9,000 are Europeans—including some 2,000 officials—while the number of half-castes is given at 30,000, the rest being natives.

The native population consists of different tribes of the Bantu group; the Congo or Fiote occupy the northern area, the Mbundu the Central District along the coast; the North-East is inhabited by the Lunda, while in the South a great number of smaller tribes exist, which may be collectively called South-Angolese or Ambuella group. A fair sprinkling of the Bushman-type is a matter of ethnographical interest.

The majority of the white population are Portuguese; a number of agricultural immi-
grants from Northern Portugal have succeeded in establishing permanent homes on the healthy plateau in the highlands of Angola; other attempts at importing colonists from the old country and from Madeira have not come up to expectation. In the years 1874, 1875 and 1880 some hundred Boer families immigrated from the Transvaal, and the construction of the Benguela railway is responsible for the importation of a certain number of Englishmen. Other European nationalities are only sparsely represented.

The relations between the predominant representatives of the white race and the natives is not conducive to a progressive development of the colony. The natives, who are fairly intelligent and well provided with fire-arms although of antiquated types are by no means ready to labour for their white masters. As a matter of fact the men are not keen on hard work at all, but prefer hunting, trade and transport, while the more persevering work of agriculture, etc., is left to the women and up to recent times—when slavery was suppressed—to slaves. Military posts distributed by the Portuguese for the maintenance of law and order, have only a small radius of influence, and it is said to be risky for a white man to travel in the interior without military escort. Little feuds between hostile neighbouring native tribes still take place occasionally. By the so-called Military Law of 1884 conscrip-
tion was introduced for all natives between the ages of 18 and 35, partly for military service, but to a greater extent for labour and transport.

The southern bank of the Congo, which forms the frontier of Angola for some 80 miles, has the importance of a seashore, as it is in parts navigable for big sea-going vessels; and most of the traffic of the Angolese Congo district is dealt with at river ports. The only other river which connects the hinterland with the coast in a commercial sense is the Cuanza, which is navigable for a distance of some 160 miles. Most of the numerous rivers and rivulets in the Colony are only periodical water-channels, but nevertheless of some consequence for the development of local settlements. The perennial rivers, which remain to be mentioned, are the Cunene at the southern frontier, the Cubango running through South-East Angola, which are both navigable in places, and the Cubango, which is navigable for nearly 200 miles and forms part of the north-eastern frontier-line, but is of no special benefit to this Colony on account of cataracts and waterfalls. The yearly average rainfall varies from under 20 to over 60 inches.

Sleeping sickness, malaria and the tsetse-fly cattle disease are not unknown especially in the neighbourhood of swamps or stagnant waters and in deeply-cut river valleys; districts above 4,500 feet are immune.
AGRICULTURAL PRODUCTS

Generally speaking one may say that nearly 30,000 square miles are from a health point of view suitable for permanent European settlements; this area includes the solid block of the high plateau and a stretch along the coast comprising Mossamedes, Porto Alexandre and Tiger Bay. The area in which Europeans may live and work for years without the necessity of change of climate but which are not suitable for permanent settlements, is about double that figure, and includes further long stretches along the Coast and more especially Loanda, Lobito and Benguella. The rather poor reputation of the latter place is probably more due to the neglect of sanitary measures, than to climatic conditions. In the remaining zones of the colony Europeans could only reside and work for comparatively short periods without a change. As a rough estimate it may be said that fully 200,000 agricultural colonists could be settled within the 30,000 square miles referred to as suitable for European settlement.

The form of vegetation varies from desert, karroo-steppe and savannahs (i.e. steppe country with shrubs and isolated trees) in the coastal zone, locally fertilized and turned into oases by rivers or rather isolated artificial irrigation, to forests of increasing density in the zone of the western escarpment, while the interior high plateau is generally covered by karroo-steppe, savannahs and thin forests.

The plants which are cultivated for native food are mealies, manioc, certain kinds of beans and peas, pumpkins and bananas. In some districts lemons, oranges and figs are raised with favourable results, in others wheat, rye, oats and potatoes. Sugar cane is cultivated in many places and has, together with other plants—e.g. sweet potatoes—been used to a great extent for the production of alcohol; the production is, however, now restricted and controlled by a decree issued in 1911. Of commercial interest one may also mention the oil-palm, rubber-bearing trees, a certain shrub, the root of which yields rubber, and wild coffee, while the production of cotton is still in its infancy. Tobacco is so far grown only in a few places. Locusts are from time to time detrimental to crops especially in the southern districts. An insect of commercial value is the bee; for the honey supplements the diet of the native and the wax forms an important item of export. Of domestic animals, horses and even mules cannot stand the climate well, but donkeys thrive. The latter and oxen are used for transport. Cattle are not as common as one would expect, periodic epidemics of rinderpest being greatly responsible. The breeding of pigs, on the other hand, is successful on the high plateau.

With regard to mining Angola is still practically a terra incognita. A Portuguese company is prospecting for diamonds and is
working deposits in the Lunda district. It has averaged 100,000 carats a year in output but hopes to double that quantity before long. The actual ascertained reserve of diamonds is said to be over a million carats.

Gold is washed in small quantities from alluvial river deposits by natives in several places; it is reported from a place at the Lombijje River, about 50 miles north of Ambava, but the "Great Gold Zone Mining Co., Ltd.," which worked the deposit, proved a failure, and results from another place on the river, Chitanda, worked by the "Cassingo Concessions, Ltd.," seem to be somewhat indifferent. Still, indications of gold persist and hopes are entertained of future success. Copper ores near Bambe and mineral oil in the county of Libongo on the Dande River and along the coastal area near Mossamedes are reported. Iron ore occurs at several places and the ruins of an old foundry near Oeiras on the Luvulla river near the Loanda-Melange railway, where also coal seams have been found, are certainly of interest. A salt deposit occurs at Demba in the county of Quissama.

The colony has been far from proving self-supporting. The budget for 1913 showed a revenue of roughly £685,000, expenditure £1,018,000, deficit £333,000. Financial conditions became worse through the insurrection of natives during the war; and the budget for 1917-18 had gone up to much higher figures, namely, revenue £2,680,000 expenditure £3,330,000, deficit £650,000. Since the war, however, an effort has been made to place the finances of the colony on a sounder footing, while a more progressive policy in the development of its resources has been followed. Steps have been taken to improve the currency, and the Lisbon Government has displayed its interest in the potentialities of the colony by establishing an experimental cotton station at Catete, about 60 miles inland from Loanda, the chief cotton-growing centre in the province. The financial future of Angola, however, must depend upon its transit trade and the development of its wealth in coffee, cotton, sugar, maize and so on, in which direction there is still a great deal to be done.

The principal exports are rubber, coffee, wax, dried fish, cane sugar and, to a small extent, cotton. Tariffs favour Portuguese products and shipping to such an extent, that foreign competition is well-nigh impossible. It is thus only to be expected that very little capital seeks investment in Angola.

Angola possesses three good harbours at Loanda, Lobito and Tiger Bay. Loanda is said to have been neglected and to require deepening by dredging. Lobito on the other hand is deep enough for steamers to moor at its piers. Tiger Bay comprises an enormous area, but it is at present little used situated, as it is, facing desert-country without
fresh water. An aqueduct from the Cunene River is projected, by which the prospective value of this harbour would be made available.

In addition there are three other ports useful for shipping at Benguela—only 22 miles from Lobito—Mossamedes and Porto Alexandre. All the other coast-towns have only open roadsteads. The importance of the southern bank of the Lower Congo for shipping has already been emphasised.

The Lobito-Benguella Railway, which is ultimately to connect with the famous Katanga district in the Belgian Congo occupies easily the first place of importance. About 430 miles of this railway, which is of Cape-gauge, has been built by English capital and engineers, and connects the two coast-places Lobito and Benguella with Bihe on the high plateau, but the line now runs 100 miles or more beyond that place.

The northern line, connecting Loanda with Malange, covers about 310 miles and is of metre gauge.

The Mossamedes line in the south, which has a gauge of only 60 c.m., connects with Lubango, a distance of some 150 miles inland.

The result of the building of the railways on the native settlements is of interest. The routes of their trade-caravans from the interior westwards have naturally been shortened to the extent to which the railroads advanced into the interior and the small villages, which were previously supported by the caravan-trade, have been deserted, the inhabitants withdrawing more and more into the interior.

No details of technical value are available with regard to waterpower, but special attention may be drawn to the falls of the lower Cuanza and Luvulla which are favourably situated as regards the Loanda-Malange railway.

The towns of the colony call for no special notice and this can only be expected with such a small European population. They rarely consist of more than the government offices and military barracks with a few stores and factories. The Portuguese have, however, built a considerable number of commodious stone houses as they generally do in their colonial possessions.

To sum up the trade position, it cannot be said that Portuguese West Africa possesses at present a high commercial importance apart from its ownership of Lobito Bay, perhaps the best natural harbour on the West Coast, and the Benguella Railway which is under construction with a view to linking that port with the Katanga. It has, however, undeveloped resources which may one day give it wealth of its own. The bold railway enterprise inaugurated by Mr. Robert Williams in 1902 is undoubtedly destined to prove
the principal of the Western ribs of the Cape-to-Cairo system, and Lobito Bay may consequently some day attain a higher status even than Lourenco Marques. Such a development is far from being in sight yet, but it would seem none the less inevitable. A rich and undeveloped part of Africa is being opened up by the Benguella line, and a new outlet is being provided for the great mineral wealth of the Katanga. Moreover, in view of the existence of the East Coast system from Dar-es-Salaam, an eventual trans-continental route is assured the importance of which can hardly be exaggerated. The Atlantic and Indian Oceans in these latitudes will be directly joined for the first time, probably with a train-ferry service across Lake Tanganyika.

Meanwhile, the construction of the Benguella Railway has been carried some 500 miles from its sea terminus at Lobito Bay. In all about 800 miles will have to be covered before a junction is made with the main system from north to south. At present a small branch runs 52 miles westward from the latter, joining Ruve with Kambove, in the Katanga, and it is towards this spur that the Benguella line is being pushed. In 1923 the railway carried 227,775 passengers and 177,888 tons of goods. Its net earnings steadily increase and are now about £90,000 a year.

To secure the full benefit of the railway development it is obvious that the harbour at Lobito Bay, with all its natural advantages, will need to be completely transformed. Its wooden jetty, with ample depth of water for the largest vessels, serves all purposes at the present moment, but it is only a matter of time before permanent wharves, with up-to-date cranage and warehouse equipment, will have to be built.

The present trade of Angola including what is known as the Congo District, is neither large nor interesting. It may be said to represent the minimum requirements of a backward and undeveloped territory.

Some limited planting operations are conducted under white control, but agriculture depends almost entirely on native cultivation, the principal exports being, as already stated, wild rubber, beeswax and other products. Recent statistics covering this trade are difficult to obtain, but during a period of twenty-three years and more there has been very small growth shown. The annual imports are rather less than £2,000,000, and the exports do not exceed £1,500,000. The imports, apart from railway equipment and material, consist mainly of cotton goods, foodstuffs, articles for domestic and personal use for the small white population, and Kaffir truck of the usual character.

Coffee is the most valuable of the tropical products exported and a railway is being built
from Amboim harbour to tap the rich coffee area which lies inland. The sugar industry promises well and one concern alone expects soon to produce 10,000 tons of sugar a year. Maize is grown chiefly by the natives, and an increase of production to 300,000 tons a year is looked for. Cotton, wheat, beans and sisal are also cultivated. Soap is manufactured at Loanda and a match factory is also being built there to have a minimum annual production of sixty million boxes. There are also saw-mills in the interior, and other enterprises include a furniture factory, tobacco factories and brick and tile works.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

AT BUSY DELAGOA BAY.

The Central Railway Station.

The Matolla Bridge on the Ressano Garcia Line.

A View of the Wharf near the New Coaling Plant.
Portuguese East Africa.
THE PROVINCE OF MOZAMBIQUE

1.—LOURENCO MARQUES AND THE GOVERNMENT AREAS.

The Portuguese province of Mozambique is undoubtedly one of the richest parts of Africa, though at the present time it is almost undeveloped. What progress it has made so far has been due largely to its transit trade, for its ports also serve inland territories belonging to other nations, but the richness of its soil will in due time yield vast wealth and build up for it a great home trade of its own.

Mozambique province has an area approximating to two-thirds of the Union of South Africa and a native population of about four millions. With a coast line extending over a thousand miles it possesses a number of ports of value, while inland, both tropical and sub-tropical, products grow in profusion. The economic potentialities of this area can best be surveyed by dealing with them in two sections (i) Lourenco Marques, the great port of the Province, and the areas administered by the Government; (ii) the huge territory controlled by the Mozambique Company.*

* See page 99.

Under the first head there comes, in the main, the southern part of the Province of Mozambique, the trade and development of which is for the present mainly associated with the neighbouring British territory of the Transvaal, much of the sea-borne traffic which it handles, while also supplying a large amount of invaluable native labour for its gold mines. In this southern area is situated the magnificent sheet of water generally called Delagoa Bay, upon the shores of which stands the capital of Mozambique Province—Lourenco Marques, an important port and trading centre. Delagoa is about twenty miles wide. From its entrance at the Indian Ocean it has a navigable deep water channel extending for over twenty-five miles, which is well lighted by means of luminous buoys and vessels can move in it with ease either by night or day. The harbour is practically land-locked and sheltered from every wind.

It is somewhat curious, however, that although Delagoa Bay is one of the finest harbours in all Africa, it was not adequately developed until long after the
more northerly parts of the Portuguese possessions on the east coast of the continent. Discovered by Antonio de Campos in 1508, and explored by a trader named Lourenco Marques in 1544, it does not seem to have attracted the attention of traders to the same extent as other places on the coast. Ships called at irregular intervals and there was a Portuguese fortress at Point Mahone at Catemoe, but the commercial value of the magnificent harbour was not realised. The sheet of water had been officially christened the Bay of Lourenco Marques in the middle of the sixteenth century, but the British name Delagoa Bay was widely adopted, though the town on its shores was called Lourenco Marques. In the seventies of the eighteenth century, Delagoa Bay was visited by Dutch, Austrian and English traders, and its possibilities were evidently beginning to be understood.

The Portuguese had more than once to tear down trading establishments set up without their permission on land they regarded as belonging to them. In 1781 the Lisbon Government sent out a Military Governor and a new fortress was built on the site of the present town of Lourenco Marques. The settlement, however, was only a small one, and wars with native tribes prevented the development of trade on any considerable scale. Between 1796 and 1820, a number of whalers made the Bay their headquarters, and indeed a whaling station was established, though apparently without the consent of the Portuguese.

As the whole of Southern Africa became better known, the uncertainty regarding the ownership of Delagoa Bay gave rise to trouble. In 1822 a British naval officer visited it for the purpose of charting the Bay, but the Portuguese alleged that attempts were made to enter into treaties with natives and secure land concessions, and a long controversy between the Portuguese and English Governments ensued. In November, 1861, all outstanding disputes were brought to a head by an officer from a British warship landing with a letter stating it was proposed to take possession of Inyack Island, and some years later it seems that there was actually a landing there. The outcome was the military occupation of the island by the Portuguese and the submission to the arbitration of the President of the French Republic of all the disputed points. The award declared the rights of Portugal to the territory had been proved. This was in July, 1875, and from this point the progress of the settlement was more rapid, though even then the advance for some years was slow compared with that of the neighbouring British territory. In 1887 Lourenco Marques was raised to the dignity of a town, though it consisted only of a
square and a few streets. What gave it a tremendous lift was the opening of the railway to the Transvaal in 1895. The gold on the Rand was discovered in 1886 and a great town rapidly sprang up and became a big centre of trade. Delagoa Bay was the nearest seaport for the Rand, while the territory round it also benefitted from the fact that the mines began to find that native labour from Portuguese territory was necessary for the needs of the expanding industry.

Delagoa Bay now went ahead with wonderful rapidity. Not only did merchandise for the Rand pour through it, but its obvious importance in the economic life of the sub-continent attracted capital for its development, and subsequently money also for the development of some of the rich land lying north of it. The Portuguese authorities were fully alive to the possibilities of the period and their faith and energy had much to do with the extraordinarily rapid expansion of a new settlement into a large and well-equipped town. A big programme of public work was put in hand and before long the old inhabitants of Lourenco Marques hardly knew their old town. The mosquito-infested swamp which once gave the port a bad reputation for fever was filled in. Upon what was once a waste with pools of stagnant water, there were constructed the picturesque public gardens which are now one of the attractions of the place. Hard roads were thrust out in all directions across former sandy wastes. But the commercial attractions of the capital of the Province received even more attention. Modern wharfs were built, the latest cargo-handling machinery was imported, and a well-planned programme carried out for the purpose of making Delagoa Bay one of the best equipped harbours in the continent to serve the developing needs of the hinterland.

Lourenco Marques possesses one advantage of which no other port in South Africa can boast. Its rivers are navigable over long distances by small craft and motor boats. In the Union of South Africa there is not a port to which any considerable quantity of river-borne cargo could be brought. But five rivers, navigable for distances ranging from 15 to 200 miles, reach Lourenco Marques, and in years to come, as the economic resources of the province are developed, they must prove of very great value to the port for freight-carrying and for tourist excursions.

That the Province of Mozambique alone will one day provide the port at Lourenco Marques with a large amount of traffic is certain. It has great economic potentialities and in the distant future will be a big producer of cotton, sugar and other products. Indeed, the sugar industry is already well established and preparations are being made for large extensions.
For some time to come, however, Delagoa Bay must be mainly dependent for its prosperity upon the transit trade. It is, indeed, the natural port of the Rand, and a big coal and mineral area in the Transvaal. That there would be close commercial relations between the two territories was recognised in the earliest days of the settlement of the Transvaal. As far back as December, 1875, there was signed at Lisbon a Treaty of Amity and Commerce between Portugal and the South African Republic, which provided for the free interchange of the products of the soil and industry of the two countries. This Treaty was signed before the discoveries of gold on a considerable scale caused the trade of the Transvaal to advance by leaps and bounds. But when this tremendous expansion, caused by the springing up of the Rand as a great mining centre did begin, the old free trade agreement stood, and the Portuguese did their utmost to facilitate transport to a region still not served by railways. Indeed, all important South Africans will admit that the Portuguese authorities at Delagoa Bay have always done their best to maintain friendly relations with South Africa and to provide adequately for the transit trade of the Transvaal. As soon as British administration was firmly established in the Transvaal the relations between that territory and the Portuguese Government was laid down in the Modus Vivendi of June, 1904. This agreement dealt with native labour for the mines on the Rand, railway traffic and customs matters, and it lasted until 1909, when it was replaced by an agreement on the same lines known as the Mozambique Convention. The Convention was given a life of ten years, to be renewed thereafter for yearly periods until denounced. Not long after the Convention was signed at Pretoria the Union of South Africa was established. It kept the Convention going until on April 1st, 1922, it gave twelve months' notice of termination. The Convention thereafter ceased to be operative on March 31st, 1923. Before it actually lapsed negotiations were carried on for the purpose of finding a basis for a new Convention. General Smuts, the then Prime Minister of the Union, invited the Portuguese Government to send a delegation to South Africa to carry on the discussion. The Lisbon Government sent out General A. A. Freire d'Andrade, a former Governor-General of Portuguese East Africa, as the head of the delegation which included several experts on Mozambique. The Portuguese representatives arrived at the Cape in May, 1922, and negotiations were carried on for six weeks but no agreement could be reached. The Portuguese offered to guarantee still better facilities at Delagoa Bay for the handling of Transvaal traffic, especially coal, but General Smuts wanted a share in the
actual control of the port which the Portuguese could not permit. A complete deadlock ensued, and the Portuguese delegation returned to Lisbon to report on the position. The negotiations were not resumed, and thus at the end of March, 1923, the Convention became unoperative by the efflux of time. This might have created an awkward situation for the Rand’s gold mining industry, as the Convention gave it the right of recruiting native labour in Portuguese territory. However, at the last moment a Modus Vivendi was signed at Lisbon covering this point. The rest of the Convention, however, finally disappeared, and with it went the free trade principle embodied in the Treaty of 1875.

However, it was generally recognised on both sides of the border that the lapsing of the Convention could only be a temporary difficulty and that a new agreement was bound to be reached before long. Thus the Portuguese continued to grant all possible facilities for the Transvaal and acted as though the Convention still stood. Further, conversations took place with a view to ending the deadlock, but delay was caused first by the fall of the Portuguese Cabinet and then by the defeat of the Smuts Government in the Union in June, 1924. General Hertzog became Prime Minister of the Union, and within a few months he paid a visit to Delagoa Bay and inspected the port facilities and discussed the general situation with the local administration. It is believed that General Hertzog does not hold quite the same views as General Smuts on the question of the Union exercising a certain amount of control over the port arrangements at Delagoa Bay, and there is therefore reason to think that a new Convention will now be negotiated without much difficulty.

As a port Lourenco Marques has been equipped with a thoroughness which will enable it to handle a great deal more trade than it receives at the present time. The Portuguese authorities have spent money freely in order to make it the centre of the export coal trade of South Africa. The ferro-concrete wharf is a mile long and its deep water front will accommodate twelve steamers at one time. There are eleven commodious sheds for cargoes, as well as a transit shed and a "King’s" warehouse. The landing equipment includes over thirty cranes with a lifting capacity ranging from two to sixty tons.

There are two plants for dealing with the coal traffic. One is of the McMyler type which has a nominal capacity of 400 tons per hour, though this has been exceeded on more than one occasion. The second and newer coaling plant was formally inaugurated on June 10th, 1923, and has a capacity of 600 tons per hour, though this can be exceeded in case of emergency. The two plants en-
able the port to deal with 10,000 tons a day or some 3,000,000 tons a year.

A new dry dock of 1,800 tons deadweight capacity has recently been opened. The harbour is well equipped with tugs, engines, power, lighting, and so on, and all the traffic likely to come to it can be dealt with rapidly, while if necessary a further extension of the wharf accommodation can easily be carried out.

The railway system is also in excellent order. The main line runs from Lourenco Marques to the Transvaal border at Ressano Garcia. It is 55 miles in length, is laid with 80 lb. rails and is in such good condition that high speeds can be obtained on it. Another line, 40 miles long, runs to the Swaziland border. This was built in order to link up the line which Lord Milner promised would be run from Brayten in the Transvaal across Swaziland, thus shortening the journey to the sea. But the line from the Transvaal has not been built yet, and it is impossible to say when it will be begun. There is a third line branching off from the main line to Xinavane, which is to be extended to the Limpopo Valley, a vast tract of highly fertile land, the economic exploitation of which will bring great wealth to the Province.

At present, as already emphasised, the prosperity of Delagoa Bay depends mainly on the transit trade of the Transvaal. The port has been equipped chiefly for that traffic, and the town lives very largely on it. Everything possible will be done to keep and extend the through traffic, and Delagoa’s claim to it is a strong one, for it is obviously the natural port of a big and valuable section of South Africa.

But the development of the economic resources of the Portuguese territory alone must in the long run be sufficient to keep Delagoa Bay going. It is not an industrial centre at the moment, but its potentialities are considerable and the comparatively small enterprises which now exist should be greatly extended as time goes on. The agricultural possibilities of the hinterland are really enormous. Sugar is an established success already. Cotton can be cultivated with ease. Indeed, many economic products flourish, and only capital is required to develop a big and most promising area.

The following figures for the year ended December 31, 1923, show the activity of Lourenco Marques as a port:

<table>
<thead>
<tr>
<th>Nationality</th>
<th>No. of Ships</th>
<th>Tons of Cargo brought in</th>
<th>Number of Passengers</th>
</tr>
</thead>
<tbody>
<tr>
<td>British</td>
<td>136</td>
<td>136,684</td>
<td>5,796</td>
</tr>
<tr>
<td>Portuguese</td>
<td>24</td>
<td>5,746</td>
<td>838</td>
</tr>
<tr>
<td>German</td>
<td>44</td>
<td>50,655</td>
<td>1,384</td>
</tr>
<tr>
<td>American</td>
<td>12</td>
<td>6,136</td>
<td>10</td>
</tr>
<tr>
<td>Dutch</td>
<td>48</td>
<td>19,918</td>
<td>72</td>
</tr>
<tr>
<td>Italian</td>
<td>4</td>
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<td>6</td>
</tr>
<tr>
<td>Norwegian</td>
<td>14</td>
<td>23,178</td>
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</tr>
<tr>
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<td>16</td>
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<tr>
<td>Danish</td>
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<td>22,972</td>
<td></td>
</tr>
<tr>
<td>Japanese</td>
<td>6</td>
<td>303</td>
<td>44</td>
</tr>
</tbody>
</table>

The cargo exported in 1923 comprised 18,583 tons of ore and general goods, and 639,381 tons of coal (including bunker).
The coal export figures for 1923 were unusually low, as they were in 1922, owing to high freight and rail rates and the slump in the export trade, and the figures quoted do not indicate the real potentialities of the coal traffic from the Transvaal. At the time of the Convention negotiations, the Union delegates talked hopefully of at least 3,000,000 tons of coal a year passing through Delagoa Bay from the Transvaal, and indeed the estimate did not appear exaggerated at the moment. The export coal business from the Transvaal will probably soon become much bigger than the Lourenco Marques traffic figures for 1923 suggest as likely. In the Province of Mozambique the manufactures include soap, leather, sacking, matting and ropes, cement, paper, tanning, beer, etc. Some of them are on a small scale at present but development is possible as such industries as sugar, cotton and so on expand and increase the general wealth of the country. It is fairly safe to predict that the establishment will come first and that manufacturing development will then follow. The exploitation of the natural products of the Province is already making progress, especially where concerns with ample capital have taken the work in hand.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE IN THE MOZAMBIQUE COMPANY'S TERRITORY.

On the Sugar Estates near Beira.—A Sugar Train on the Sena Estates.—A Steamer on the Shire River, near Lake Nyasa.
The Province of Mozambique.

II.—THE TERRITORY OF THE MOZAMBIQUE COMPANY.

The Africa of to-day, from the Cape to the Great Lakes, bears a vastly different aspect from what it did some seventy years ago when Livingstone, Speke, Burton and others revealed the physical features of the Dark Continent and opened the door to civilisation. It is now possible to envisage a Central Africa which, in a comparatively few more years, may reproduce, in different detail, the settled civilisation of the South, with arterial systems of railways conveying vast tonnages of raw materials to either coast, there to be shipped to the markets of Europe; and cities and villages in the temperate highlands on both sides of the Equator imitating in their appointments all the conditions of comfort prevailing in the countries of the Old World—homes where European families may be reared in sturdy growth. Even now it is not only the littorals of Central Africa that boast the benefits of an advancing civilisation, and it is merely a matter of time, opportunity, and capital when the rich plateaux and the richer lands of the coast belt and the riverine alluvials will have transformed the Darker Africa of last century into what is destined to be one of the greatest granaries of the world.

It says much for the astuteness of the Portuguese of four hundred years ago, when Henry the Navigator led the way in African and Indian discovery, that they planted their flag on sections of the East and West Coasts that are now known to be amongst the most valuable portions of the Continent. Given sufficient capital for their development, and energy in its application, Mozambique and Angola, colonies larger in area than almost any of the States of Europe, the Portugal of to-day may find in these possessions the basis of a prosperity to which it has long been unaccustomed. Unfortunately, although under the Monarchy the Portuguese Government did something towards the development of the African Colonies—as witness the harbour works at Lourenco Marques—very little additional progress can be credited to the Governments of the Republic. Schemes have been adumbrated and sporadic efforts have been made to bring them to fruition, but the varying conditions in Portugal, the instability of many
Ministries that have followed each other in rapid succession, and the general indifference of the ignorant proletariat and the disregard of placemen to the clamant necessities for development by means of roads and railways and a continuous policy of expansion have limited whatever advance has been made during the last ten years to private enterprise. Without the foreign money, chiefly British and French, that has been put into Mozambique, little or no progress would have been effected in these great Colonies. In the Province of Mozambique agrarian development has been confined for the most part to the Territories of Manica and Sofala, which are administered under a Charter by the Companhia de Mocambique. The nomenclature is a little confusing to the European ear, and it is necessary to explain that the Mozambique Company’s Territory denotes the central part of the Province of Mozambique, bounded on the south by the Provincial district of Inhambane—next to that of Lourenco Marques or Delagoa Bay—and on the north by the Zambezi River. The Mozambique Company’s Territory, extending to some 65,677 square miles, was really colonised for the first time in 1893 by the nucleus of the Administration. Previous to this no organised attempt had been made to develop the possibilities of the estuary on which Beira, the seaport and capital of the Territory, is built. Sofala, round the corner of the bay, had already passed into ancient history as the coastal settlement of the ancient race that may have been responsible for the Zimbabwe ruins and the mines that had been made to yield their gold from the schist formations of what is now Rhodesia. But the Sofala of the ancients now lies buried under the sea, and even the fine old fort that was raised above the high tide land of those days by the early Portuguese has been demolished in order to save the stone with which it was constructed, for the structure was being overwhelmed by the erosion of the sea.

The Territory is bounded on the north by the Zambezi river up to a point about twenty miles below Tete, and then by tributary streams, while on the south it extends to the 22nd parallel of South latitude, so that it just falls within the Tropical zone. In the south-west corner it stretches out a broad finger, beyond the 22nd parallel, to the Limpopo river, which it borders for about 50 miles, reaching up to the point where the Portuguese, Rhodesian, and Transvaal frontiers meet. North and south the length of the Territory ranges from 200 to 400 miles, increasing with the distance inland. East and west the width ranges from 120 to 250 miles, being least in the centre, where Beira is situated at the mouth of the Pungwe and Buzi rivers. Between the Zambezi and the 22nd parallel the
THE CLIMATE

coast makes a big inward curve, and the length of coast is estimated at 270 miles.

For the most part the coast is low-lying, and fringed with mangrove swamps. Inland the country rises in great irregular steps to the Rhodesian border. In the central portion of the territory, behind Beira, the flat coastal plain, sloping gently up to an elevation of some 200 ft., is succeeded by more broken ground, rising fairly rapidly to about 2,000 ft. Beyond this a belt of rolling country of a general elevation of from 2,000 to 2,500 ft. extends back to near the frontier, where there is again a rapid rise—forming the main eastern escarpment of Rhodesia—to heights of from 3,000 to 4,000 ft. in the valleys, and from 6,000 to 7,000 ft. along the crest of the mountains. In the northern and southern portions of the Territory, the steps are broader and shallower, due partly to the lesser elevation of the Rhodesian plateau in that vicinity. Apart from the highlands along the central section of the Rhodesian border, the Gorongosa mountain group rises to 2,000 metres (6,500 ft.) in the centre of the region between the Beira Railway and the Zambezi; and in this northern half of the Territory also, but nearer to the sea, the general low level of the terrain is interrupted by the Cheringoma Plateau.

The Mozambique Company’s Territory is well watered. The principal river basins have already been mentioned. Only the Zambezi, which is free to the shipping of all nations, is navigable by shallow-draught steamers for any considerable distance.

Along the coast and in the river valleys the climatic conditions are those of most low-lying tropical countries. Rain may be expected in every month of the year, but the heavy rains, on which the farmers rely for the crops, fall in the summer, generally from December to March. Though the temperature in these months seldom rises much above 90 degs., it seldom falls below 75 degs., and the high mean, coupled with the humidity of the atmosphere, renders the summer rather trying. The annual rainfall is over 50 inches, and occasionally is twice as great. In the highlands of the interior the elevation helps to counteract the effects of latitude. The rainfall is not markedly different, and the days are hot in summer; but the nights are cooler, and European settlers are able to maintain a state of robust and vigorous health.

The Mozambique Company, founded in 1888, administers its extensive and varied Territory under a charter granted by the Portuguese Government in 1891. As subsequently modified, this charter invests the company with practically sovereign rights (though ultimate authority is reserved, of course, to the Portuguese Government) for a period of fifty years from the original date of issue (February 11, 1891), and at the end
of that time it may be renewed. The company is Portuguese (Companhia de Mocambique), and has its headquarters at Lisbon; but British, French, and Belgian capital has been largely interested in it from the start, and the Lisbon board is assisted by committees in London and Paris. In Africa the Company’s Territory is administered by a Governor, working through a number of Government Departments. The detailed work of administration is carried out by “commandants” or district commissioners. When the charter was granted the Territory was almost entirely undeveloped. Beira was little more than a name—a few shanties on a sandy beach. Now it is a port with a population of about 12,000, including about 1,600 Europeans and 850 Asiatics.

From Beira as a centre, the whole of the Territory has been brought under control with the exception of the Barue district, in the north-west, which has been in Portuguese military occupation since 1901. Many mining and planting companies are engaged in developing the resources of the Territory, as also are a large number of individual settlers who have taken up land, principally in the higher parts of the country, in the neighbourhood of the Beira Railway. Until 1918 the Mozambique Company itself combined agricultural and trading operations with its administrative duties; but in that year the two functions of the company were separated, and its business pursuits are now conducted by the Mozambique Industrial and Commercial Company, Limited. The Mozambique Company holds all the shares in the latter enterprise, and is thus directly interested in its success; but the arrangement has the advantage of leaving the parent company free to devote itself entirely to the work of administration.

The development which has already taken place is indicated by the revenue and trade returns. In the latest report, that for the year 1922, the revenue in English sterling—calculated on the basis of exchange at par—is given as £383,286, chiefly derived from Customs, hut tax and poll tax, concessions and ground rents and port dues. In the same year the expenditure amounted to £380,854. The commercial movement of the Territory in 1921 was valued at no less than £13,083,745 and an analysis of this total brings out very clearly the importance of Beira as a distributing centre, for while imports were valued at £1,724,600 and exports at £1,845,000, re-exports, trans-shipments, and goods in transit represented the large balance. In spite of the difficulties of shipping which still lingered in 1922, as part of the aftermath of war, the port of Beira was entered in that year by 478 ocean-going and coasting vessels, of a tonnage of 1,254,761. The ships of 30 companies, representing 8 different nationalities, visited the port.
AGRICULTURAL RESOURCES

These results are only a fraction of what may be expected as schemes of development progress and population increases. At present the Territory is very sparsely populated but not more so than Rhodesia, and though there is some ebb and flow from year to year, according to the circumstances of the natives and the attractions offered by neighbouring territories, a survey of the first two decades of the twentieth century shows a very big increase during that period. In 1900 the total population was returned as 108,000; in 1922 it was 278,952, some 2,600 being whites. The majority of the whites are resident in the Beira district, while most of the remainder are settled in the districts of Chimoio and Manica—that is, in the upland regions behind Beira. In these districts nearly all the maize grown in the Territory is produced, and European settlement is on the increase. The principal towns—ships are Vila Pery and Macequeque, both on the Beira railway. Other centres include the ancient Portuguese settlement of Sofala, on the coast, south of Beira; Vila Machado, west of Beira, in a mixed farming area; and Sena, on the Zambezi, the headquarters of an important sugar-growing industry.

Naturally, with a population of only four or five to the square mile, it has only been possible to begin to tap the resources of the Territory. As will be seen from the following sections, there is a wide range of economic products capable of development on a large scale, and great opportunities are open to a policy of progressive enterprise.

The agricultural resources of the Territory range from the tropical products of the lowlands to the sub-tropical products of the highlands. Both health conditions and capital requirements favour the growth of different systems of development in the two zones, though neither system is exclusive. The lowlands are specially suited to the operations of large companies, of which several are engaged in planting enterprises on the Zambezi and Buzi rivers. The highlands offer the best field for mixed farming, and attract most of the individual settlers.

Sugar.—By far the most valuable crop is sugar. On the Zambezi the Sena Sugar Estates Limited, with a capital of £1,500,000, control estates at Sena, Marromeu, and Mopea—the last named on the left bank of the Zambezi, outside the Mozambique Company's Territory.* The Sena Sugar Company is the largest single enterprise of its kind in Africa. Nearly 18,000 acres of cane were harvested on its three estates in 1923, and over 33,000 tons of sugar were manufactured from the crop.

Another important sugar-producing company is the companhia Colonial do Buzi, which owns large estates on the lower

* See page 117.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

A general view of the Cala Factory, shewing, in centre, the Labour Office.

A view of the growing Cane on the Sena Sugar Estates

A typical Zambezi scene at Sena
SUGAR PRODUCTION

Buzi River, not far from Beira. In 1920 it added to its holdings by the purchase of the Inhanguvo Sugar Estates (also on the Buzi) for a sum of £325,000, thus increasing its capacity for sugar production to 15,000 tons per annum. Actually it had 6,500 acres under cultivation for cane sugar in 1920, and its output of sugar in that year was 6,273 tons. In addition it produced over 20,000 gallons of brandy and 260 gallons of alcohol. The area under sugar cultivation is being steadily increased and much larger figures of production may be expected in future years. Nor is this the sum total of its activities. While devoting itself mainly to the sugar planting industry, the Companhia Colonial do Buzi also grows maize, breeds its own cattle, supplies Beira with fresh fruit, runs saw-mills, and manufactures bricks and tiles.

If the latest returns from the Sena Sugar Estates and the Companhia Colonial do Buzi be combined it will probably be found that the total production of sugar in the Mozambique Company’s Territory is in the neighbourhood of 50,000 tons a year.

This production consists partly of yellow sugar, and partly of more highly refined white sugar, the former being exported mainly to Portugal (where imports of sugar are classified on the Dutch scale), and the latter being exported to the Transvaal, the United Kingdom, and other European markets, as well as providing for local needs.

Further sugar-planting enterprises are in course of development. In 1920 a company in the Gorongoza district made a beginning with a small plantation of 25 acres, and in the district of Neves Ferreira, which lies at the back of Beira, the Companhia Portugaza do Ultranmar has secured a concession of 50,000 acres for the plantation of sugar cane and the establishment of a sugar factory.

Sisal. Though still in its initial stages, perhaps the most important planting enterprise in the Territory, next to the cultivation of sugar, is the Mozambique Industrial and Commercial Company’s sisal plantation at Chuapanga, on the Zambezi. This was established in 1916. By the beginning of 1924 an area of 5,000 acres had been planted and further areas are now being planted out. Cutting was begun in 1920, and the crop in that year yielded 423 tons of fibre. The yield from the 1921 crop was 442 tons, and in 1923 the yield was 967 tons. It is estimated that eventually the plantation will be capable of producing 2,000 tons of fibre per annum. An up-to-date sisal factory, completed in 1920, is served by lines of light railway traversing the plantation.

Sisal plantations have also been started by the Companhia Colonial do Buzi and by the Mozambique Plantation and Trading Company—the latter an
important corporation which was founded in 1913 by the Prince of Monaco and is engaged in many enterprises in the Territory.

Cotton. A promising native industry is cotton growing. Lands along the Zambezi are specially suited to the production of large quantities of fine-quality cotton. This opinion, which had long been advocated by the Mozambique Company’s agricultural officers, was endorsed in 1915 by a well-known Nyasaland planter, who was commissioned to examine and report on the conditions, and again in 1916 by Mr. Percival, a representative of the British Cotton Growing Association. In 1915 the Director of Agriculture in the Mozambique Company’s Territory estimated the yield of seed cotton in the best native fields near Chemba at over 1,000 kilogrammes per hectare (about 8 cwt. per acre); and he reported that in some cases the length of staple was 1½ in., the average being one inch. Through the Mozambique Industrial and Commercial Company, efforts are now being made to develop the cotton industry on a large scale, and a cotton ginnery with a capacity of 2,000 tons of seed cotton per annum has been erected at Chemba. The output of cotton lint was only 30 tons in 1918 but in 1923 it had risen to 250 tons, and a rapid increase is now expected. The cotton is grown by native cultivators, both on lands belonging to the company and on their own plots, the company guaranteeing to buy the privately grown crops at a fixed price.

Copra. The cocoa nut palm is cultivated on the Mozambique Industrial and Commercial Company’s estate near Chiloane which contains 60,000 palms. In 1920 a crop of about 380,000 nuts was gathered, and the production of copra in that year was 57 tons. In 1922 the production was 82 tons and in 1923 it rose to 100 tons.

Mangrove Bark. One of the most valuable of the products exported from the Territory is mangrove bark, of which there are enormous quantities in the mangrove swamps along the coast. The bark furnishes a useful tanning material, and for many years its exports were exceeded in value only by those of sugar, maize, and minerals. The industry declined during the war, but is rapidly reviving under the auspices of two companies which have been granted concessions embracing the whole of the coast. One of these is the Mozambique Trading and Plantation Company, which has the right of collecting the bark from the mouth of the Savanne River (25 miles north of Beira) to the southern limit of the Territory; the other is the Companhia Agrícola do Beira, which has similar rights from the Savanne River northwards. The latter company, which was constituted with Portuguese capital at the end of 1918, and also enjoys large
MAIZE PRODUCTION

agricultural concessions in the hinterland, has erected near the mouth of the Savanne River a large factory costing £50,000, for the extraction of tannin from the bark—an industrial development which will increase the value while reducing the bulk of the exports. In 1920 over 3,800 tons of mangrove bark were exported from the Territory.

Maize. Though grown to some extent in the lowlands, maize, which is the second most important crop in the Territory, both in quantity and in value, is essentially an upland product. For example, out of less than 87,000 bags of maize grown within the Territory, which were received at Beira in 1918, over 77,000 bags came from the upland districts of Chimoio and Manica (nearly 60,000 bags from Chimoio alone), the remainder being credited to Neves Ferreira, the district between Chimoio and Beira. The climatic and soil conditions in the uplands are admirably suited to the production of large crops; no part of South Africa is more highly favoured in this respect. It has been estimated that in Manica and Chimoio the average yield of maize from well cultivated land on which only one crop is grown per annum is ten bags per acre. As a bag is 203 lb., this is equivalent to 34 bushels per acre. In some cases the returns are very much larger—up to sixteen bags per acre. In Neves Ferreira the yield per crop is only six or seven bags per acre, but in this district two crops per acre can often be obtained. The total area under maize in 1923 is estimated to have been over 50,000 acres, and the yield reached the record figure of over 45,000 tons.

Nothing is more remarkable, on the economic side of the Territory’s development, than the expansion of the maize crop in recent years. In 1911 the yield was estimated at 36,000 bags; in 1914, the year when the war broke out, it had increased to 150,000 bags; in 1918, the last year of the war, when the seasonal conditions were very adverse, it had further increased to 180,000 bags; and in 1925 the total went up to something like 450,000 bags, while it is said that in a really good season a crop of 750,000 bags is within the capacity of the present white population. The local requirements are estimated at 110,000 bags, leaving a surplus for export even at the present rate of production of well over 300,000 bags a year.

Fields of from 500 to 700 acres of maize are quite common in the Chimoio and Manica districts, and near Vila Pery, in Chimoio, may be seen an unbroken expanse of 2,500 acres under maize. The use of modern methods of cultivation is now general. Hand labour has practically disappeared, except in rough hilly places where ploughing is impossible, and on an occasional field during the first year of clearing. Up-to-date agricultural machinery has been bought by
the farmers, and the settled areas present such visible tokens of prosperity as new brick houses, sheds for storing maize and machinery, and stables for cattle.

Practically all the maize grown, except what is required for seed purposes and local consumption, is exported through Beira, which is also the port of outlet for a great deal of the Rhodesian maize crop. The port is equipped with a maize drying and cleaning plant, but is greatly in need of increased and improved storage facilities. In 1919 Mr. Littlejohn Philip, who was invited to South Africa by the Union Government to draw up a scheme for the erection of grain elevators within the Union, also paid a visit to Beira to investigate the conditions at that port, and there is little doubt that if Beira is to take on the development which is anticipated, it will have to adopt sooner or later the elevator system of handling grain in bulk.

_Citrus Fruits._ In Manica and Chimoio are all the natural requirements for the development of a valuable industry in citrus fruits. The climatic conditions are favourable, and there are large areas of rich, deep red soil, which could be placed under irrigation at a minimum cost. Some of the richest and best-watered lands are traversed by the railway. Both Washington Navel and Valencia Late oranges are grown, but not on a commercial scale, except on an estate about 15 miles from Macequece, where orchards of not only oranges, but lemons, naartjes, and apples, give promise of a considerable production in the near future. As in Rhodesia, the Washington Navel fruit is inclined to be watery and lacking in flavour at first, but after the seventh year an orange of full and excellent flavour is obtained. Valencia Late oranges give good results from the first. Two small consignments of grape fruit—the first exports of citrus fruits overseas—were sent to Europe in 1920. It is significant of the transport difficulties which confront the development of trade that it was found cheaper to rail the fruit to Cape Town than to ship direct from Beira.

Many other kinds of fruit are grown in the Territory—peaches, plums and other stone fruits for home use in the Manica and Chimoio districts, and mangoes, pineapples, bananas, etc., in all districts, both for home use and for market. The principal markets are Beira, Rhodesia, and South Africa, but an export trade to Europe is looked for eventually.

_Coffee._ Experimental coffee plantations have given promising results in Manica and Chimoio. The variety grown is _Coffea arabica_. At Vumba, near Macequece, both the Mozambique Industrial and Commercial Company and the Mozambique Trading and Plantation Company are giving attention to this crop, but the quantities grown are at present too small to permit of the development of
COFFEE, TOBACCO, ETC.

an export trade. In 1918, the dreaded disease Hemileia vastatrix made its appearance near Vila Pery, but precautionary measures have been taken against it and hopes are still entertained of developing the industry on a commercial scale. A large number of trees have been planted from seed distributed by the Mozambique Company.

Tobacco. Tobacco is grown by the natives all over the Territory for their own use, and though European farmers have not given much attention to the crop, experimental plots have given good results with both Virginia and Turkish leaf. Some growers have obtained a yield of 750 lbs. an acre.

Miscellaneous. Increasing attention is being given by the more progressive farmers to the cultivation of haricot beans, which give excellent results and would play a useful part in a rotation of crops. Groundnuts, at present chiefly grown by the natives, are also beginning to attract the attention of farmers, and would similarly be a very useful crop. There is no doubt about the ability of the country to grow them. At the Tropical Products Exhibition in London in the summer of 1921 the gold medal for the best sample of undecorticated groundnuts was awarded to an exhibit on the Mozambique Company's stand.

Wheat, barley, and oats all offer opportunities as winter crops. At present the production of these cereals in the Territory is not sufficient for local requirements, but some farmers are growing enough wheat for their own consumption, and the agricultural authorities are seeking to stimulate interest in the cultivation of special varieties imported from India.

The cultivation of rice is being taken up in Neves Ferreira, and gives promise of developing on a large scale. So encouraging are the prospects, indeed, that those acquainted with the conditions believe enough rice can be grown, not only to meet local requirements, but to supply the South African markets.

An experimental tea plantation has been established on the coast at Manga, five miles from Beira, and, though still in its early stages, has made good progress.

Livestock. The livestock industry in the Mozambique Company's Territory has taken on a marked development in recent years—a development which is all the more noteworthy because the natural advantages which the Territory offers for this branch of enterprise are mingled with many serious difficulties. There are wide stretches of pastoral country covered with excellent grasses and capable of supporting large herds—as, indeed, the abundance of game testifies, particularly on the Cheringoma Plateau and the plains of Gorongoza, where thousands of buffaloes and antelopes find sustenance. From the point of view of the livestock
owner, there is a fly in the ointment — literally a fly, the dreaded tsetse. It does not occur everywhere. There are districts which are quite free from it, such as the country along the Zambezi in the north, the district of Manica in the highlands, and the Alto Save country in the extreme south. In some districts however the presence of the tsetse is a serious menace, and naturally the occurrence of these fly-belts limits the movements of cattle and hampers the free development of the livestock industry. Even in those parts of the country which are free from the tsetse there is menace of disease—Red Water, and East Coast Fever.

It says much, therefore, for the enterprise of the farmers and of the companies interested in agricultural development that rapid progress has been made, especially in the last decade, in building up healthy herds of improved types of cattle. This has been accomplished by grading up the native cattle with imported animals of European stock, and by construction of dipping tanks. In 1910 there was not a single dipping tank in the Territory; in 1920 there were 68 dipping tanks scattered through the mixed farming and pastoral areas. Afrikander cattle, Herefords, Shorthorns, and Devons have been introduced for grading up purposes, the Hereford breed being especially favoured. The largest owner of cattle is the Mozambique Industrial and Commercial Company, which has herds numbering some 6,600 head in the country bordering the Zambezi from Vila Fontes to the mountains. In these herds very satisfactory results have been obtained by the introduction of Hereford bulls three-quarter bred. Some pedigree Hereford bulls have also been imported, and herds of heifers 15-16ths pure bred. These have been inoculated against Red Water and Gall Sickness, and it is hoped to develop a good strain of locally bred cattle enjoying a high degree of immunity from disease.

Other large ranching enterprises are in course of development. In the district of Govuro, a Portuguese company has established a large cattle-breeding station. The Mozambique Trading and Plantation Company is engaged in breeding cattle in Manica, where it has obtained successful results by crossing the native cattle with pure bred stock from Rhodesia, and in the same district Mr. J. P. Hornung, who is Chairman of the Sena Sugar Estates, Limited, has obtained a concession of a quarter of a million acres with a view to raising cattle on a large scale.

Sheep and goats do well in the highlands, where excellent results have been obtained by crossing the native animals with Angora goats and Merino sheep. At present, however, this branch of pastoral industry has received comparatively little attention. Horse breeding can scarcely be said to exist. It is almost im-
possible to raise these animals, on account of horse sickness.

These conditions are reflected in the livestock returns of the Territory. At the end of 1920 the total number was just under 83,000, made up of 49,620 cattle, 21,621 goats, 4,704 sheep, 6,535 pigs, 351 donkeys, 94 mules, and 57 horses.

The forest resources of the Territory are as yet unexploited. Large forest areas abound in the districts of Gorongoza and Mossurize. The largest and most valuable tree is the African mahogany, "Khaya senegalensis," other valuable trees being the "bloodwood," "Pterocarpus angolensis"; the African blackwood, "Dalbergia melanoxylon"; the Mahogany bean tree, "Afzelia cuanezensis"; and other useful trees such as "Trichelia emetica," "Parinarium mobola," etc.

All mining rights are vested in the Mozambique Company, but except in certain districts, extending north-east and south-west from Beira, which are closed to prospecting for precious stones, combustible minerals, and mineral oils, licences to prospect for and work deposits are granted to the public on easy terms. The most highly mineralised zone appears to be the mountainous country along the Rhodesian border but neither here nor elsewhere has the Territory been thoroughly prospected. Mining enterprise, indeed, has been practically limited to the Macequece field, extending west, north, and east of the township of that name, which is situated on the Beira Railway about 22 miles from the Rhodesian frontier. Geologically this field is similar to the Rhodesian mining field of Umtali, just across the border. The Department of Mines has its headquarters at Macequece, and there is a regular production of gold and copper from the locality. To the north of Macequece extensive deposits of iron have been located.

The tax on production payable to the Mozambique Company is fixed by law at 10 per cent. of the net profits, except in the case of gold propositions with a monthly production of less than 800 ounces of fine gold. In such cases there is a tax of from 1 to 4 per cent. on the gross output, the rate increasing with the production. Mining machinery and material and explosives are imported into the Territory free of duty, and for dutiable articles destined for Macequece and entering the Territory by the port of Beira, there is a specially reduced customs charge of 5 per cent. ad valorem.

In 1920 gold was produced to the value of over £40,000 nearly all from alluvial claims. The alluvial deposits have been worked since ancient times, but the reefs were almost untouched until recent years. The output of copper in 1920 amounted to 132 tons, valued at £15,500. This was all the production of one mine—the Edmundian—which has been proved to a
depth of 1,200 feet and is well equipped.

Outside the Macequece mining field, gold is known to be widely distributed in small quantities in many of the streams. The occurrence of monazite has also been proved in some of the stream beds. Indications of coal and of copper ore have been found in the south-west, and of graphite in the west centre of the Territory. Mica has been located in the Chemizi valley, near the border, and there is a large tin-bearing area near Inchope station, 83 miles from Beira. But the Tete coal deposits are regarded as of the greatest importance at present, for the field is estimated to contain over 100,000,000 tons of fuel.

As regards the possibility of oil being found on a large scale, it can only be said that if the geological data already determined is proved beyond dispute this Territory will be the only portion of South Africa offering encouragement for the existence of an industry that, in conjunction with the coal field north of the Zambezi, would revolutionise the entire outlook of this section of the Continent. The area in which mineral oil may be found lies between the Pungue and the Zambezi rivers. In practically the whole of this area tertiary rocks occur, of the same age and composition as the Tertiary rocks in the Arabian oil fields. Oil was prospected for and discovered in small quantities near Inhambane in exactly the same rocks. It is a well-known fact, however, that in addition to having the correct formation, it is also necessary to have these sedimentary rocks assuming an anticlinal structure, so that the oil after being exuded from the rocks is gradually forced by water to the highest point in the dome. Such an anticline exists in the area mentioned, and the highest point is in the vicinity of Inyaminga, about 100 miles from Beira on the Trans-Zambesia Railway. The geological survey made by the well-known geologist, Mr. F. P. Mennell recently of this area was not sufficiently detailed to enable the exact position at which prospecting work should be started to be stated with certainty, but at present it appears that the most likely spot is close to Inyaminga itself. Mr. Mennell suggests that a further extensive and detailed survey should be made and drilling operations be put in hand to get details of the strata. Going west from Inyaminga, Mr. Mennell was able to get sections of the strata, and sufficient fossils were collected, in situ, to prove the age of the rocks beyond question. So far as is known at present this is the only extensive area in South Africa which contains the Tertiary and cretaceous formation in which mineral oil is likely to occur.

The town of Beira is situated on a spit of sand and "matope" a thick clay covered by sand—forming part of the shore of the estuary and from which the
Mr. LIBERT OURY,
London Director of the Mozambique Company and the leading figure in the progressive Industrial and Commercial development of Mozambique, Zambezia and Nyasaland.
country inland continues nearly flat for many miles towards the watershed on which the trunk line from the port passes on to Rhodesia, the Congo Belge and the Union of South Africa. At present it is a long and somewhat straggling place protected from the sea by a solid wall of concrete which, starting at the harbour, runs for about a mile seawards and in front of the residential part of Ponta Gana. There are some fine buildings in Beira, but improvements in the general class of dwellings are necessary not only for the comfort of families but to embellish the appearance of the town. A good deal of building is now going on, and the place is being gradually improved. The administrative buildings, the court house, and other official quarters are spacious and attractive, and the Savoy Hotel is one of the finest along the coast. It may truly be said that Beira, as it stands today, has literally usurped what, up to nearly thirty years ago, was the encroachment of the sea. As the town extends, the process of filling-in the inequalities of the surface with sand and thus bringing the site to a level is continued, and the result, as regards the health of the place, is eminently satisfactory. The streets, entirely composed of sand, are packed hard in the centre between the trolley lines which provide locomotion for the inhabitants and an efficient means of transport. The sides of the streets are kept loose, thus providing a complete filter for the torrential rains. The consequence is that although malaria fever exists in an endemic form there is very little of it, and severe cases are practically unknown. Beira is really one of the healthiest towns on the littoral within the tropics, and the fact is that the cool weather starts about the end of April and lasts for six months or longer, while the heat is only excessive for some three months in the year, and it is not unhealthy even then. It may thus be claimed that Beira, considering the latitude in which it is situated, is extraordinarily salubrious. As the town expands—as it must do owing to the steady broadening of its commercial activities—its amenities will be improved, and there is no reason, climatically, why it should not become in course of time a very considerable city serving a great hinterland.

The Port of Beira is formed by an estuary resulting from the confluence of the Pungue and Bazi Rivers, and the harbour offers safe anchorage, with room for large ships. The steamers are loaded and unloaded by means of a very complete lighterage plant—directed by the Beira Boating Co.—which connects with the Customs and Railway Piers. The entrance to the harbour is marked by well-lighted buoys, and a 25 miles lighthouse enables the outer buoy to be easily picked up. There is a 22 ft. tide and 20 ft. of water on the bar at ordinary
Views of the Docks and Port Equipment at Beira.
PORT IMPROVEMENTS

high tides. Vessels drawing 2 4 ft. of water anchor close in. The port is in all respects one of the best of stream anchorages along the East Coast, and compares favourably, in its ability to handle cargo, with almost any of the Union ports. It deals with a considerable tonnage, and the exports especially are increasing rapidly.

Beira is the natural port of entry for Southern and Northern Rhodesia, the Nyasaland Protectorate, and the great lake country to the north and also at present for the Congo Belge. The building of the Zambezi bridge will make it the natural port for a much larger and richer area and will establish communication with the Tete coalfield. In time to come, no doubt, when other railways are laid down to connect Central Africa with both coasts, it is possible that a little of the volume of traffic now coming to ocean-going boats at Beira may be deviated to new outlets, but there is little fear that the trade of the port will ever be seriously affected in the future owing to the fact that it forms the pivotal centre of vast hinterlands stretching for hundreds of miles on either side devoid of any other workable harbour.

The question of port improvements at Beira, in view of the increasing demands upon its facilities for handling ships expeditiously, has recently been under serious consideration, and pending the construction of a complete system of deep-water wharves, what is called the "little plan" is now in course of being carried out. When the work of the Chiveve Creek scheme is completed, the railway pier will be doubled in length, and all the work of the port will be done on the railway. All cargo will then be landed and shipped and passed through the Customs in a co-ordinate area, and in the case of goods in transit for Rhodesia, the Belgian Congo, and British Nyasaland, all will be loaded straight into trucks for despatch to its different destinations. The capacity of the port will thus be considerably enlarged and despatch will be accelerated.

In 1924 the traffic handled at the port attained 600,000 tons. Beira will eventually become the bunkering and coal exporting port for the great Zambezi coalfield now being developed 390 miles away. The plans for the new deep water wharf, providing berths for three ocean steamers, have been approved and the work will now be pushed forward under the supervision of Sir George Buchanan, the well-known consulting engineer.
The Story of the Cape to Cairo Railway and River Route

The Leading Zambezi Sugar Industrialist.

Mr. John P. Hornung, J.P.
The pioneer Chairman and Managing Director of the Sena Sugar Estates, Ltd., and head of Messrs. Hornung and Company, Ltd.
The Zambezi Sugar Industry.

THE ACTIVITIES OF THE HOUSE OF HORNUNG.

THE history of the Zambezi Sugar Industry unfolds a tale not so much of romance and good fortune, as has often been the case in the discovery of minerals, but one of a remarkable example of human energy, doggedness, and the will to conquer, leading to eventual success when time after time defeat seemed inevitable.

The central figure in this pioneer work was Mr. John Peter Hornung, who to-day is the Chairman and Managing Director of the Sena Sugar Estates, Limited.

Originally intended for a solicitor, he soon proved that he had no use for the prospect and evinced a desire to go abroad. His father gave him a passage to the Argentine, where he worked on a sheep ranch. Returning from there he persuaded his father to let him go to Portugal, and it was through his connections in Lisbon that he eventually found himself proceeding to the Zambezi to an opium industry in the Zambezi Valleys. During his travels in Africa he conceived the idea of growing sugar cane on the Zambezi, and found, with seed cane brought from Natal and planted at Mopea, that it was a feasible proposition. From this point the uphill work commenced. He returned to Portugal to raise the capital, and was successful after great difficulty, but the sum at his command was inadequate. The Company formed was known as the Companhia do Assucar de Mocambique.

The machinery was ordered in England and sent out to Quelimane to be taken up the Qua-Qua river to Mopea, which was then practically virgin country. There were no facilities for loading or unloading the machinery and the labour was raw and undisciplined. The whole factory was transported up the Qua-Qua in native canoes—a stupendous business. It is difficult to imagine a huge mill roller weighing several tons being loaded on and unloaded from a canoe, man handled up the river bank and placed in position; couple this with the fact of natives fleeing into the bush at the slightest provocation leaving the white man alone and helpless, and it gives just a slight picture of what went on day after day, and month after month, until Mopea Factory was finally
VESSELS OF THE SENA SUGAR ESTATES STERNWHEELER FLEET.

S.W. "Mazarro."  
S.W. "Cala."  
The Coasting S.S. "Waterbuck."  
S.W. "Charumba."  
S.W. "Mopea."
The project was started in 1887 and the mill was ready and crushed its first crop of cane in 1893—five to six years of work at times so hopeless and disheartening that only a man with indomitable courage and energy could have seen it through—a man to whom defeat never entered into his calculations, though it often did to those round him.

From this point matters moved slowly owing mainly to lack of capital for development. The first crop in 1893 produced 600 tons of sugar; Mr. Hornung then arranged a lease of the business from the Companhia do Assucar de Mocambique and by putting back his profits into further development the business gradually increased and more and more sugar was grown and manufactured. In 1906 the business was well enough established to encourage the idea of trying to raise more capital in England and to form a British Company to erect a new factory. This was successful and a Company called the Sena Sugar Factory was floated and a new factory was erected at Caia.
The factory buildings at Cala (Vila Fontes) Estate, with cane trucks in the foreground.

The Factory at Mopea.
The Manager's house on the Mopea Estate.

(Chengadaia) on the south bank of the Zambezi about 25 miles higher up than Mopea. The first crop at Caia was taken off in 1908 and produced 5,231 tons.

Meanwhile a French venture had put up a factory at Marromeu, also on the south bank of the Zambezi, but 25 miles lower down than Mopea. This Company did not progress very well and negotiations were quickly arranged for its purchase by the Sena Company. The first crop for the Sena Company at Marromeu was in 1910 and produced 2,650 tons of sugar. From this point onwards the industry flourished. However, there were still two important objects to achieve, firstly to amalgamate the interest of the Sena Sugar Factory and Hornung & Co who still held the Mopea property on lease from the Companhia do Assucar de Mocambique, and secondly to purchase the Mopea freehold. In 1920 this was achieved by the formation of the Sena Sugar Estates, Ltd., with a capital of £1,500,000 which amalgamated the interests of the Sena Sugar Factory and Hornung & Company. In 1922 negotiations were successful for purchasing from the Companhia de Mocambique the Mopea property in Africa together with their refinery in Lisbon.

The activities of the Company have not ceased here. In 1922 subscriptions were obtained for £500,000 1st Mortgage Debentures and with this money a new factory has been erected in the Luabo district on the north bank of the Zambezi, 17 miles lower down than Marromeu. It has
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

a capacity of 20,000 tons. It was designed to crush 50 tons of cane per hour but in actual working has often attained 60 tons per hour.

In addition Marromeu and Caia were in due course connected by a new railway line, Caia being on the main line of the new Trans-Zambesia Railway. The line was largely used in 1924.

It will alleviate to a great extent the river transport which becomes very difficult on the shallow Zambezi River during the dry season, and will also give transport direct by rail to the nearest ocean port of Beira.

As the business was developing, so the river transport improved. The Zambezi Navigation Company gradually built up a fleet and this Company finally merged into the Sena Sugar Estates, Ltd. The fleet to-day consists of 10 stern wheel steamers Larges, storage hulks, tugs, etc., and the Coasting steamer "Waterbuck" of 800 tons capacity.

The factories are equipped to manufacture either white or raw sugar and the principal markets for the output are the Transvaal, Portugal, East Coast of Africa, the United Kingdom and the Continent.

The statistics given in the next column will show the progress made by the industry.

<table>
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Of the last total, the Caia estate produced some 10,500 tons, the Mopea estate over 12,000 tons, and the Marromeu estate about 16,000 tons.

The capacity of four present factories is 65,000 tons; acreage under cultivation is 23,000 acres; railway track 100 miles, with complement of rolling stock. Upwards of 200 Europeans are employed. Now that the new factory at Luabo is working it is estimated that the Company will soon be growing and manufacturing 60,000 tons of sugar annually almost a unique achievement in the sugar world to-day. The enterprise was handicapped for a time by the loss of the South African market owing to the absence of a Convention between the Union and Mozambique, but it is anticipated that a new agreement will soon be negotiated and that the sugar industry will benefit accordingly.

What the future holds in store for the Zambezi sugar industry is impossible to foretell, but if the successors of the founder carry on in the same spirit there is no doubt that it will continue to flourish and develop.
The Trade History of Portuguese Nyasaland.

PORTUGUESE Nyasaland is a commercial and industrial territory of which very little is generally known, yet it presents a commercial and industrial field of some present importance, and of much greater future possibilities. It lies between Tanganyika on the north, and Mozambique and Quelimane on the south, with Lake Nyasa on its western boundary. It covers roughly 73,000 square miles, is the most northern section of Portuguese East Africa, and is administered by the Companhia do Nyassa, the principal shareholders in which are a British concern, the Nyassa Consolidated, Ltd. Prior to 1886 its interior was practically a terra incognita, but in that year members of the Universities' Mission to Central Africa established themselves at Likoma, on the eastern side of Lake Nyasa. There is little or no trade history to record during the next twenty years, the work of effective military occupation not being fully accomplished before 1913. Reliable statistics are difficult to obtain, but at that date there would seem to have been an import trade in the neighbourhood of £120,000 per annum, and an export trade varying between £75,000 and £95,000. This trade was almost entirely in the hands of two German firms, whose stores offered severe competition to the British Indian traders who had done much pioneering commercial work among the native tribes. The largest class of imports then, as now, consisted of cotton goods and clothing; while the principal exports were rubber, simsim, wax, groundnuts and mealies, mainly shipped to German ports. In those days the old capital, Ibo, was still the principal port, but the transference of the seat of government to Porto Amelia, with its fine natural harbour of Pemba Bay, has since altered the commercial centre of gravity.

With the outbreak of the Great War in 1914 there naturally came a period of sadly-hindered development. Military operations once more took precedence of industrial and trading activities, and the latter had to be restarted eventually under greatly altered conditions. The Nyassa Consolidated, Ltd., promptly took an important step
after the conclusion of the war by establishing an effective trading department with headquarters at Porto Amelia, under the management of Mr. Walter F. Folliott. This organisation has since been actively building up a far-reaching system of stores, covering the country from the coast to Lake Nyasa, while also encouraging the numerous Indian traders to open up new avenues of trade. A motor transport service has been started and a scheme for a railway line 525 miles in length, running from Pemba Bay to the western boundary, is in being. In fact, two alternative routes have already been surveyed. Eventually it is hoped to connect with the Shire Highland Railway, and thence with Beira.

The first section of this line, some 125 miles as far as Medo, will serve a rich belt of country in a fair stage of development, a number of plantations under European control being in working. Everything possible is being done to encourage agriculture, both planting and native cultivation. The native population is by no means disinclined to labour and substantial quantities of copra, coffee, cotton, cocoa, rubber, ivory, wax, gum copal, ground nuts, oilseeds, indigo and timber are now being marketed. Both Portuguese and British capital has also been interested in the planting possibilities, and a considerable amount of land has been allotted in this connection.

A number of mineral areas have also been located by Nyassa Prospectors, Ltd., and gold, iron and coal are known to exist, while hopes are entertained that a mineral oil industry of importance will in time be added to the country's assets.

So far as the import trade is concerned, it may be divided into two classes. That for the service of the European population, which includes a number of British settlers, consists of manufactured goods for personal use and agricultural service from Great Britain, and wines and foodstuffs from Portugal. The native trade is of the usual "Kaffir truck" character, largely, as previously stated, consisting of cotton goods. Development is necessarily at a very early stage, but the natural wealth of the country which has already been proved is sufficient to assure industrial and commercial growth of an important character, while that which yet remains to be discovered constitutes a reserve of unknown possibilities on which extremely sanguine hopes are based by those most familiar with the country.

The steamships of the Union Castle and other lines call regularly at Porto Amelia, which possesses a stone pier and one of the finest sheltered anchorages on the African coast. It is undoubtedly destined to become an important commercial and shipping centre and railway terminus.
British Nyasaland.

ITS PAST, PRESENT AND FUTURE.

By Sir ALFRED SHARPE, K.C.M.G., (Formerly Governor of the Protectorate).

Our knowledge of Nyasaland in modern times may be said to commence with Dr. Livingstone, who pointed to the Shire Highlands as a suitable district for some description of colonisation by Europeans. The first step taken in this direction was the advent of missionaries—the two Scotch Churches and the mission sent by the English Universities. After the missionaries came the traders, the most notable of these being the African Lakes Corporation and the British Central Africa Company, who at the present date have branches throughout Nyasaland (and Northern Rhodesia). Then followed wars with the Arabs on Lake Nyasa, and finally, British government in the year 1891. Sir Harry Johnston was appointed the First “Commissioner” of Nyasaland, which was at that time called “British Central Africa.” Sir Harry left the Protectorate in 1896, and I was appointed to succeed him in 1897.

When Sir Harry Johnston first arrived he found chaos. Every native chief’s hand was against his neighbour’s, and in the northern portion of Nyasaland all were engaged in fighting with the Arabs, who were endeavouring to establish themselves on the shores of Lake Nyasa. From 1891 to 1897 we had almost incessant fighting.

At the present date Nyasaland is in a very satisfactory condition, having no wars or disturbances, and the natives are, I have no hesitation in saying, contented and satisfied with British rule. They pay a very moderate hut tax. There are a number of different tribes who vary much in characteristics, but they are an excellent lot, anxious to carry out their obligations, and on the best of terms with European settlers and officials. Nyasaland natives cannot by any means be described as lazy; on the contrary, they are generally anxious to obtain work, and out of a total population of over a million it may be safely stated that fully 100,000 men are desirous every year of doing periods of work of from one to twelve months.

As the Protectorate became more settled, Europeans saw the opportunity for taking up planting enterprises. The first crop
Views of the buildings and white staff of the Imperial Tobacco Factory at Limbe, Nyasaland.
cultivated was coffee, and this industry gave good profits until the great fall in coffee prices some years ago. It is still planted, but settlers have now gone in extensively for cotton and tobacco. The cotton grown in the highlands of the Protectorate is a much improved variety of American upland. It fetches in the home market about 2d. a pound more than ordinary American upland. Most of those who first went into planting operations had only small capital, and the question of whether a man stood or fell often depended upon whether the first season happened to be a good or a bad one. Capital is required, and its investment in the Protectorate undoubtedly gives good rates of interest.

Other products of the Protectorate are tea, chillies, fibre, and rubber. On the Eastern side of the Manje mountains are some 20,000 acres of land well suited for tea.

With regard to rubber, the only tree which appears to be really suited for cultivation in Eastern Africa is the "Ceara." The climate is not hot and damp enough for "Para." "Ceara," however, is a hardy tree and does well throughout Eastern Africa. Rubber collected from it is more expensive to produce than that obtained, for example, in the Malay Peninsula. It has been calculated that "Ceara" rubber in Nyasaland costs about 3/6 a lb. to place on the home market. The outlook, therefore, is unpromising.

The Imperial Tobacco Syndicate some years ago erected a tobacco factory near Blantyre, and I am informed that they are well satisfied with results. They purchase tobacco from planters mostly, but go in for a certain amount of cultivation themselves.

The climate of the districts in which most Europeans live may be said to be good for a tropical Colony. For five months in the year it is healthy and very pleasant; for another two months it is hot but not unpleasant; the remaining five months are wet, hot and somewhat disagreeable (the rainy season). Nyasaland scarcely falls within the definition of a "colonizable" country. That is to say, it could not be colonised as New Zealand or Australia can. On the other hand, with the increase in comfort in living which has been arrived at during the last few years, I can quite conscientiously say that there is no reason why Europeans who are fixed in definite stations should not bring out their wives; in fact, white women seem to have better health than men, and to suffer less from fever.

My first acquaintance with Nyasaland was in 1887 at which time the only way of getting into the country was to disembark at Quelimane, a Portuguese port at the mouth of one of the former branches of the Zambezi river, whence we proceeded in boats, poled and paddled by natives, up the Quelimane river for two days to its head of navigation.
From there an overland journey of a mile or two brought us to the banks of the Zambezi, near Mopca. From Mopca we went on up the Zambezi and Shiré Rivers in a sternwheel steamer, the "James Stevenson," which had recently been launched, to what was then the head of navigation on the Shiré River, Katunaga. From this place we climbed up by road to the Shiré Highlands (Blantyre).

In later years navigation on the Zambezi and Shiré Rivers got worse and worse, and the first railway was constructed to do away with water transport on the Shiré River.

At the present date communications have vastly improved: the Beira-Zambesi Railway which completes the line of railway communication between the port of Beira and the Shiré Highlands of Nyasaland is at present broken at the Zambezi where, however, steps are being taken to connect the two lines up by a bridge across this great river. It is also intended to continue the Nyasa-land Railway north from Blan-tyre to Lake Nyasa and when this is carried out the products from the whole of the Nyasa regions can be transported to Europe at a comparatively small cost. Water transport on Lake Nyasa itself is a simple matter, there is deep water from end to end, a distance of 360 miles, with a variety of ports both on the East and West sides. At present there are only two or three steamers plying on the Lake, the largest of which is the Government steamer "Gwendolen," about 300 tons. (This steamer by the way, which was launched in Lord Salisbury's time, was named after Lady Gwendolen Cecil.)

The conditions of development in Nyasaland have been on quite different lines from those in British East Africa (the Kenya Colony). Whereas in the latter the development of that country has been largely due to influx of capital, not only expended in direct development of the country, but also to a great extent spent in the country by tourists, travellers and big game expeditions, Nyasaland development has been on sound lines. Planting may be said to have given profits from its very initiation, in the eighties, firstly with coffee, then cotton, and finally tobacco, tea, and other minor products. British East Africa has been to some extent a playground for rich people; Nyasaland is a country of pure agricultural development carried out by steady hard work. As proof of this I may give the example of a relation of my own who commenced planting tobacco in 1919. In the first year his small crop of this product practically returned him the whole of his capital expenditure. His second crop, after providing all current expenses, left him a profit of about £1,000. He is satisfied with his venture: he has his wife and family living with him, and looks forward to a prosperous future. In the more elevated
districts of Nyasaland, say, at 4,000 feet above sea level, especially in the south of the Protectorate, the climate is if anything preferable to that of most parts of Rhodesia.

The planting community now look forward to prosperity in coming years when the trade of the world resumes normal conditions. This indeed is a certainty, it is only a question of "how long." The inflated prices of practically every article of consumption—the result of the war—including the cost of labour, have had to come down, and the Protectorate is gradually accustoming itself to new conditions. In some respects the post-war slump will have had good results. It has necessitated the most economical methods of cultivation, has encouraged the use of machinery in the place of pure manual labour, and has compelled planters to modernise their methods.

In the future when rail communication is complete from the port of Beira to Lake Nyasa there is no doubt that the trade of this Protectorate will greatly expand. There are quite a number of products which with cheaper carriage can be exported at a profit, such as beans, ground nuts, and maize, all of which are grown in vast quantities and at low cost throughout Nyasaland.

As yet the mineral resources of the country are more or less unknown. There are vast deposits of various descriptions of rich iron ores which at present will not bear the cost of transport, and the following are some of the minerals which have been found to exist but are not yet worked at a profit:—Gold, silver, lead, mica, coal, etc.

It was at one time though that cotton would be the main export of Nyasaland, but the fluctuations in market value of this article have been such as to make it a risky crop for planters. Its cultivation by natives has largely increased, however, and has been greatly encouraged by the operations of the British Cotton Growing Association, who have erected ginneries in the country. I think myself that the two great future crops of Nyasaland will be tobacco and cotton, and that both of these will give lucrative employment to thousands of planters.

Owing to the construction of numerous roads throughout the Protectorate, some of them good, others fairly good, and others bad, motor transport is possible throughout. One can travel in a motor car from one end of the Protectorate to the other, as there is a good main road running from Blantyre through Zomba to Fort Jameson in Northern Rhodesia, with a branch running due north throughout Nyasaland to the Nyasa-Tanganjika Plateau. I know of no pleasanter expedition in Africa than this south to north journey, which can be carried out with perfect ease on a motor-bicycle; and throughout its length the traveller can ob-
tain in various districts excellent big game shooting.

Land can be bought with a freehold title at prices which are quite low when compared with British East Africa from a number of land-owners who purchased their holdings in ancient days before the advent of the British Government; or it can be leased on reasonable terms direct from the Government.

**Nyasaland’s Trade Figures.**

First and last an agricultural country, the character of the trade of British Nyasaland, both inwards and outwards, is naturally mainly influenced by that fact. As it has been seen already, its exports are almost wholly products of the soil; its imports are solely for the service of some 1,400 white planters, officials and traders, and for the native population numbering about 1,200,000. Unless cotton-ginning is classified as such, it has no factories or manufacturing industries, and its requirements therefore are limited to agricultural implements, articles of good standard for European’s personal and domestic use, and Kaffir truck.

More remote, perhaps, than any of the British African markets except its neighbour, Northern Rhodesia, the commercial limitations of British Nyasaland hitherto are easily explained; but now that the opening of the Trans-Zambesia Railway has placed it in direct communication with Beira, supplementing, if not superseding the old unhealthy river route to Chinde, a new and important phase of its history may be said to have been entered upon. More complete transport communications have long been a crying need. The Protectorate’s first railway, the line between Blantyre and Port Herald, was completed in 1908, but was not extended southwards to Chindio, on the Zambezi River, until 1915. The linking at that point with the Trans-Zambesia Railway is a great step forward, and now the country awaits the extension of the line northward from Luchenza to Fort Johnson, on the Shire River close to its outlet at the southern end of Lake Nyasa—an undertaking provided for by the Imperial Government as long ago as 1913. Another important project is the linking up of Lake Nyasa and Lake Tanganyika by railway.

Meanwhile, Nyasaland has exchanged Beira for Chinde as its main port, and land carriage for water transport, a development which must stimulate its trade materially as general conditions become more favourable. Hitherto, the advance of trade has not been rapid, though there
AN UPWARD TENDENCY

NYASALAND'S IMPORTS & EXPORTS, 1893—1923.

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<td>1923</td>
<td>462,000</td>
<td>425,000</td>
</tr>
</tbody>
</table>

is a decided contrast between the total of £65,000 recorded in 1893, and the £1,171,000 reached in 1921. As the table of imports and exports shows, for thirty years past there has been constant fluctuation, prosperity and depression alternating in accordance with crop results and the state of the produce markets, yet the predominant tendency over periods of years has been consistently upward. Progress on the whole has been sound, but far from sensational. Careful official administration and much persistence and pluck on the part of planters in face of many and various difficulties have been displayed as a rule since the territory was declared a British Protectorate in 1891, and their results are reflected in the record of annual revenue receipts and expenditure since 1905 given below.

The character of the Protectorate's import trade needs only brief description. Far in advance of all other items are cotton goods and textiles generally, these comprising the bulk of the native demand as well as meeting the requirements of the European population. Another essential item is farming and other machinery for the service of the staple industries; and then

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue £</th>
<th>Expenditure £</th>
<th>Year</th>
<th>Revenue £</th>
<th>Expenditure £</th>
</tr>
</thead>
<tbody>
<tr>
<td>1905-06</td>
<td>76,740</td>
<td>108,790</td>
<td>1916-17</td>
<td>148,285</td>
<td>128,270</td>
</tr>
<tr>
<td>1909-10</td>
<td>76,650</td>
<td>108,730</td>
<td>1917-18</td>
<td>144,240</td>
<td>143,675</td>
</tr>
<tr>
<td>1910-11</td>
<td>94,980</td>
<td>112,370</td>
<td>1918-19</td>
<td>187,645</td>
<td>150,200</td>
</tr>
<tr>
<td>1911-12</td>
<td>97,355</td>
<td>118,070</td>
<td>1919-20</td>
<td>186,925</td>
<td>217,660</td>
</tr>
<tr>
<td>1912-13</td>
<td>128,270</td>
<td>116,360</td>
<td>1920-21</td>
<td>267,970</td>
<td>261,815</td>
</tr>
<tr>
<td>1913-14</td>
<td>124,850</td>
<td>133,105</td>
<td>1921-22</td>
<td>283,760</td>
<td>379,500</td>
</tr>
<tr>
<td>1914-15</td>
<td>118,525</td>
<td>143,160</td>
<td>1922-23</td>
<td>284,925</td>
<td>392,000</td>
</tr>
<tr>
<td>1915-16</td>
<td>137,190</td>
<td>125,665</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
in order of values, follow vehicles (including cycles), iron and steel, oils, preserved and tinned foodstuffs, wines and spirits, and paper and stationery. The following table shows the value of each of these classes of goods during 1922 and 1923, the last two years for which a record is available:—

<table>
<thead>
<tr>
<th>IMPORTED ARTICLES</th>
<th>1922</th>
<th>1923</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textiles</td>
<td>247,655</td>
<td>238,675</td>
</tr>
<tr>
<td>Farm and Other Machinery, Implements, etc.</td>
<td>17,375</td>
<td>18,305</td>
</tr>
<tr>
<td>Iron and Steel</td>
<td>27,280</td>
<td>23,390</td>
</tr>
<tr>
<td>Vehicles</td>
<td>18,600</td>
<td>25,520</td>
</tr>
<tr>
<td>Oils</td>
<td>19,700</td>
<td>20,670</td>
</tr>
<tr>
<td>Preserved and Tinned Foods</td>
<td>17,350</td>
<td>13,570</td>
</tr>
<tr>
<td>Wines and Spirits</td>
<td>13,455</td>
<td>11,583</td>
</tr>
<tr>
<td>Paper and Stationery</td>
<td>8,505</td>
<td>10,500</td>
</tr>
</tbody>
</table>

In 1913 the total imports were in the neighbourhood of £273,000, but in 1919 they had jumped to £649,000, falling back to £520,000 in 1921. These figures have all the appearance of a great forward movement set in since the war, but the truth is that they signified no real progress, the only difference between the pre-war and post-war totals being one of prices and not of quantities, and this same factor was largely responsible for the further drop to £462,000 in 1923. In fact, the actual volume of the imports is probably less to-day than in 1913, for the decrease recorded is not wholly to be accounted for by the drop in prices which it is known has taken place.

The Customs Tariff of the Protectorate is a moderate one, a general rate of fifteen per cent. ad valorem being imposed, with special rates for certain articles. Imports also have to bear a levy to cover road, river and wharfage dues of one per cent., but no transit dues are imposed at Beira or Chindio on goods using the Trans-Zambesia Railway. Exports also contribute to the Customs revenue, paying the same levy as imports, with special duty on ivory of 1/6d. per lb., and hippo teeth and rhinoceros horns of 1d. per lb. Buildings used as bonded warehouses are licensed for a fee of £10 per annum, but otherwise trade carries no serious fiscal burdens, the largest contribution to the public revenue being the native hut tax.

Foreign competition for the Nyasaland market is not, and never has been, of a serious character. More than three-fourths of the import trade is served by the United Kingdom and the British Possessions, while it is to the United Kingdom that at least 95 per cent. of the Protectorate's exports are shipped. Within the Empire a certain limited rivalry, perhaps, occurs between Manchester and Indian cotton.
goods of the cheaper sort. The Union of South Africa is also on the way to a useful expansion of its supplies to the Protectorate.

An outstanding feature of British Nyasaland’s trade history has been the lengthy process of achieving even an approximate balance between imports and exports. During the first seventeen or eighteen years under Imperial administration, indeed, the discrepancy was extraordinarily great. For example, in 1895 the produce passing outwards only reached the negligible figure of £10,000, while the needs of the country had to be met by imports worth £75,000. That state of affairs continued more or less until 1909, the imports always climbing more rapidly than the much smaller exports. In the year mentioned, however, there was a marked change due to depression, and for the first time the respective amounts for imports and exports approached each other, the one falling from £189,000 to £155,000, while the other rose from £92,000 to £143,000. Then came a period of fluctuation, until in 1914 the exports, valued at £201,000, exceeded the imports, valued at £189,000, for the first time in the country’s history. The war years once more brought out discrepancies, as was only to be expected, but by 1921 the supremacy of the exports was regained, and the figures also stood at a higher combined level than ever before, the imports amounting to £520,000, and the exports to £651,000. Since then, however, the balance has again been reversed by a small margin. If productivity can be increased without interruption, and the world’s markets improve, it is evident that an industrial basis will exist of sufficient proportions to carry both import and export trade on any scale to which they may grow. A country’s trade depends on its industries, and British

Nyasaland’s Principal Exports, 1920-23.

<table>
<thead>
<tr>
<th>ARTICLE</th>
<th>1920</th>
<th>1921</th>
<th>1922</th>
<th>1923</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco</td>
<td>£481,520</td>
<td>£297,000</td>
<td>£316,540</td>
<td>£257,998</td>
</tr>
<tr>
<td>Cotton</td>
<td>£86,480</td>
<td>£65,560</td>
<td>£72,920</td>
<td>£85,649</td>
</tr>
<tr>
<td>Tea</td>
<td>£33,479</td>
<td>£22,505</td>
<td>£20,425</td>
<td>£39,934</td>
</tr>
<tr>
<td>Fibres</td>
<td>£4,800</td>
<td>£3,495</td>
<td>£9,961</td>
<td>£15,425</td>
</tr>
<tr>
<td>Maize and Flour</td>
<td>£22,500</td>
<td>£3,415</td>
<td>£333</td>
<td>£681</td>
</tr>
<tr>
<td>Rubber</td>
<td>£9,620</td>
<td>£3,265</td>
<td>£757</td>
<td>£3,813</td>
</tr>
</tbody>
</table>

Nyasaland, although hitherto leisurely in its progress, is well favoured in regard to the possession of industrial possibilities. Its two great needs are more European planters owning adequate capital, and a stimulation of its large, but dormant, reserve of native labour.

The productivity of the Protectorate is, of course, faithfully mirrored in the list of its
principal exports. Tobacco, it will be observed, heads the list, and, though with a decreasing margin, it still towers high above every other class of produce shipped. The history of this industry is a chequered one, and largely typifies the course of the Protectorate’s industrial activities in general, rising and falling in magnitude and keenness of prosecution according to circumstances at different periods. The statement may be disputed, but Nyasaland planters have always had—and doubtless with frequent excuse—a tendency to turn from one crop to another according to the state of the world’s produce markets, an opportunist policy which may have had its advantages, but has also resulted on occasion in their being too late to secure the full advantages at which they aimed.

In spite of such vicissitudes, however, tobacco has long been their most consistently successful crop, though of late it has been suffering from troubles that are the direct outcome of previous success. In 1919 prices were high, and the Protectorate had nearly 10,000 acres under tobacco. The opportunity was tempting, and considerable quantities of inferior stuff were unloaded on a too-willing market in order to secure the passing profits offering. The natural result followed, however, in a falling off in the demand, and also, perhaps, in prejudiced memories among buyers. Then came the glut, stocks accumulated for several years, and in 1921 the acreage fell from 10,000 to 6,000, and the exports from £481,520 to £297,090. Quality of leaf is now being restored, and reputation is being rebuilt, thanks to the co-operation of the Administration and the Nyasaland Planters’ Association in promoting careful standardisation and grading. The Imperial Tobacco Co., which has a factory at Limbe, takes roughly twenty-five per cent. of the crop each year, mainly from the smaller growers, while the remaining seventy-five per cent. is shipped to brokers in England in the ordinary way. Tobacco gives an average yield of from 300lb. to 500lb. per acre, and though more costly to work than cotton, gives a good return under normal conditions, and is likely to remain a leading product.

Cotton takes second place to tobacco, and is certain to become a much bigger industry when the market for it improves. Much useful work has been done at the two Government experimental farms to assist its development, and native cultivators have been encouraged by such measures as a rebate on the hut tax, the issue of free seed, and the provision of facilities for marketing the staple. In 1914 native growers had 9,000 acres under cotton, and European planters about 28,000 acres, but the war and the later boom in tobacco resulted in a temporary falling off. The industry has existed for over twenty years, the British Cotton
Growing Association, the British Central Africa Co., the African Lakes Corporation and the Government having done much to promote and extend it.

Tea is next in volume and importance as an export, while a substantial portion of each year's output is also consumed locally. It is grown principally on the southern slopes of Mlange, and to a localized extent in the Blantyre district. The acreage employed is about 4,500, and the exports in 1923 were valued at £39,934.

Coffee was originally the staple plantation crop of the Protectorate, and the exports reached their highest point in 1900, amounting to over 2,148,000 lb. Competition from other producing countries brought down the level of profit considerably, and in 1920 the exports were only 64,362 lb, rising again to 92,216 lb in 1923. It is an industry which is capable of restoration to a higher output, though it will probably not again become the premier planting activity.

Among other of the Protectorate's products may be mentioned Mauritius and sisal hemp, which is assured of an increasingly important future. Rubber is another item possessing considerable possibilities, though there has been no systematic collection of wild rubber since 1914, the prices obtainable not being sufficiently encouraging. In 1920 the exports of plantation rubber—mainly Ceara and some Para—were worth £9,620, falling in 1921 to only £3,265, but rising again to £3,813 in 1923. Maize, beans, wheat, rice, groundnuts, chillies and capsicums are also standard products. Many fruits flourish, but no facilities for their export existed prior to the completion of the Trans-Zambesia Railway, an event which may or may not result in an outward trade eventually developing.

Such is a brief survey of the industrial basis on which British Nyasaland's future export and import trade will be built. It is potentially sufficient to warrant the highest hopes when men and money become adequately available.
NATIVE TRADE IN TANGANYIKA

The Native Market at Morogoro.

A halt on the Tanganyika Railway.
Tanganyika Territory.

ITS TRADE AND DEVELOPMENT.

The story of the commercial and industrial development of Tanganyika is divided into two distinct chapters, and each is necessarily merely introductory in character. There is the record of German ownership, the fruits of which were just beginning to show in 1914 when the Great War broke out. Then in 1919, after an interval of chaos in which the industrial assets created by the Germans almost entirely vanished, a new start was made under British rule. Under the new regime neither trade nor industry has yet reached even its pre-war standard, though some moderate acceleration of the pace has become apparent with the establishment of civil courts, public services, and the disposal and re-opening of ex-enemy plantations and other properties. At its highest point—in 1913 and 1914—the market was worth £2,667,925 as a purchaser of imported goods, and was shipping produce in return to a value of over £1,777,500. To-day, the figures are on a somewhat lower level (the trade imports, excluding Government goods, amounted to £1,238,086 in 1922) and in effecting this change it has to be remembered that an important factor has been the severance of the districts of Ruanda and Urundi, now under Belgian administration, and the war-wastage of the population as a whole. There are signs, however, that before long the pre-war figures will be passed. The exports in 1922 reached the fine total of £2,204,594.

The Territory as it stands to-day, and exclusive of Ruanda and Urundi, comprises about 360,000 square miles, with a population of about 3,000 Europeans, of whom roughly 1,000 are British (we quote the latest available statistics); about 9,400 Indians, who are mainly retail traders or skilled craftsmen; 5,600 Goanese, Arabs, etc.; and a native population of between 4,000,000 and 4,500,000, or about half the pre-war figure, when, of course, the two Belgian districts were included.

On the whole, the trade for which this population is responsible may be regarded as fairly satisfactory, but it is obviously
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

TANGANYIKA'S IMPORTS BY COUNTRIES OF ORIGIN, 1921 AND 1922.

<table>
<thead>
<tr>
<th>Country of Origin</th>
<th>Foodstuffs, etc.</th>
<th>Raw Materials, etc.</th>
<th>Manufactured Goods</th>
<th>Total Trade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1921</td>
<td>1922</td>
<td>1921</td>
<td>1922</td>
</tr>
<tr>
<td>U.K.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>21%</td>
<td>22%</td>
<td>13%</td>
<td>20%</td>
</tr>
<tr>
<td>S. Africa</td>
<td>15%</td>
<td>19%</td>
<td>72%</td>
<td>2%</td>
</tr>
<tr>
<td>Kenya and Uganda</td>
<td>24%</td>
<td>18%</td>
<td>7%</td>
<td>23%</td>
</tr>
<tr>
<td>Zanzibar</td>
<td>29%</td>
<td>28%</td>
<td>10%</td>
<td>44%</td>
</tr>
<tr>
<td>Germany</td>
<td></td>
<td></td>
<td>1%</td>
<td>9%</td>
</tr>
<tr>
<td>Other</td>
<td>11%</td>
<td>13%</td>
<td>10%</td>
<td>9%</td>
</tr>
</tbody>
</table>

Total Val. £ 225,612 233,267 33,013 7,864 1,143,984 1,122,736 1,426,125 1,386,212

TANGANYIKA'S PRINCIPAL IMPORTS, 1921 & 1922.

<table>
<thead>
<tr>
<th>Article</th>
<th>1921</th>
<th>1922</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food, Drink and Tobacco</td>
<td>225,612</td>
<td>233,267</td>
</tr>
<tr>
<td>Raw Materials and Articles mainly unmanufactured</td>
<td>33,013</td>
<td>7,864</td>
</tr>
<tr>
<td>Articles wholly or mainly manufactured</td>
<td>1,143,736</td>
<td>1,122,736</td>
</tr>
</tbody>
</table>

COTTON PIECE GOODS ONLY

<table>
<thead>
<tr>
<th></th>
<th>1921</th>
<th>1922</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unbleached</td>
<td>10,212,928</td>
<td>12,525,480</td>
</tr>
<tr>
<td>Bleached</td>
<td>567,139</td>
<td>792,399</td>
</tr>
<tr>
<td>Printed</td>
<td>1,664,003</td>
<td>1,644,115</td>
</tr>
<tr>
<td>Dyed in the piece</td>
<td>2,545,343</td>
<td>2,875,266</td>
</tr>
<tr>
<td>Coloured</td>
<td>923,880</td>
<td>973,042</td>
</tr>
</tbody>
</table>

TANGANYIKA'S IMPORTS & EXPORTS, 1900-23.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>IMPORTS</th>
<th>EXPORTS</th>
<th>YEAR</th>
<th>IMPORTS</th>
<th>EXPORTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>601,527</td>
<td>214,682</td>
<td>1911</td>
<td>2,294,580</td>
<td>1,421,890</td>
</tr>
<tr>
<td>1904</td>
<td>716,945</td>
<td>447,330</td>
<td>1912</td>
<td>2,515,460</td>
<td>1,570,920</td>
</tr>
<tr>
<td>1905</td>
<td>882,767</td>
<td>497,485</td>
<td>1913</td>
<td>2,667,925</td>
<td>1,777,522</td>
</tr>
<tr>
<td>1906</td>
<td>1,257,640</td>
<td>549,735</td>
<td>1920</td>
<td>1,737,640</td>
<td>1,282,460</td>
</tr>
<tr>
<td>1907</td>
<td>1,190,320</td>
<td>625,010</td>
<td>1921</td>
<td>1,426,125</td>
<td>1,246,870</td>
</tr>
<tr>
<td>1908</td>
<td>1,289,340</td>
<td>543,690</td>
<td>1922</td>
<td>1,386,212</td>
<td>1,441,584</td>
</tr>
<tr>
<td>1909</td>
<td>1,697,085</td>
<td>655,975</td>
<td>1923</td>
<td>1,799,038</td>
<td>1,733,229</td>
</tr>
<tr>
<td>1910</td>
<td>1,932,940</td>
<td>1,040,270</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
IMPORT AND EXPORT FIGURES

Tanganyika's Principal Exports, 1913, 1922 and 1923.

<table>
<thead>
<tr>
<th>ARTICLES</th>
<th>1913</th>
<th>1922</th>
<th>1923</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sisal</td>
<td>£538,583</td>
<td>£289,388</td>
<td>£367,228</td>
</tr>
<tr>
<td>Cotton</td>
<td>£120,753</td>
<td>£140,750</td>
<td>£177,710</td>
</tr>
<tr>
<td>Hides and Skins</td>
<td>£274,511</td>
<td>£65,803</td>
<td>£117,554</td>
</tr>
<tr>
<td>Beeswax</td>
<td>£70,743</td>
<td>£24,792</td>
<td>£24,758</td>
</tr>
<tr>
<td>Copra</td>
<td>£117,400</td>
<td>£89,633</td>
<td>£131,536</td>
</tr>
<tr>
<td>Coffee</td>
<td>£46,363</td>
<td>£203,784</td>
<td>£204,987</td>
</tr>
<tr>
<td>Groundnuts</td>
<td>£95,932</td>
<td>£190,553</td>
<td>£264,129</td>
</tr>
</tbody>
</table>

Calculated on a Rupee Value of 1s. 4d. in 1913.

open to great expansion. Everything depends, of course, upon industrial development, and on inducing the natives to take a fuller part in that development. Plantation production comprised in the past, and is likely to do so again, mainly sisal, coffee, copra and cotton; but the natives have been successful in cultivating or harvesting natural supplies of cotton, coffee, copra, groundnuts, grain, beeswax, sim-sim, hides and skins, etc., which already figure in exports.

The only minerals hitherto mined on a commercial scale in Tanganyika are mica and gold, but asbestos, coal, copper, graphite, lead, lignite, silver and mercury are known to exist, and will undoubtedly in time figure substantially in the exports of the country.

Another potential source of wealth lies in the forests of valuable hardwood trees, but difficulties in connection with seasoning the timber have to be overcome before the business can grow to its full proportions.

When these assets are all contributing more adequately to the earning power of the Territory the trade will doubtless alter materially in size and character. At present, as the accompanying table shows, cotton piece goods are the most important class of imports, and India is increasingly sharing with Manchester the privilege of

Tanganyika's Principal Imports, 1913, 1922 and 1923.

<table>
<thead>
<tr>
<th>ARTICLES</th>
<th>1913</th>
<th>1922</th>
<th>1923</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton Piece Goods</td>
<td>£759,396</td>
<td>£590,466</td>
<td>£722,325</td>
</tr>
<tr>
<td>Foodstuffs, Miscellaneous</td>
<td>£196,790</td>
<td>£119,795</td>
<td>£127,567</td>
</tr>
<tr>
<td>Kerosene</td>
<td>£31,126</td>
<td>£29,563</td>
<td>£38,442</td>
</tr>
<tr>
<td>Rice</td>
<td>£185,755</td>
<td>£21,517</td>
<td>£4,612</td>
</tr>
<tr>
<td>Spirits</td>
<td>£20,506</td>
<td>£30,122</td>
<td>£25,623</td>
</tr>
<tr>
<td>Tobacco and Cigarettes</td>
<td>£43,836</td>
<td>£45,471</td>
<td>£37,821</td>
</tr>
<tr>
<td>Wines and Beer</td>
<td>£38,508</td>
<td>£13,927</td>
<td>£12,597</td>
</tr>
<tr>
<td>Other Imports</td>
<td>£1,391,728</td>
<td>£535,549</td>
<td>£830,051</td>
</tr>
<tr>
<td>Total</td>
<td>£2,667,425</td>
<td>£1,386,212</td>
<td>£1,799,038</td>
</tr>
</tbody>
</table>

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supplying these. Foodstuffs are naturally the second item in point of quantity, and these include a considerable amount of canned goods for the service of the white population.

With the re-opening and development of the plantations there can be no doubt that the imports will increasingly include small gas and oil engines, power and lighting sets, mechanical appliances and implements, light railway material, motor vehicles, etc.; while the demand for building materials, domestic hardware, and similar lines will become more and more important.

If the commercial organisation of Tanganyika still remains far from complete, it is equally true that a substantial foundation is being laid. The National Bank of India, Ltd., the Standard Bank of South Africa, Ltd., the National Bank of South Africa, Ltd., and the Banque du Congo Belge all have branches at Dar-es-Salaam, Tanga, and elsewhere; and influential Chambers of Commerce exist at Dar-es-Salaam, Tanga, Bukoba and Muanza, working in close association with similar bodies in Kenya Colony and Uganda. Various important merchant firms, particularly those established in Nairobi and Mombasa, have opened operations in the Tanganyika market, and have done admirable pioneer work under discouraging conditions. Behind them are the numerous Indian firms and peripatetic traders who, as they always have done, form the principal retail distributors throughout the wide spaces for which Dar-es-Salaam and Tanga are the sea-gates.

Tanganyika was destined by its former German owners to be the eastern terminus of a great trans-African trade route and chain of markets. That is even more certainly its destiny under British rule, but it will also now contribute to, and form part of the still greater Cape-to-Cairo scheme. Its economic products are such that great development is assured, and every year it is disclosing better results.
For a proper appreciation of the trade and potenti-
alities of Tanganyika Territory it is imperative that the mind should visualise a country three times as large as the British Isles, but with a population only three times that of Birmingham.

By the middle of 1914 the Germans were just beginning to reap the benefit of their large investment of labour and money in the development of native trade and plantation or estate production.

As soon as war broke out in 1914, development and practically all trade ceased, with the result that when the Tanganyika Government entered into full possession of the Territory, they found that through lack of labour and supervision the plantations and estates had greatly deteriorated, and much of the value of the work and capital invested by the Germans altogether wasted.

As the British Army advanced south and more and more plantations, estates, premises, etc., came into its hands, a determined attempt was made by the British Military Commission — appointed for the purpose — to prevent further deterioration, and, as soon as possible, the Civil Government appointed a Custodian of Enemy Property, i.e., in March 1917, and, in the following May, took over the whole of the Northern area from the Military Authorities, subsequently extending their area of jurisdiction to the Central and Southern districts and absorbing the office of Custodian of Enemy Merchandise appointed by the Military Authorities.

All through the War the shortage of freight space retarded the realisation of produce from estates in the conquered portions of the territory, with the result that deterioration became trebled and a good deal of valuable raw material was lost to the Empire.

Where possible estates were leased and in other cases caretakers appointed; the terms of the lease or tenancy provided for upkeep, replanting, etc., but as almost the whole British population of East Africa was in the Army, the large majority of these leases fell into the hands of aliens — principally
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

TANGANYIKA'S SALT INDUSTRY.

AT THE GOTTORP SALT WORKS.—The evaporated salt can be seen stacked in heaps (on the right) in readiness for packing into the long leaf-covered rolls in which form it is handled, and which can be seen on the left of the photograph.

Greeks—with the natural consequence that the cream was skimmed off, so that it will be a long time before the estates reach their pre-war level of upkeep.

The products of Tanganyika Territory are essentially tropical and semi-tropical, the main exports being sisal, cotton, hides and skins, copra, coffee, groundnuts, ghee, grain, bees-wax and sim-sim. Statistics of these exports will be found on page 139 and the recovery since 1922 will be noted. In a lesser degree there were in pre-war days some exports of wattle and mangrove bark.

It is of interest to divide these products into their two natural categories, viz.:—

Plantation Production.
Sisal, Coffee (partly), Copra (partly), Cotton (partly under German regime).

Native grown.
Cotton, Hides and Skins, Coffee (partly), Copra (partly), Groundnuts, Ghee, Grain, Bees-wax, Sim Sim.

So far as minerals are concerned the only products exported in pre-war days were Mica and Gold.

In 1917 it was decided to utilise for war purposes the stocks of mica available in Tanganyika Territory and mining
operations were started in the Usambara Mountains and the Uluguru Mountains in the south.

Although these are the only two minerals which have hitherto been exported, there seems some reason to believe that the following could successfully be exploited as their presence has been proved—coal, copper, lead, silver, graphite, asbestos and lignite.

In common with the other natives of East Africa, the Tanganyika Territory native is usually the owner of many cattle, sheep and goats. The parts of ex-German East Africa handed over to the Belgians, viz., Ruanda and Urundi, were by far the most suitable for cattle raising and the natives of these provinces owned immense herds.

Whole districts of Tanganyika Territory are, however, unfortunately permeated with East Coast fever and Tsetse fly, and there would seem to be no prospect of successful ranching in these districts until some means is found of combatting these pests.

As a "new" country the manufacturing industries of Tanganyika Territory are few and comprise:—

i. Electric Power Stations at Dar-es-Salaam and Tanga.

ii. Soap Factories. Two at Dar-es-Salaam and one at Tanga of which the limited output is purely for local consumption.

iii. Salt. At Gottorp, 60 miles east of Kigoma, the Germans erected a factory on the salt springs located there. The output was 400 tons monthly and only one spring was worked. A greater quantity could be produced but at the moment 400 tons meets the demand. This salt is disposed of as far east as Tabora and a large quantity is sold in the Congo. A considerable quantity is used in Ruanda and Urundi for native and cattle use. It is packed in rolls of leaves of 18 lbs. weight, as the easiest means of transport and the rolls are used as currency in these provinces. This factory was formerly very remunerative.

When, however, capital is available there should be no reason why Tanganyika Territory should not possess a flourishing industry in the extraction of oil from oil bearing seeds and nuts. There is a mill at Lulunguru for this purpose set up by the Germans but not working at present.

Sisal. The larger proportion of sisal production is grown on the Tanga Railway in the Usambara district. In pre-war days it enjoyed a high reputation but for the reasons already detailed the quality has much deteriorated. A large number of estates have been closed down as not worth running. Efforts are now being made to establish standards in which the sisal will be graded for export and this policy, it is hoped, will do much to retrieve its lost reputation.

Cotton. The Germans gave much attention and encouragement to the development of this native crop and the present
Government's policy is to continue such encouragement, more especially as regards native growing. At the present time there are no large cotton plantations, the crop being grown by natives or Indians on their "shambas" (small holdings).

The most favourable district for cotton growing hitherto has been the district behind Lindi in the south. Figures cannot be given for this district as much of the crop was shipped through Dar-es-Salaam. Latterly, however, there has been some activity in cotton growing on the Central Line between Morogoro and Kilossa and remarkably good results are being obtained in that district. Cotton is also grown in the Muanza district and the majority of this is shipped via Lake Victoria and the Uganda Railway to Mombasa.

The Government is making strenuous efforts to secure the growing of uniform types of cotton. Very stringent but necessary laws have been passed regarding weighing, selling, etc., all with the general idea of securing to the native the full benefit of his crop and inducing him to put forth greater efforts. When the native realises the advantages of this policy and improved transport becomes available for the purpose of opening up undeveloped areas, there is reason to anticipate the establishment of a successful cotton industry on a large scale in Tanganyika Territory.

*Hides and Skins.* During the war large stocks of hides and skins were accumulated, but owing to lack of transport they could not be realised, and consequently rotted. The close of the war witnessed another reverse for this industry as it was the first to feel the reaction in European prices.

*Copra.* This is a comparatively new industry; the estates beginning to bear only towards the year 1912/13 during which the export of 5,477 tons represented an increase of 1,200 tons over 1912. Copra is produced all along the coast of Tanganyika Territory.

*Coffee.* This crop is partly produced by the natives and partly by Europeans on plantations. In pre-war days the coffee from the Moschi district at the western end of the Tanga Line and from the slopes of Kilimanjaro had gained a high reputation for excellence. It was only in the year 1912/13 that the German-planted coffee began to bear in any quantity and a large expansion of this industry is possible and, indeed, probable. The district from West Usambara through Arusha and up to the slopes of Kilimanjaro is all good coffee land. There are also large quantities of coffee grown by the natives near the new Belgian boundary.

*Groundnuts and Sim-Sim.* These products are purely native-grown, the greater quantity coming from the Tabora district, the southern shores of Lake Victoria and, in smaller quanti-
ties, from the Lindi district. Sim sim favours the coastal area.

From administrative reports there seems no reason why the production of this crop should not be increased enormously, especially in view of the possibilities of a local oil seed crushing industry on an adequate scale.

Ghee. Although there are no actual pre-war figures relating to the export of this produce, it is estimated that it reached about 3,000 tons. Until better transport is available for the distribution of the large quantities of milk available in Tanganyika Territory it is likely that the milk will continue to be made into ghee for which there is a considerable local demand. It is also exported to Zanzibar and other African ports.

Beeswax. The greater part of the beeswax exported from Tanganyika Territory is gathered from the Central Railway. It is essentially a question of amount of labour available and variable market prices in foreshadowing the amount of beeswax that may be gathered at any particular period.

Grain. The main exports under this heading comprise M'tama*, peas, beans, maize, millet, rice and pulse, other varieties being produced practically solely for the local market. The soil almost everywhere is so suitable to the production of so many kinds of grain that as the country is opened up and labour and transport organised, there would be practically no limit to production and export.

Rice. The curious position arises of both import and export of the same article at the same time. The former has, however, considerably decreased owing to the restriction of exports of locally produced rice and the high price commanded by the Indian variety. Large areas are now being worked by the natives and the large amount of delta-land provided by the rivers affords good areas for production—in fact there seems no reason why the country should not soon be self supporting in this particular.

Sugar. So far sugar has been produced in Tanganyika Territory for local requirements only, but all along the coast there are so many areas suitable for the production of this crop that sugar growing on a large scale is quite within the region of practical politics. Before such large production is possible, however, a liberal policy of encouragement will have to be adopted by the Government and very close investigations made into the possibilities of labour supply.

Rubber: Plantation. The Germans sunk an immense amount of capital in rubber estates, and all along the Central and Tanga lines plantations can be seen. Most of these are not being worked though in many cases efforts are being made to plant cotton between the trees.

Minerals. Reference has already been made to the

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* M'tama: this is the Swahili name for the grain generally known as Sorghum (Holcus sorghum).
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pre-war exports of gold and mica. The Germans were hopeful of large developments in the former in the Muanza district where approximately 15,000 claims were pegged. Although there are 20,000 square miles of potential gold producing country in this district, prospecting will be no sinecure as health conditions are bad and the persistency of fly prevents animal transport.

Coal was discovered by the Germans near New Langenburg but until transport either to the Coast or to Nyasaland is available no great development can be expected. It is also said to have been discovered near Kisaki.

Timber. It seems anomalous that East Africa with its large resources of standing timber should have to rely on imports of wood for building and other purposes. The main difficulty lies in properly seasoning the wood, having regard to the climate, but the large and growing local market and also the nearness of the South African ports will undoubtedly encourage the establishment of the industry.

With regard to the import trade into the Territory, figures of which are given on page 138, the large proportion of imports from Kenya, Uganda and Zanzibar will at once be apparent.

Cotton Piece Goods. Like all other East African countries cotton piece goods are the most important class of imports. Thus, unbleached cotton (americani) manufactured in India and Japan form approximately 48% of the cotton piece goods import, and cotton piece goods form nearly as great a percentage of the total value of all imports.

It is interesting to notice that in this particular line the Indian mills are showing increased activity in Tanganyika Territory as in other parts of Africa. Indeed in one class cotton blankets the Indian mills are able to compete very strongly.

The natives in many districts, particularly near Lindi, are getting good value for their crops and are able to afford the newest and more expensive qualities of printed lines. In fact when produce markets recover and the native begins to realise good values for his crops, there would seem to be a good opening for cotton goods in this territory.

Food, Drink and Tobacco. Food, drink and tobacco form the next largest class of imports. The figures speak for themselves and no comment is necessary.

Tinned and preserved provisions are not separately enumerated, but there is no doubt that they comprise the larger portion of the amounts given under the heading "Other Foodstuffs" and as the white population increases there should be an increased demand for these goods.

Manufactured Goods. The general expansion of the market foreshadows an increased demand for not only machinery and agricultural implements for plantations and estates, etc., but also a demand for manufactured
In other lines, there is strong American competition in machinery, hollow and hardware, motor and electrical goods, fancy goods, etc., and in these lines there can be no doubt that the Germans are also making strong efforts to secure a large portion of the trade of Tangan-yika Territory and the surrounding territories hitherto dominated by them, even should the accomplishment of their object be achieved at little or no profit to them.

On all parts of the Coast it is becoming increasingly necessary from the British standpoint that United Kingdom manufacturers and exporters should take more trouble in making quotations especially when trying to do business by catalogue through the mail. The best way to quote would appear to be "Delivered Duty Paid Coast Port" (Dar-es-Salaam or Tanga) for it is in this form that most American catalogues are priced.

Many of the Indian firms in Tangan-yika Territory have been established there for a considerable time. These firms are the distributors. The small Indian trader will penetrate districts and make a living where a white man either could not go or would fail. During the war and since, the majority of the trade of Tangan-yika Territory has been carried on by Indian firms with headquarters in Zanzibar for whom the Indian firms in Tangan-yika Territory act as agents.

goods such as hollow-ware, hardware, crockery, glass, building materials, metal manufactures, etc., when the settlers and natives of the country are able, by reason of the recovering produce markets and improved production, to realise the labour and expenditure invested.

There will undoubtedly be a demand for gas and oil engines, electrical and mechanical appliances for plantations, locomotives and wagons for the railways, motor transport to act as feeders to the railways and also mining and milling machinery for the undoubted mineral and timber development of the country.

In regard to motor transport it must be realised that roads are now few except in the larger towns, but that when they are opened up to feed the railways there will be a vast field for the sale of cars, lorries and cycles of British make; particularly will the demand be large for a cheap, medium-weight general utility car of high clearance.

With regard to competition, it will be realised that from India and Japan is, of course, mainly against American unbleached cottons, but there is a distinct tendency towards India which other manufacturers must face.

Again, direct lines of steamships have been arranged from both America and Germany to the Coast and will doubtless afford further facilities to the exporters in those countries.
EAST AFRICAN PRODUCTS.

Typical Exports from Kenya and Uganda.
The Trade History of Kenya.

Commercially, Kenya Colony and the Uganda Protectorate are exceedingly difficult to separate. For years they have been treated as one entity in Customs matters and in compiling Government statistics of trade, and the general designation “British East Africa,” before its recent official abandonment, was commonly used to include both.

Yet in nearly all essentials the two territories are widely different. Kenya Colony now looms large as a country for white settlement, while Uganda, if only for climatic reasons, must always remain a centre of tropical plantations with the native, in a far higher degree than in any other part of Africa, playing an important part as an individual industrialist. Yet the partnership between the two territories must also always remain close and practical, for the Kenya Colony embraces Uganda’s route to the sea, and handles the great bulk of the latter’s trade.

This close connection has to be borne carefully in mind in attempting any study of the Kenya Colony as a separate market. Its distinct characteristics have to be recognised. The trade history of Kenya is one of the longest and most interesting in Africa, yet the modern phase with which we are concerned here easily falls within the past quarter of a century. It was in 1887 that the territory definitely came under British administration, the Imperial British East Africa Company obtaining its charter a year later. Eight years of uncertain conditions followed, and then came the first big landmark in the Colony’s career—the beginning of the construction of the Uganda Railway from Mombasa to the Victoria Nyanza.

The year 1896 saw this event, and with it began commercial activity in real earnest. Much of such activity was, of course, directly connected with the railway work, but even so the imports of general merchandise were worth £176,930 per annum, and the exports of produce stood at £73,760. By 1900 the respective totals had risen to £446,610 and £121,680, and in 1905, when the administration was transferred from the Foreign Office to the Colonial Office, they had reached £518,140 and
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£214,580. In 1910, when the white population was barely 2,000, the imports amounted to £775,240, and the exports to £590,060. In that year the Union Castle Mail Steamship Co., Ltd., inaugurated a regular service of steamships to Mombasa, and that important development, followed by the amelioration of the labour difficulty under the governorship of Sir Percy Girouard, may be said to have marked the beginning of progress and prosperity for the Colony.

The history of the following twelve years is easily told, though it covers a momentous and chequered period. The Great War affected British East Africa no less than the Union of South Africa and Rhodesia, and, when the campaign in what is now the Tanganyika Territory was brought to a conclusion, there followed peace problems of scarcely less gravity. The soldier settlement scheme of 1910, the subsequent widening of electoral representation, and finally the financial depression of 1921, with its complications owing to changes in the exchange value of the Indian rupee, then the standard coin, all had a deep effect upon the industrial and commercial activities of the Colony, but with the eventual substitution of the standardised florin for the rupee, and the later adoption of the shilling, the settlers and merchants courageously cut their losses and worked to establish anew the prosperity which, if not yet smooth, is now beyond question. In 1921, in fact, the Colony's imports, including those of Uganda, had been raised to no less than £6,911,860 (on the basis of Fls. 10 to the £), and the exports of East African produce only, including those of

KENYA COLONY'S IMPORT & EXPORT TRADE, 1896-1921.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>IMPORTS (£)</th>
<th>EXPORTS (£)</th>
<th>YEAR</th>
<th>IMPORTS (£)</th>
<th>EXPORTS (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1896</td>
<td>176,930</td>
<td>75,760</td>
<td>1909</td>
<td>797,160</td>
<td>409,990</td>
</tr>
<tr>
<td>1897</td>
<td>261,700</td>
<td>78,130</td>
<td>1910</td>
<td>775,240</td>
<td>590,060</td>
</tr>
<tr>
<td>1898</td>
<td>297,650</td>
<td>72,620</td>
<td>1911</td>
<td>997,980</td>
<td>962,910</td>
</tr>
<tr>
<td>1899</td>
<td>472,370</td>
<td>71,140</td>
<td>1912</td>
<td>1,247,260</td>
<td>1,016,900</td>
</tr>
<tr>
<td>1900</td>
<td>448,610</td>
<td>121,680</td>
<td>1913</td>
<td>1,808,340</td>
<td>1,203,200</td>
</tr>
<tr>
<td>1901</td>
<td>450,000</td>
<td>71,330</td>
<td>1914</td>
<td>2,147,940</td>
<td>1,482,870</td>
</tr>
<tr>
<td>1902</td>
<td>421,260</td>
<td>96,360</td>
<td>1915</td>
<td>1,469,210</td>
<td>1,004,790</td>
</tr>
<tr>
<td>1903</td>
<td>443,030</td>
<td>134,530</td>
<td>1916</td>
<td>1,708,330</td>
<td>1,114,420</td>
</tr>
<tr>
<td>1904</td>
<td>436,950</td>
<td>134,160</td>
<td>1917</td>
<td>3,024,120</td>
<td>1,613,850</td>
</tr>
<tr>
<td>1905</td>
<td>518,140</td>
<td>214,580</td>
<td>1918</td>
<td>2,809,680</td>
<td>1,741,940</td>
</tr>
<tr>
<td>1906</td>
<td>672,360</td>
<td>316,140</td>
<td>1919</td>
<td>3,397,810</td>
<td>2,498,570</td>
</tr>
<tr>
<td>1907</td>
<td>753,650</td>
<td>419,210</td>
<td>1920</td>
<td>3,119,530</td>
<td>3,563,720</td>
</tr>
<tr>
<td>1908</td>
<td>799,720</td>
<td>494,710</td>
<td>1921</td>
<td>6,911,860</td>
<td>5,060,930</td>
</tr>
</tbody>
</table>

Note.—These figures include in-transit trade of Uganda and other territories. The totals for 1921 are calculated at Fls. 10 to the £.

(See later figures given on page 155.)
IMPOR TS AND EXPORTS

Uganda, to £4,669,500. During the following year imports fell to £2,871,240, and exports to £2,780,998, rising again in 1923 to £4,257,793 and £3,996,432 respectively.

Of the imports, about 44 per cent. come from the United Kingdom; some twenty-five per cent. are bought from other parts of the British Empire, particularly India and the Union of South Africa; and the remainder are supplied by America, Japan, France, Holland and a few other foreign countries.

For its agricultural equipment, for the personal and domestic needs of its European population, and for the supply of native requirements, Kenya Colony depends almost entirely upon imported goods. In payment for these it mainly grows and ships pastoral and plantation products necessary for European industries, and, so far as one item, coffee, is concerned, for European breakfast-tables.

As might be expected, cotton goods represent by far the largest individual item in the list of imports amounting to about one-third of the total. The native demand in Uganda ensures this, but the European trade in high-class cottons, silk, linen, woollen and worsted goods touches a high figure every year. Wines, spirits, beer, canned foods, furniture, earthenware and cutlery constitute the principal other domestic necessities. Machinery, metal goods, hardware, implements, fencing materials, bags and sacks, vehicles, etc., all stand at sufficient totals in the detailed table of imports to indicate the nature and extent of the territory's railway and industrial needs.

Agricultural and pastoral activities must, of course, provide the bulk of the exports, and must for years to come remain the basis of trade in general. Unless these flourish and develop on broad and secure lines there can be no real prosperity. What part mining industries may also play it is too early to forecast. Actual discoveries of minerals have so far not conveyed any exceptional promise, but it must be admitted that the country has never been geologically surveyed nor has it even been expertly or systematically prospected on lines which could justify a definite conclusion. It is very significant, however, that during the latter part of 1922 the number of applications for prospecting licences showed a marked increase, and the Government regarded it as advisable to promulgate new mining regulations in preparation for such developments as might occur.

For practical purposes the great and apparently inexhaustible deposits of carbonate of soda at Lake Magadi stand alone at the present time among Kenya Colony's mineral resources. These deposits, which are estimated at something like 200 million tons, form the floor of the lake and are replenished unfailingly wherever quantities are removed. They have for
Views at Lake Magadi, shewing the soda deposits, which are naturally replenished as deposits are removed.
3. Hinterland of Mombasa.
AGRICULTURAL AND PASTORAL ACTIVITIES

years been worked by the Magadi Soda Co., Ltd., who erected an elaborate plant in 1912, but suffered considerable interruption to their operations during the war. This concern, despite financial vicissitudes, has reached an output capacity of about 80,000 tons per annum, though twice that amount will probably be obtained when the promoters’ intentions are eventually carried out. The industry is of sufficient importance and promise to have justified the construction of a 91 miles branch railway to connect the works with the main line. Owing to various difficulties, however, the exports practically ceased in April, 1923, and a re-organisation scheme has now been put in hand.

With regard to other minerals, it is only possible at present to say that mica has been worked; that gold, silver, copper, iron and graphite have been found, but not yet proved in sufficient quantities to justify industrial action; while the existence of tin is confidently suspected.

Agricultural activities are in a much more advanced condition. Maize is the largest crop produced, and there is no limit to the possible output. The export for 1923-24 was officially estimated at 68,000 tons. Wheat is also successfully grown on the Uasin Gishu Plateau, and large areas suitable for this crop exist in the Highlands. In this connection it is interesting to note that existing flour mills have an annual capacity of nearly 100,000 bags. Coffee of a very high quality is a staple product, and will figure much more largely in the exports when all the trees now planted come into bearing. The Kenya and Uganda export in 1922 amounted to 129,261 cwt.

Flax is a comparatively recent crop, but does well at altitudes up to 6,000 feet, and undoubtedly has a substantial future. Sisal hemp also does well at heights up to 6,000 feet, but the industry is one which calls for large capital, and also needs advances in transport facilities and labour-saving machinery. On the warmer coast levels sugar, copra, cotton, citrus fruits, groundnuts, rubber, tobacco, simsim, etc., are produced profitably, but in most cases in far smaller quantities than the possibilities warrant.

The pastoral industries are important and growing, as may be seen by reference to the list of exports of hides and skins, horns, wool, etc. According to the latest reliable estimates there are about 2,542,000 head of cattle in the country, of which nearly 170,000 are European-owned; and over 2,500,000 sheep, native-owned with the exception of roughly 131,000. At the date of the last agricultural census, June, 1922, the total acreage of land regarded as suitable for European settlement was 6,060,000, of which 3,804,000 had been allotted, but only about 234,000 acres were actually under cultivation.
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AT NAIROBI.
Top: View of the Railway Workshops.
Centre: The Goods Yard.
Bottom: The Station.
Some valuable woods are included in the 3,500 square miles of forests owned by the Kenya Colony, and the present extent of the local timber industry is indicated by the fact that twenty-four saw-mills are in operation. Kenya cedar is very valuable and an export trade is being built up. The wood is being extensively used in pencil making.

With all that has been accomplished, however, the Kenya Colony is still in its industrial infancy. Nevertheless, the possibilities are obviously very great, and as they are realised the inward and outward trade will grow in proportion. The importance of the country’s prospects is indicated by the fact that during 1922 the Government of the Union of South Africa thought it advisable to send a Trade Mission to this market, and also entered into a Customs agreement with both the Kenya Colony and Uganda. The existing white population is in the neighbourhood of 10,000, and is growing steadily; while the natives number about 3,000,000, and will always provide a characteristic market of considerable value.

Mombasa, the principal port, has a white population of nearly 700, and a total population of about 37,000. Situated on an island, it has two excellent harbours, the more spacious being at Kilindini on the west side of the island. A fairly well-equipped wharf and pier exist while several important harbour schemes are in progress under Government and other initiative. Nairobi, the capital, lies 327 miles inland, and has developed rapidly in recent years into a town possessing a number of handsome buildings, good roads, electric power and light, and a good water supply. It has a population of over 3,000 Europeans, and is the centre of the territory’s commercial and governmental activities.

For trade statistical purposes Kenya and Uganda are bracketed together. The main trade totals for 1922 were as follows:

KENYA AND UGANDA TRADE 1922.

<table>
<thead>
<tr>
<th>Total Trade Imports excluding Government Goods</th>
<th>£2,871,240</th>
<th>Domestic Exports</th>
<th>£2,780,998</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Imports, all headings</td>
<td>£5,145,386</td>
<td>Total Exports—all headings</td>
<td>£5,504,579</td>
</tr>
</tbody>
</table>

PRINCIPAL DOMESTIC EXPORTS FROM KENYA AND UGANDA, 1922.

<table>
<thead>
<tr>
<th>Maize</th>
<th>393,769 cwts.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chillies</td>
<td>9,588 &quot;</td>
</tr>
<tr>
<td>Coffee</td>
<td>129,261 &quot;</td>
</tr>
<tr>
<td>Carbonate of Soda</td>
<td>48,710 tons</td>
</tr>
<tr>
<td>Cotton</td>
<td>254,508,000 lbs.</td>
</tr>
<tr>
<td>Flax and Tow</td>
<td>1,925 tons</td>
</tr>
<tr>
<td>Sisal and Tow</td>
<td>8,970 &quot;</td>
</tr>
<tr>
<td>Seed Cotton</td>
<td>2,440 &quot;</td>
</tr>
<tr>
<td>Flax</td>
<td>401 tons</td>
</tr>
<tr>
<td>Sim-sim</td>
<td>2,915 &quot;</td>
</tr>
<tr>
<td>Copra</td>
<td>1,111 &quot;</td>
</tr>
<tr>
<td>Groundnuts</td>
<td>1,577 &quot;</td>
</tr>
<tr>
<td>Beeswax</td>
<td>306 cwts.</td>
</tr>
<tr>
<td>Hides</td>
<td>23,891</td>
</tr>
<tr>
<td>Skins</td>
<td>278,431 (Nos.)</td>
</tr>
<tr>
<td>Rubber</td>
<td>1,130,000 lbs.</td>
</tr>
</tbody>
</table>
### UGANDA'S EXPORTS, 1904—1923.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>TOTAL</th>
<th>YEAR</th>
<th>TOTAL</th>
<th>YEAR</th>
<th>TOTAL</th>
<th>YEAR</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1904-5</td>
<td>£60,378</td>
<td>1909-10</td>
<td>£225,271</td>
<td>1914-15</td>
<td>£616,526</td>
<td>1919-20</td>
<td>£1,828,357</td>
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<tr>
<td>1905-6</td>
<td>£89,826</td>
<td>1910-11</td>
<td>£340,326</td>
<td>1915-16</td>
<td>£593,735</td>
<td>1920</td>
<td>£1,134,156 (Mar-Dec.)</td>
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<tr>
<td>1906-7</td>
<td>£116,001</td>
<td>1911-12</td>
<td>£392,594</td>
<td>1916-17</td>
<td>£1,076,904</td>
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<td>£1,539,538</td>
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<tr>
<td>1907-8</td>
<td>£178,608</td>
<td>1912-13</td>
<td>£457,010</td>
<td>1917-18</td>
<td>£784,693</td>
<td>1922</td>
<td>£2,780,998</td>
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<tr>
<td>1908-9</td>
<td>£174,513</td>
<td>1913-14</td>
<td>£526,159</td>
<td>1918-19</td>
<td>£1,247,457</td>
<td>1923</td>
<td>£3,996,432</td>
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### UGANDA'S IMPORTS, 1904-1923.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Merchandise</th>
<th>Govt. Stores.</th>
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<td>£190,817</td>
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<tr>
<td>1905-6</td>
<td>£165,618</td>
<td>£19,224</td>
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<td>1906-7</td>
<td>£222,588</td>
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<td>1907-8</td>
<td>£267,967</td>
<td>£14,888</td>
<td>£371,355</td>
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<td>1908-9</td>
<td>£281,254</td>
<td>£41,740</td>
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<tr>
<td>1909-10</td>
<td>£288,876</td>
<td>£34,228</td>
<td>£323,409</td>
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<tr>
<td>1910-11</td>
<td>£347,823</td>
<td>£32,428</td>
<td>£380,251</td>
</tr>
<tr>
<td>1911-12</td>
<td>£428,199</td>
<td>£51,753</td>
<td>£480,347</td>
</tr>
<tr>
<td>1912-13</td>
<td>£535,891</td>
<td>£54,424</td>
<td>£582,315</td>
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<tr>
<td>1913-14</td>
<td>£754,754</td>
<td>£61,414</td>
<td>£616,168</td>
</tr>
<tr>
<td>1914-15</td>
<td>£483,144</td>
<td>£63,227</td>
<td>£546,371</td>
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<td>1915-16</td>
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<td>1916-17</td>
<td>£744,346</td>
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<td>1917-18</td>
<td>—</td>
<td>—</td>
<td>£936,560*</td>
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<tr>
<td>1918-19</td>
<td>—</td>
<td>—</td>
<td>£1,132,600*</td>
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<tr>
<td>1919-20</td>
<td>—</td>
<td>—</td>
<td>£1,039,845*</td>
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<tr>
<td>1920-21</td>
<td>—</td>
<td>—</td>
<td>£2,303,950*</td>
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<tr>
<td>1922</td>
<td>—</td>
<td>—</td>
<td>£959,460*</td>
</tr>
<tr>
<td>1923</td>
<td>—</td>
<td>—</td>
<td>£1,434,190*</td>
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*Approximate figures based on the Customs allotment.

On the Uganda Railway—Bound for Lake Victoria.
The Trade of Uganda.

In a General Report made by Sir Harry Johnston on Uganda in the year 1901 we find the following words: "I firmly believe that before many years are over the country will at any rate produce a local revenue sufficient to relieve the British tax-payer from any obligation to provide further funds for the protection and development of Uganda. I hope, in addition, that Uganda may develop such wealth that it will be enabled in time to pay off its debt, and to justify amply the action of the statesmen of 1890 and 1894 who brought it within range of the British Empire... Where is the profit in this transaction to come in? The profit, I think, will lie in the marked development of British commerce in the countries of the Uganda Protectorate. I say 'British' commerce, meaning that of the United Kingdom. British Indian commerce has already profited by the development of Uganda, but British India, though it has helped us with Indian soldiers, has provided no funds towards the cost of the Uganda Administration. It is the British tax-payer, therefore, who should be helped as much as possible to profit from the interest he has taken in these Central African countries."

That prophetic statement of Sir Harry Johnston has already been fulfilled, for in the year 1915-16 the Grant-in-aid allowed yearly to Uganda from the British Government was dispensed with, and since then Uganda has been a self-supporting Protectorate. In 1894-95 the Grant-in-aid was £95,000, and reached its height in 1899-1900, at which period it stood at £397,000, though it must be admitted that this included measures taken to deal with the Mutiny. Ever since then it has dwindled, till in 1914-15, the sum granted was £10,000, and never since has Uganda looked back. In 1922 the revenue was £820,366 and the expenditure £920,229, but in 1923 the Administration budgetted for a revenue of £879,050 and an expenditure of the same amount. The surplus fund on December 31st, 1922, amounted to £381,079 and there was an unspent balance of loan funds amounting to £157,557.
The statistics of imports and exports are not available after 1916-17, for in that year the amalgamation of the Customs Department with the Kenya Colony took place and no separate figures were kept. Nevertheless, it is possible to arrive at approximate totals for the fiscal years 1917-18 to 1923, by taking the proportion of the united Kenya Colony and Uganda figures represented by the Uganda Protectorate’s allotment of one-third of the Customs duties jointly received. This we have done in the table of imports given on page 156 which is as up-to-date as the published official statistics at the time of writing will permit.

The principal exports for the year 1923 are as follow:

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Centals</th>
<th>Value</th>
<th>Tons</th>
<th>Value</th>
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<tbody>
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<td>620,897</td>
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<tr>
<td>Cocoa</td>
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<td>1,088</td>
<td>673</td>
<td>18,520</td>
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<tr>
<td>Rubber</td>
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<td>11,034</td>
<td>2,088</td>
<td>34,985</td>
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<tr>
<td>Maize</td>
<td>874,701</td>
<td>249,545</td>
<td>716,928</td>
<td>34,324</td>
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<tr>
<td>Flax, Fibre &amp; Tow</td>
<td>1,063</td>
<td>94,861</td>
<td>796</td>
<td>60,798</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Centals</th>
<th>Value</th>
<th>Tons</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sisal Fibre</td>
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</tr>
<tr>
<td>Sesame</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groundnuts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hides</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skins, Sheep</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and Goat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ivory</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

NOTE.—The above figures include Kenya Colony products.

In the early days, we are told, the bulk of the imports came into the Protectorate on the heads of porters or labourers, carried in this way from the East Coast ports through what was then German East Africa to Mwanza, a port in that territory on the Victoria Nyanza, at the south end of the lake. Thence they were conveyed by dhows and canoes. The dhows were owned by German firms and Arab traders, and the canoes by natives of Uganda. The latter proceeded in convoys of 50 in charge of a chief, and the traffic on the lake was a remunerative one, as can be imagined when a load of 60 lbs. cost as much as 10s. In those days the exports consisted mainly of ivory, and the means of outlet was the same.

The Uganda Railway altered this condition of affairs when its construction was complete, and the bulk of the traffic to and from the coast naturally goes this way now. The building of this railway marked an era in the history of the Protectorate, and now further railways or branch lines have been made
within the confines of the country itself.

As has been already remarked the cotton industry is the principal industry of the Protectorate. Heretofore cotton ginneries were in the main in the hands of the Europeans. But with the march of events greater and greater areas of cotton were being planted up, and this brought in Indian capital with the result that many ginneries are now run by Indian firms. The growing of cotton is in the hands of the natives generally, but recently the European planters have taken to it, and planted it as a catch-crop between coffee or other crops. The European is beginning to give more attention to this source of revenue.

In 1921 the export of cotton from Uganda was 77,533 bales. In 1922 it was 61,641 bales, while in 1923-24 a record acreage was reported and the export was expected to be well over 100,000 bales.

The import trade has been increasing rapidly, and is due mainly to the influx of Europeans and Indians, and to the desire of the better class native to adapt himself to European customs. Of course the war upset this to a great extent, but the country is settling down to accommodate itself to the altered conditions, and with the fall of prices at home a bigger trade is anticipated. The vexed question of currency had a great deal to answer for, and now that the shilling and the cents basis is in use it is hoped that there may be no more changes in this respect. The change from the rupee to the florin and shilling basis met with a mixed reception, and in the main the present currency may be said to be still unpopular.

The principal article of import is now, as heretofore, yarns and textile fabrics, and in the year 1916-17, the last available statistics owing to the amalgamation of Uganda Customs with that of Kenya, this commodity was imported to the tune of £332,522. Wheeled vehicles of all kinds figured at £32,039, blankets (for natives) £31,880, soap, £24,221—but in regard to this latter, although an enterprising firm started a soap factory, the imports have risen much higher; machinery, £15,556; provisions, £24,350; bags and sacks, £24,508; tobacco, £19,675; salt, £17,265; agricultural implements, £14,936; cement, £5,940; kerosine oil, £14,517; and metals of all kinds, £14,901.

Sugar imported totalled £10,804, but local production is a factor to take into account. It has been fully demonstrated that Uganda as a sugar cane growing country need fear no rival, and not only can it be self-supplying in this regard, but considerable trade can be done in exporting white sugar equal to anything produced elsewhere.

The bulk of the import trade has been from the United Kingdom, the cheaper qualities
coming from foreign countries. But unless the Britisher is prepared to lay himself out to meet the wants of the country, in a very short time the United Kingdom may have to give way to rivals who are keener than she is.

The foregoing statistics must, of course, be studied in careful relationship to the character and size of the population. When it is realised that there are roughly only 1,300 Europeans and 5,600 Asians in the country, as compared with 3,100,000 natives, the purchases of such items as agricultural implements, machinery, metals, wheeled vehicles, etc., must either be regarded as possessing an unusually high per capita value, or the native user is more of a power here than in most African markets. The fact is that the latter is the case. The Baganda especially are commercially, industrially and socially, probably the most advanced native people in the whole of Africa, and no one who knows them can doubt that they are destined to make very great progress as the years pass. They have shown themselves sound and enterprising industrialists, and many of the chiefs carry out planting operations on a large scale. Some own motor cars, while the demand for motor cycles and ordinary cycles is exceptional. There is, of course, still much to be done in educating the natives in the uses and possibilities of modern machinery and implements, but they are apt and willing learners, and their buying power increases every year as they expand their ideas and industrial customs in accordance with the lessons of European civilisation.

The small white population is, of course, mainly composed of officials, merchants and employees of the various large trading companies which are prominent in the market, and European plantation managers and employees. Theirs is relatively a high standard of imported requirements.

The Asiatic section of the population is almost entirely engaged in mercantile pursuits. Banking facilities are provided by branches of the Standard Bank of South Africa, Ltd., and the National Bank of India, Ltd., at such centres as Entebbe, Kampala and Jinja. A strong Chamber of Commerce has its headquarters at Kampala, and there are also a Cotton Ginners Association and a Planters’ Association at that town; all of these organisations have an influential and stimulating effect on commercial progress. Trade is taxed directly to a moderate extent, but there is also an indirect form of taxation to be taken into account in the shape of railway charges. Roughly twenty per cent of the Government revenue is derived from the direct taxation of trade, the taxes taking the form of a general trading licence fee of Rs. 150 per annum, with Rs. 15 for each additional licence. More than half the
revenue, however, is derived from the native poll tax of Rs.7.50 per head, which is to some extent an incentive to the native to work and generally to increase his earning and spending power.

Customs duties are also imposed, and provide about twenty-four per cent. of the country's revenue. These are mainly collected by the Kenya Colony Customs authorities, one third being allotted to Uganda. The general import duty is at the rate of twenty per cent. of c.i.f. values, though some luxury articles, such as wines and spirits, cigars, cigarettes, perfumery, silk, etc., pay as much as thirty per cent., while others, such as building materials, liquid fuels, paint, soap, etc., enter for ten per cent. Articles which reach Uganda without paying duty in the Kenya Colony are taxed at a general rate of ten per cent. ad valorem, with certain exceptions. There are, at present, no bonded warehouses in Uganda, those at Mombasa and Nairobi meeting all requirements.

The commercial history of Uganda cannot be carried back so far as the beginning of the period covered by this work. When the great scheme of a Cape-to-Cairo railway was first conceived in 1887 the territory was still independent, and not even under European influence apart from missionary effort. It was only in 1901, when the Uganda Railway was completed, that the trading and industrial possibilities came within range of adequate realisation. Indeed, that factor alone was sufficient to ensure the progress that has followed, so that to-day no one acquainted with East Africa can have any doubt that when the through railway route from Cape Town to Cairo is an accomplished fact Uganda is destined to become one of its greatest feeders and will contain a junction to which the trade of territories far outside its borders will be attracted. The opening up of the Nile route will certainly considerably modify transport conditions between Europe and all the East African markets, now served entirely by steamship services via the Suez Canal or the Cape. As an entrepôt for the eastern part of the Belgian Congo, into which there now run three principal transport routes, viz., Port Masindi—Butiaba, Kampala—Heimas—Butiaba, and via Toro, Uganda also possesses possibilities beyond present estimation.
The STORy of the CAPE to CAIRO RAILWAY and RIVER ROUTE

1. A Sudan Government Express Train at Wadl Halfa.
2. The Mail Train at Asouun Station.
3. The "Sunshine Express" at Athbara Station.

Photos by Leo Weintal
The Sudan: Its Finance and Trade.

WHEN, in 1898, the British troops under the command of Kitchener, "the Conqueror," triumphantly entered Khartoum after fighting the momentous and determinate battle of Atbara, thus dealing a fatal blow at the power of the Khalifa, they found the finances of the country—like the moral and physical condition of the people—in a state of complete chaos. Even previous to the Mahdi regime, the economic condition of the Sudan had been poor. Under exacting and dishonest Egyptian rulers, the people had been starved and robbed; indeed, in the hands of the Mahdi and of his successor the country had been drained of its very life-blood, and prevented, at the same time, from recuperating through the many and almost untouched natural resources of which it stood and stands to-day possessed.

The primary aim of the new Administration was to clear the country of this reproach. Naturally, at this epoch, little or nothing could be expected in the way of monetary contributions from the people themselves. The entire revenue barely exceeded £E35,000; but as an indication of the thorough grasp of their responsibilities and of the benevolent intentions which actuated the British-controlled government departments, by 1906 the receipts were well over £E800,000. These sums, however, had been amassed without the exercise of any undue pressure against the greatly-impoverished people.

Nor was this the only satisfactory feature manifested. A nominal surplus of some £E243,000, calculated after all allowances had been made for administration expenditure, was displayed. In fact, in this memorable year of the Sudan, the revenue enjoyed represented the largest sum recorded under either the old government, when the Lado, Massawa (now Italian territory) and Darfur (now incorporated in the Anglo-Egyptian Sudan, but formerly a tributary State) were included. From this time onward, the revenues of the country steadily improved, year by year showing—if not a sensational—at least a consistently-advancing tendency.
The financial relations between the Sudan and Egypt were, until the advent of the British Administration, always very greatly involved; even Gordon had found it impossible to differentiate between the accounts of Egypt proper and those of the Equatorial Province, by which name the Sudan was then geographically known. Thanks to the constant supervision and the undoubted administrative ability of the three successive Governors-General—the late Lord Kitchener, Sir F. Reginald Wingate and the late Sir O. Lee Stack, the finances of the Anglo-Egyptian Sudan were placed upon a thoroughly sound and substantial basis; this had been fully accomplished by 1913, since which date the new country was enabled to proceed without any aid whatever from the Egyptian Treasury.

The discontinuance of an annual contribution—which, between 1899 and 1913, had varied between the amounts of £E.122,548 (the total in 1902) and £E.457,900 (in 1909)—was decided upon wisely as it transpired owing to the consistent growth of the Sudan revenues. On the other hand, the Sudan did not give up everything: for the Egyptian Government was requested to return certain Customs’ dues collected at Egyptian ports upon goods coming to and going from the Sudan. This practice was continued until such time as a formal agreement had been established between the two Administrations, destined to form the basis for an assessment of goods passing the Sudan Customs stations. At the time of the abandonment of the Egyptian contribution, certain nervous critics foresaw “financial disaster” for the Sudan. But the responsible authorities were all well aware of the consequences likely to attend the step undertaken, and their optimism proved to have been well justified.

It was always the belief of the Sudan authorities that the young country under their administration would be enabled to dispense with any financial contribution from Egypt. The late Sir Eldon Gorst, however, while acting as British Agent at Cairo, expressed himself as thoroughly convinced that it was the duty of Egypt to finance the Sudan. “It cannot be doubted,” he wrote, “that if the judicious policy of allowing the increasing receipts of the Sudan to be applied to Sudanese purposes and of granting considerable sums for capital expenditure in that country be continued, the deficit of the Sudan budget will in a comparatively few years disappear.” Within a decade this prophecy was verified. Again, Sir Vincent Corbett, while acting as Financial Advisor to the Egyptian Government (1904-07), took an equally sanguine view of the Sudan’s financial future: while Sir F. Reginald Wingate, by the unflagging expert attention which he devoted to the economic condi-
tions of the country, and by his support of the policy adopted by the Financial Department, materially aided the country to regain its independence of other financial assistance.

By 1913, then, the revenue had advanced to £E1,361,000, a sum which may be compared once more with the total revenue of £E35,000 which was all that could be scraped together, when, but five years before, the Sudan had passed for ever from a purely native to an Anglo-Egyptian administration. The revenues collected in 1913 seem to have been all the more remarkable when one bears in mind that that year was the first in which the Sudan had failed to receive any contribution from Egypt, and was thrown entirely upon its own resources. The difficulties faced appear no less serious when it is recalled that such revenue as was available had to be collected from a still but half-civilised people, scattered over an enormously wide area of country, exceeding one million acres in extent, the preponderating number not paying—and never being called upon to pay—any taxes whatever.

By 1919, the Sudan had become economically so sound that little or no difficulty was found in raising a loan upon the London money-market. This issue proved not only of considerable moment from a purely reproductive point of view; it at once stamped this once-derelict African country as having achieved something like an economic triumph, by adopting a policy which speedily brought it from a state of barbarism to the verge of a settled prosperity. The success of the loan was, in fact, a tacit recognition in the highest and most useful quarters that the Anglo-Egyptian Sudan had, at length, entered upon a sound and continuous path of prosperity, one which lost none of its effect by being brought about in a thoroughly quiet and unostentatious manner.

The public loan of October, 1919, and February, 1921 for the sum of £6,380,000 was exactly double that previously arranged for; the reason was that, after the Great War, all engineering construction (for which the greater part of the money was intended) had advanced in cost more than 100%. Little or no opposition was offered when the British Treasury proposed to guarantee an interest of 5½% on the loan, the rate being 2% higher than that originally arranged for. At that period, 3½% upon a Government guaranteed investment was considered sufficiently attractive; but the War changed all that. The public in search of a thoroughly attractive investment, having become accustomed to War Loans bearing interest at the rate of 4% free of tax, or 5%, or even 5½% subject to tax, shrewdly considered the Sudan issue sufficiently sound. Their faith has been abundantly justified. The 5½% bonds now occupy a high position among gilt-edge securities, since, being guaran-
bled by the Imperial Government, they stand to all intents and purposes as British securities, and enjoy the same amount of public favour. Drawings at 10\% will commence in 1929, and terminate in 1959.

Considerable as was the sum raised upon the dates referred to, it did not prove sufficient for the requirements of the vast engineering works now being undertaken in the Sudan, destined to supply both for that country and for Egypt sufficient water in summer time. It, therefore, became necessary to raise further funds for this purpose, and the British Government once again promised its practical assistance. Such aid could in no way be deemed risky, since, by the end of 1921, the Sudan Government, as in the past, showed accounts of a most satisfactory nature, displaying, indeed, a surplus at the end of the full financial year.

Development of the economic resources of the country has proceeded gradually, a wise policy determining that it should on no account be burdened in the earlier stages of its career with loan charges in excess of its capacity. In July 1922 the Administration officially published the "Guaranteed Sudan Loan Act, 1922," by the terms of which the Governor-General of the Sudan was authorised to float a loan not exceeding £7,000,000 (sterling) on the security of the whole of the incomes of the properties of the Sudan Government, the money raised being specifically devoted to the completion of the irrigation works mentioned in the Sudan Loan act of 1919. Under these powers the Government issued in January, 1923 stock to the amount of £3,250,000. The issue was 93 per cent. and the interest is 4\% per cent. The total net proceeds of all the Sudan issues has been £9,014,600, and the debt is a small one for a country of such potentialities. The balance unspent on January 1st, 1924 was £1,216,643.

The revenue of the Sudan in 1922 was £E3,498,595 and the expenditure £E3,496,999. The estimated revenue in 1923 was £E3,816,124 and the estimated expenditure £E3,442,765. The latest report available suggested a surplus of £E373,360 in 1923 and budgetted for a revenue and expenditure of £E3,561,000 in 1924. The Sudan Government urges a cautious policy for a few years in order to build up a cash reserve against the possibility of a deficit on interest charges during the early years of the Gezira and Kassala irrigation schemes, but the Governor-General's report for 1923 stated that "in the meanwhile the general revenue shows signs of healthy expansion and provided there are no unfavourable developments the future can be viewed with confidence."

The Sudan's trade in recent years has been most satisfactory. Its foreign trade in 1923 totalled £E7,427,429 against £E6,551,660 in 1922, an in-
WHERE THE SUDAN BUYS

<table>
<thead>
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<td>1</td>
<td>2</td>
<td>0.47</td>
<td>1.6</td>
</tr>
<tr>
<td>Greece</td>
<td>1.5</td>
<td>-</td>
<td>-</td>
<td>0.3</td>
<td>-</td>
</tr>
<tr>
<td>Japan</td>
<td>1.5</td>
<td>1</td>
<td>1</td>
<td>1.5</td>
<td>5.9</td>
</tr>
<tr>
<td>France</td>
<td>-</td>
<td>0.5</td>
<td>1.3</td>
<td>1.3</td>
<td>1.6</td>
</tr>
<tr>
<td>Arabia</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
<td>0.25</td>
<td>-</td>
</tr>
<tr>
<td>United States of America</td>
<td>0.5</td>
<td>1.25</td>
<td>1.6</td>
<td>3.2</td>
<td>2.3</td>
</tr>
<tr>
<td>Eritrea</td>
<td>0.5</td>
<td>1</td>
<td>-</td>
<td>0.58</td>
<td>-</td>
</tr>
<tr>
<td>Other Countries</td>
<td>1.5</td>
<td>4.75</td>
<td>4.6</td>
<td>10.77</td>
<td>7.6</td>
</tr>
<tr>
<td>Various (including parcel post)</td>
<td>2</td>
<td>2</td>
<td>1.7</td>
<td>3.13</td>
<td>3</td>
</tr>
</tbody>
</table>

crease of 13.4 per cent. The cotton export in 1923, despite the poor flood, amounted to 5,093 tons against 4,400 tons in 1922. The grain crop in the principal grain-growing district in the Blue Nile province totalled 49,000 tons in 1923 against only 44,000 tons in 1922, and there was an export of 37,453 tons. The gum arabic export in 1923 reached the record figures of 22,425 tons as compared with 14,568 in 1922 and a previous maximum of 19,615 in 1912.

The above table shows the shares of the principal countries in the import trade of the Sudan for the period 1919-1923 inclusive.

The progressive expansion of the trade of the country is most satisfactory. Railways and roads are being extended, while Port Sudan is steadily increasing its business; the tonnage of the vessels using it has grown from 509,498 in 1919 to 2,265,375 in 1923. With the opening of the railway line to Kassala a considerable increase in traffic at the port is expected and proposals for extending the harbour are under consideration.

But the future of the Sudan undoubtedly lies with cotton. The great Makwar dam will probably be completed during this season (1924-25) and the excavation of the irrigation canals is already making rapid headway. Moreover, a great deal of cotton has already been planted in the irrigation area and is being watered by pumps pending the completion of the dam. The completion of the Kassala Railway which has been laid with great rapidity, will enable the Kassala Cotton Company to push ahead with its big cultivation scheme. It has placed over 9,000 acres under irrigation and the irrigated area is to be greatly extended.
The Story of the Cape to Cairo Railway and River Route

Scenes at Port Sudan

1. The Electric Power Station.
2. A View of the well-equipped Wharf.
3. The Royal Train at Port Sudan on the occasion of the visit of H.M. King George in 1912.

(Photos by "African World")
### THE GEZIRA SCHEME

#### Principal Sudan Imports.

<table>
<thead>
<tr>
<th>Article</th>
<th>1919</th>
<th>1920</th>
<th>1921</th>
<th>1922</th>
<th>1923</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton Stuffs</td>
<td>4,688</td>
<td>3,001</td>
<td>3,381</td>
<td>3,355</td>
<td>4,317</td>
</tr>
<tr>
<td>Petroleum</td>
<td>1,245</td>
<td>933</td>
<td>1,412</td>
<td>1,518</td>
<td>1,555</td>
</tr>
<tr>
<td>Salt</td>
<td>7,638</td>
<td>7,829</td>
<td>7,556</td>
<td>10,048</td>
<td>7,789</td>
</tr>
<tr>
<td>Soap</td>
<td>1,079</td>
<td>907</td>
<td>1,633</td>
<td>1,180</td>
<td>1,519</td>
</tr>
<tr>
<td>Sugar</td>
<td>11,812</td>
<td>12,001</td>
<td>9,899</td>
<td>9,108</td>
<td>9,526</td>
</tr>
<tr>
<td>Tea</td>
<td>815</td>
<td>1,262</td>
<td>1,429</td>
<td>781</td>
<td>1,291</td>
</tr>
<tr>
<td>Tobacco and Cigarettes</td>
<td>590</td>
<td>654</td>
<td>583</td>
<td>444</td>
<td>430</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>55,962</td>
<td>60,587</td>
<td>90,000</td>
<td>102,978</td>
<td>109,313</td>
</tr>
</tbody>
</table>

Indeed few countries offer so much promise in the cultivation of cotton as the Sudan, for in addition to its vast irrigable area it can also produce rain-grown cotton.

It was immediately after the re-occupation that Sir W. Garstin realised the possibility of irrigating the Gezira plain between the White Nile and the Blue Nile from the latter river. The great Makwar Dam nearing completion below Sennar will turn the visions of five-and-twenty years ago into splendid realities. Its vast granite wall will hold up sufficient water to irrigate at least three million feddans of cotton—possibly even more. At any rate there is now no limit placed on the land to be watered, all the earlier restrictions having been removed by the British Ultimatum of November, 1924 (following the murder of the Sirdar, Sir Lee Stack) to which the Egyptian Government agreed. The Gezira will become a huge cotton field bringing prosperity to the Sudan.

#### Principal Sudan Exports.

<table>
<thead>
<tr>
<th>Article</th>
<th>1919</th>
<th>1920</th>
<th>1921</th>
<th>1922</th>
<th>1923</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charcoal</td>
<td>3,153</td>
<td>3,626</td>
<td>871</td>
<td>1,352</td>
<td>1,497</td>
</tr>
<tr>
<td>Cotton and Cotton Seed</td>
<td>5,926</td>
<td>8,625</td>
<td>6,343</td>
<td>10,654</td>
<td>12,712</td>
</tr>
<tr>
<td>Dates</td>
<td>3,986</td>
<td>4,737</td>
<td>631</td>
<td>2,003</td>
<td>1,505</td>
</tr>
<tr>
<td>Dom Nuts</td>
<td>1,306</td>
<td>1,408</td>
<td>95</td>
<td>97</td>
<td>325</td>
</tr>
<tr>
<td>Dura</td>
<td>13,309</td>
<td>16,909</td>
<td>53,312</td>
<td>60,341</td>
<td>52,892</td>
</tr>
<tr>
<td>Ground Nuts</td>
<td>3,517</td>
<td>2,822</td>
<td>4,536</td>
<td>2,946</td>
<td>7,325</td>
</tr>
<tr>
<td>Gum</td>
<td>15,941</td>
<td>12,307</td>
<td>10,333</td>
<td>14,827</td>
<td>23,875</td>
</tr>
<tr>
<td>Hides</td>
<td>1,467</td>
<td>1,487</td>
<td>258</td>
<td>644</td>
<td>701</td>
</tr>
<tr>
<td>Simsim</td>
<td>7,716</td>
<td>8,626</td>
<td>13,621</td>
<td>10,301</td>
<td>10,326</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>55,962</td>
<td>60,587</td>
<td>90,000</td>
<td>102,978</td>
<td>109,313</td>
</tr>
</tbody>
</table>
But this and other irrigation projects such as that of the Kassala Cotton Company merely touch the fringe of the possibilities of the Sudan as a cotton country. Its production will be limited only by the supply of labour to cultivate the fields, for it is estimated that there are over 250,000 square miles from Kosti to the southernmost limits of the Sudan suitable for rain-grown cotton. The opportunities opened out are almost inexhaustible, for the conditions for rain-grown cotton are said to surpass those in the best areas in India. The Sudan Government is alive to the promise of enormous prosperity in years to come and is starting demonstration farms to interest the tribes in the cotton crop and its possibilities.

A correspondent of the London "Times" who travelled throughout the Sudan in 1924 was immensely impressed by its possibilities as a cotton producing land. "The country," he wrote, "starts with every advantage. It is not hampered by international difficulties in the matter of enactment of legislation, nor is it confronted with any impossible position in the matter of pests, as in Egypt, since climatic conditions are in its favour in regard to the handling of the latter. Take, for example, the pink boll-worm, which has made its appearance here. It has been found quite sufficient to expose the seed to the rays of the sun for 27 hours to kill off every single worm it contained without doing any harm to the germinating power of the seed. What assists in this respect is the fact that the seed is available at the period in the year when the sun's rays are sufficiently hot, and that the cotton season is succeeded by a period when the worm cannot find either sustenance or protection. (In Egypt cotton seed is not available until October, and is required for sowing in February, while the period after the crop is most favourable to the worm). Again, the only ginneries that exist either belong to or are worked in agreement with the Government, which possesses full power to control any outside ginneries that in the future may be put up. (It has been in this connection that legislation and con-
control have failed in Egypt). Likewise in the execution of administrative regulations such as the pulling up of cotton sticks and their storage one of the most fertile channels for the propagation of pests—the Government have means at their disposal that do not exist in Egypt for seeing that these regulations are strictly adhered to. The strong position in which the country now finds itself is due in great measure to the fact that steps were taken at a sufficiently early stage by the agricultural authorities to ensure control of ginneries, seed, and pests. In this respect the Sudan is far in advance of any country, and a practical example of what control in the Sudan can achieve is afforded by the Tokar crop, the quality and yield of which have been improved out of all knowledge in the space of a relatively few years. If finally the project for prohibiting the export of 'Baladi' (local) cotton is put into effect, all fear of the quality of cotton produced either under the irrigation or rain system being diminished by the admixture of the very inferior local variety will be eliminated, and cotton cultivation in the Sudan, whether American or Egyptian, should have a very promising future before it.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

Commercial Egypt

The Statue of Count Ferdinand de Lesseps, the builder of the Suez Canal, at Port Said.

The Bourse (Exchange), Mohamed Ali Square, Alexandria.

Cairo Central Railway Station.

Photos by A. Reid, M.B.E
The Finances and Trade of Egypt.

ADVERSE financial conditions in Egypt formed the principal, if not the only, cause of British intervention in that country. In 1875, owing to the long-sustained and reckless expenditure of the well-meaning, but sorely-misguided Ismail, son of Ibrahim Pasha, and the first of the Khedives, the finances of Egypt were reduced to a chaotic condition. During the early years of his rule, which lasted from 1863 to 1879, Ismail seemed a sort of Midas; everything he touched turned out successfully, and the material welfare of his country appeared to be advancing phenomenally. Historians have paid, no doubt, a just tribute to Ismail's earnestness of purpose, and—for an Eastern potentate—personal honesty. But the rapid pace at which his reforms proceeded, building railways which could never by any possibility be made to pay, opening schools which at that time were hardly needed, fostering trade and agriculture, upon which the prosperity of his country depended but upon an extravagant and ill-considered basis, brought about a financial crisis, which had not been paralleled since the days of the Turks in 1803, when the country had been returned to them by England. The construction of the Suez Canal, commenced in 1859 and finished in 1863, calling for the outlay of an immense sum of money from the Egyptian Treasury, brought financial disaster to completion.

Towards the end of 1875, Ismail's commitments amounted to nearly £78,000,000 sterling. Official salaries were in arrears; even treasury-bills were declined by the more speculative class of financiers. The unwilling but necessary disposal to the British Government of 176,602 Suez Canal shares, for the sum of £3,976,852 (to-day these shares are worth £30,000,000 sterling) proved but a sop in the pan; three years later financial conditions became so bad, and foreign creditors of Egypt were thrown into a state of so much alarm, that the French Minister for Foreign Affairs (M. Waddington) induced the British Chancellor of the Exchequer (Lord Derby) to co-operate in an attempt to take matters in hand and put the finances of Egypt on a permanently sound basis.
To this end, a Commission of Enquiry was instituted under the presidency of Mr. (afterwards Sir) Rivers-Wilson. He had previously been Vice-President of the Commission of Enquiry, and subsequently became Minister of Finance. At the time of his arrival in Cairo to take over charge of the country’s monetary affairs, it was found almost impossible to obtain a true estimate of the revenue. Investigations disclosed the fact that false accounts had been prepared, submitted, and blindly admitted; that there were glaring discrepancies and evident suppression of valuable sources of revenue. Neither Lord Goschen nor Lord Vivian whose services had been called in, were any better enabled to arrive at a conclusion. The newly-created Khedive was surrounded by a host of toadies and sycophants, who were not only draining the national treasury but the very life-blood of the unfortunate fellah, who, for years, had been heartlessly exploited by Ismail’s immediate predecessors. Said Pasha, Abbas Pasha I and Mohammed Ali.

While the familiar process of squeezing the luckless natives was continued, wealthier proprietors succeeded in evading a great portion, if not the whole, of the burdensome land-tax. But, as a result of that thoroughness of purpose and determination of pursuing a just policy, which ever have distinguished British officialdom, it did not take long before the finances of the country were placed upon a decidedly better basis. In April, 1878, Ismail Pasha had been obliged to find the sum of £E1,200,000 to pay the May coupon of the Unified Debt; while in the corresponding month of 1879 a sum of about £E2,000,000 fell due. How could it be possible to meet this without further impoverishing the miserable fellah and collecting from him (in the usual brutal and relentless manner) taxes sufficient to meet the impending instalment?

At this time, the debt of Egypt was about £E90,000,000, and the Egyptian Government had no money with which to settle the many claims against it. Numerous judgments were obtained against the Government, and the impossibility of executing these led to the active interference of the Powers, under whose auspices the Mixed Courts had but recently been established. Everything was sacrificed in the attempt to pay the interest and sinking fund on the funded debt. Lord Cromer has told us that at this period (1878) a sum of £E1,579,000 was devoted to the extinction of debt, and that the nominal capital paid-off amounted to £E3,110,000. The total revenue pledged to the service of the Unified Debt, which had been estimated to yield £E4,800,000, produced no more than £E3,328,000. Other factors contributed to defeat the efforts made by the European controllers of Egypt’s involved finances. An exceptionally bad
THE DEBT DIFFICULTIES

Nile, the Russo-Turkish War, and the general depression of trade assisted in no small measure to the hastening of the crisis, while famine in Upper Egypt brought about the climax.

To add to the wholesale confusion, violent differences of opinion existed between the French and British Commissioners of Debt; and here, it may be stated, that throughout the efforts at settlement French officials remained in hostile opposition. Baron des Michels and M. Waddington proving veritable thorns in the sides of the British Commissioners, Lord Vivian and Sir Rivers-Wilson, whereas our representatives endeavoured to adapt a remedy entailing the least suffering upon the people of Egypt, the French officials turned a deaf and unsympathetic ear to the abject misery of the Egyptian fellahin; the clash of conflicting interests proved terrific. Undoubtedly the position of the British Commissioners was one of supreme difficulty, since they were ostensibly representing the bond-holders, yet, at the same time, were attempting to remedy Egypt's disastrous financial complications.

The services of Sir Evelyn Baring, who afterwards became the Earl of Cromer, had been enlisted, and the value of the policy advocated by this brilliant and conscientious administrator cannot be over-estimated. But even his warm regard for M. de Blignières, another French official, who had been nominated by the French Government, was insufficient to regulate matters; none the less, Lord Cromer, in his published works, has magnanimously paid tribute to the sincerity of his colleagues, difficult as he had undoubtedly found them. M. de Blignières was once described by Lord Salisbury as "un personnage muet."

Shortly after Sir Rivers-Wilson had been appointed Minister of Finance (August, 1878), the Domains Loan, of £8,500,000, was issued. This sum was raised, not without an effort, on the enormous properties belonging to the Khedivial family, who, for years, had batten upon the sweated labour and hard-earned wages of the unfortunate populace, thus amassing the wealth which they callously squandered. By gradual sales, the extent of the Khedivial property, which originally consisted of over 426,000 acres of land, was reduced, by the close of 1906, to about 147,000 acres; while simultaneously the outstanding loan capital was reduced from £8,500,000 to about £1,050,040, November, 1907. This needed shrewd and scrupulously-honest administration.

The Khedive's right to contract loans was withdrawn; thus Ismail, the spendthrift, was no longer in a position to build himself costly palaces and lordly harems, the majority of which he could not, and never did, occupy, nor to retain for himself and his family one-fifth of the best of the land of Egypt. In fact, it was not until Ismail him-
The Assouan Dam.

The Assouan Dam to-day—the South Side from the East Bank.

A view of the top of the Dam shewing the Sluice Gates open.
The Right Hon. LORD LLOYD of Dolobran, G.C.S.I., G.C.I.E., D.S.O.
His Majesty's High Commissioner for Egypt and the Anglo-Egyptian Sudan
of wild speculation, and then to the inevitable collapse.

England’s task had commenced by placing Egypt’s finances on a firm basis by adopting a policy of low but wider taxation; by establishing even-handed justice throughout the country; by substituting for the old (and sole) bond uniting rulers and ruled (namely reliance on and fear of superior autocratic and overwhelming forces) those kindlier bonds of human sympathy and indulgence, and a growth of confidence in their new rulers’ good intentions was engendered in the masses.

The foundation of the wealth of the country was found to exist, as from Pharaonic days, in its agricultural lands, fertilised yearly by the deposits brought down by the Nile flood, and, to a less extent, upon its manufactures and industries. Thanks to British enterprise and ingenuity, a scheme of artificial irrigation was perfected; thus, by increasing enormously the supply of the fertilising Nile water, permitting the bringing under cultivation of a superior acreage, and ensuring the valuable cotton-crop against failure from insufficient summer water. The story of this magnificent engineering effort, in which none but British engineers have played a part, has been told in a separate section of this volume to be found under the title of “The Story of the Assouan Dam.”

As year has followed year, the Egyptian budget has shown
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

The Egyptian Government Consolidated Debt.

<table>
<thead>
<tr>
<th>Guaranteed Debt</th>
<th>£</th>
<th>£</th>
<th>£</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outstanding Dec. 31, 1923.</td>
<td>5,368,900</td>
<td>362,600</td>
<td>5,006,300</td>
</tr>
<tr>
<td>Bonds held by Government and Debt Commission.</td>
<td>5,368,900</td>
<td>362,600</td>
<td>5,006,300</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Privileged Debt</th>
<th>£</th>
<th>£</th>
<th>£</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonds held by Government and Debt Commission.</td>
<td>31,127,780</td>
<td>2,428,820</td>
<td>28,698,960</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unified Debt</th>
<th>£</th>
<th>£</th>
<th>£</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonds held by Government and Debt Commission.</td>
<td>55,971,960</td>
<td>5,820,600</td>
<td>50,151,360</td>
</tr>
</tbody>
</table>

Totals | £  | £  | £  |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonds in Circulation.</td>
<td>92,468,640</td>
<td>8,612,020</td>
<td>83,856,620</td>
</tr>
</tbody>
</table>

Egyptian Trade Balance for Years 1919 to 1923.

<table>
<thead>
<tr>
<th>Categories</th>
<th>1919</th>
<th>1920</th>
<th>1921</th>
<th>1922</th>
<th>1923</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exports</td>
<td>£E.</td>
<td>£E.</td>
<td>£E.</td>
<td>£E.</td>
<td>£E.</td>
</tr>
<tr>
<td>Re-exports</td>
<td>75,888,321</td>
<td>85,467,061</td>
<td>36,550,626</td>
<td>48,716,418</td>
<td>58,387,327</td>
</tr>
<tr>
<td>Total</td>
<td>80,195,722</td>
<td>88,018,955</td>
<td>42,483,854</td>
<td>51,377,364</td>
<td>50,151,360</td>
</tr>
<tr>
<td>Imports</td>
<td>47,600,717</td>
<td>101,480,963</td>
<td>55,007,984</td>
<td>43,333,938</td>
<td>45,273,941</td>
</tr>
<tr>
<td>Trade balance</td>
<td>+32,596,006</td>
<td>-13,862,008</td>
<td>-13,024,028</td>
<td>+8,043,726</td>
<td>+14,577,046</td>
</tr>
<tr>
<td>Total foreign trade</td>
<td>127,696,439</td>
<td>189,889,858</td>
<td>97,991,940</td>
<td>94,711,602</td>
<td>105,130,928</td>
</tr>
</tbody>
</table>

Note.—The above figures exclude specie.

Principal Imports into Egypt, 1922-23.

<table>
<thead>
<tr>
<th>Categories</th>
<th>1922</th>
<th>1923</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animals and animal food products</td>
<td>£E.</td>
<td>£E.</td>
</tr>
<tr>
<td>Hides, skins and leather goods</td>
<td>1,779,130</td>
<td>1,613,456</td>
</tr>
<tr>
<td>Other animal products</td>
<td>585,130</td>
<td>612,777</td>
</tr>
<tr>
<td>Cereals, flour and agricultural produce</td>
<td>52,421</td>
<td>58,510</td>
</tr>
<tr>
<td>Colonial produce and general grocery</td>
<td>3,907,157</td>
<td>4,490,792</td>
</tr>
<tr>
<td>Spirits, beverages and oils</td>
<td>1,575,058</td>
<td>1,707,037</td>
</tr>
<tr>
<td>Paper and printed matter</td>
<td>2,829,105</td>
<td>2,899,485</td>
</tr>
<tr>
<td>Wood and Coal</td>
<td>910,080</td>
<td>852,312</td>
</tr>
<tr>
<td>Stone, earthenware and glassware</td>
<td>3,872,567</td>
<td>3,962,781</td>
</tr>
<tr>
<td>Dyestuffs, tansuffs and colours</td>
<td>1,245,955</td>
<td>1,222,667</td>
</tr>
<tr>
<td>Chemical and medicinal products and perfumery</td>
<td>441,132</td>
<td>425,812</td>
</tr>
<tr>
<td>Yarns and textiles</td>
<td>2,984,771</td>
<td>2,500,590</td>
</tr>
<tr>
<td>Metals and metalware</td>
<td>15,865,308</td>
<td>15,522,512</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>5,357,161</td>
<td>5,357,413</td>
</tr>
<tr>
<td>Total of Merchandise Imported</td>
<td>41,777,616</td>
<td>43,764,077</td>
</tr>
<tr>
<td>Total of Tobacco</td>
<td>1,556,322</td>
<td>1,500,864</td>
</tr>
<tr>
<td>Total of Imports</td>
<td>43,333,938</td>
<td>45,273,941</td>
</tr>
</tbody>
</table>
BUDGET FIGURES

a better and surer balance. Space will not permit us to follow in order of sequence the remarkable story of Egypt's financial regeneration, interrupted though it has been by occasional setbacks caused largely by overspeculation or bad seasons, or sometimes by both. But difficulties have been gallantly overcome; and during the late war the material prosperity of Egypt had not alone never been equalled but hardly ever imagined. At this period (1914-15) the national budget comprised many important changes in form, these being mostly for the better. Among such changes was that which involved not only the presentation of the entire expenditure in one account, but the suppression of payments for Inter-departmental services and other modifications, thus making for greater simplicity and unity.

There had been a gradual recovery from the evil effects of the 1907 crisis and a readjustment of the balance of trade so that in 1923 there was shown no less than £E14,577,046 in favour of exports. There had also been a general decline in the import of articles of food and clothing (with the exception of cereals and flour, to supplement a diminished local production) which afforded ample evidence that the country was consistently addressing itself to a policy of retrenchment.

To-day, we find the same spirit of economy being practised, and the new Egyptian Government has taken over the finances of the country at—to them—a most propitious moment. Instead of it being necessary, as at one time was anticipated, to draw upon reserves to the extent of some £E2,000,000 in order to balance the budget for the year 1921/22, the Minister of Finance (Sidky Pasha) was enabled to secure a surplus of receipts of £E4,000,000, which sum was added to the reserve. For the year 1922-1923, the budgetary receipts were £E33,630,000, with a surplus of no less than £E7,516,573. Moreover the budgetary surplus of £E550,000 for 1923-24 was expected to reach £E4,975,000 by March 31, 1924. Indeed, for three or four successive years the actual surplus in Egypt has enormously exceeded budgetary estimates, while trade has been extraordinarily good. It is expected that the Reserve Fund which shrank from over £E17,000,000 on March 31, 1920, to only £E1,500,000 owing to vast purchases of coal, wheat and flour at high prices will soon stand again at, at least, £E3,000,000. Indeed, during the war period and the years which followed it, Egypt under British control was noted for the flourishing condition of its public finances and the general prosperity of its people.

The Egyptian Government Consolidated Debt on December 31, 1923 stood as is shown in the table at the top of the facing page.

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The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

PRINCIPAL EXPORTS FROM EGYPT, 1922-23

<table>
<thead>
<tr>
<th>Categories</th>
<th>1922</th>
<th>1923</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.—Animals and animal food products</td>
<td>550,089</td>
<td>524,629</td>
</tr>
<tr>
<td>II.—Hides, skins and leather goods</td>
<td>244,066</td>
<td>252,077</td>
</tr>
<tr>
<td>III.—Other animal products</td>
<td>84,600</td>
<td>50,003</td>
</tr>
<tr>
<td>IV.—Cereals, flour and agricultural produce</td>
<td>5,573,397</td>
<td>5,018,747</td>
</tr>
<tr>
<td>V.—Colonial produce and general grocery</td>
<td>342,647</td>
<td>1,070,146</td>
</tr>
<tr>
<td>VI.—Spirits, beverages and oils</td>
<td>632,511</td>
<td>621,563</td>
</tr>
<tr>
<td>VII.—Paper and printed matter</td>
<td>70,881</td>
<td>62,180</td>
</tr>
<tr>
<td>VIII.—Wood and coal</td>
<td>43,489</td>
<td>30,482</td>
</tr>
<tr>
<td>IX.—Stone, earthenware and glassware</td>
<td>7,561</td>
<td>7,141</td>
</tr>
<tr>
<td>X.—Dyestuffs, tanstuffs and colours</td>
<td>54,095</td>
<td>47,525</td>
</tr>
<tr>
<td>XI.—Chemical and medicinal products and perfumery</td>
<td>141,597</td>
<td>164,471</td>
</tr>
<tr>
<td>XII.—Yarns and textiles*</td>
<td>39,937,017</td>
<td>49,963,063</td>
</tr>
<tr>
<td>XIII.—Metals and metalware</td>
<td>345,889</td>
<td>312,985</td>
</tr>
<tr>
<td>XIV.—Miscellaneous</td>
<td>57,259</td>
<td>65,367</td>
</tr>
<tr>
<td><strong>Total of merchandise exported</strong></td>
<td>48,085,098</td>
<td>58,020,379</td>
</tr>
<tr>
<td><strong>Total of cigarettes</strong></td>
<td>634,320</td>
<td>306,948</td>
</tr>
<tr>
<td><strong>Total of exports</strong></td>
<td>48,716,418</td>
<td>58,387,327</td>
</tr>
</tbody>
</table>

* Mostly raw cotton.

The Guaranteed Debt has been reduced by statutory annual amortization from £9,424,000 in 1885 to its present figure. A substantial portion of the public debt of Egypt is now held in the country, and the public fortune of Egypt was estimated at the end of 1923 to stand at £3,95,000,000. The growing confidence in the soundness of Egyptian finance is shown by the following comparison of the market value of its Government securities:

<table>
<thead>
<tr>
<th></th>
<th>Dec. 31, 1922</th>
<th>Dec. 31, 1923</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unified</td>
<td>£109 1 3</td>
<td>£114 3 9</td>
</tr>
<tr>
<td>Privileged</td>
<td>£100 8 9</td>
<td>£104 10 0</td>
</tr>
</tbody>
</table>

Egyptian trade has been remarkably vigorous in recent years, thanks to the big sums received for the cotton crop which has been marketed with great success.

Of the 1923 imports the United Kingdom supplied £14,770,651, while the total for the British Empire (including the United Kingdom) was £18,816,440. In both cases increases were shown compared with 1922.

In 1923 the cotton export alone increased by £69,801,524 over 1922, while sugar exports rose by £725,000, cotton seed by £595,000 and cotton-seed oil by £253,000. These increases more than offset the considerable decreases which have occurred in onions, cigarettes and benzine.
Egypt has a promising mining industry but it has been handicapped in recent years by a period of depression. During 1923 over 5,900 ft. of prospecting drilling for petroleum was accomplished by commercial interests while the Hurgada field produced 152,892 metric tons of crude petroleum. The production of manganese ore in 1923 broke all records, while the export of phosphates increased. The production of fine gold in 1923 was 484 ozs. troy as against 241 ozs. in 1922.

While Egypt owes its prosperity mainly to its cotton crop and its tourist traffic, both of which it has developed upon the best lines, it also possesses a number of industries which add to its wealth. One of its leading manufacturing activities is the production of cigarettes, for which in 1923 it imported tobacco valued at £E1,268,461. In 1922 its export of cigarettes was valued at £E631,320, but in 1923 the figure fell to £E366,948. For some reason or other there was a heavy fall in foreign buying in 1923, but no doubt the Egyptian brand will come back into favour again. The weaving industry is one of considerable importance, for though the work is rough and the looms antiquated, it gives employment to a large number of people. There are some 15,000 looms, and at the last census weaving was found to provide work for 72,818 hands.
of whom 19,122 were women. There is one big spinning factory, while the villagers do a great deal of spinning in their spare time. The cotton, woollen and silk yarns imported in 1923 were valued at £951,146.

The sugar industry is regarded as of growing importance and during the Great War it experienced a period of gratifying prosperity. It is carried on by a company which owns a number of factories and employs 17,000 hands. It can produce about 100,000 tons of sugar a year. Egyptian sugar is famed for its whiteness and sweetness.

The production of bricks, tiles, pottery and so on is carried on upon a large scale, ample raw material being found. Some beautiful pottery is now turned out, and there is a special school in which craftsmen are trained. The cement industry has an output of about 75,000 tons a year. Tanning and leather work are developing and their prospects are regarded as good, for raw material is plentiful and labour cheap. Soap and furniture factories, oil mills, and engineering workshops are numerous, while rugs are made in many villages. Small dye works are scattered all over Egypt in which the methods are very primitive, but there are also a few more modern concerns. Indeed there are a large number of minor industries in the country which in the aggregate provide employment for a great many people and may be capable of considerable development in years to come.

It is worth noting that the membership of the Association des Industries en Egypte in 1923 was stated to be 80 firms with a capital of £25,000,000, employing a minimum of 150,000 workpeople, of which about 97 per cent. are Egyptians, and form with their families an aggregate of 800,000 inhabitants.
The Story of the Cape to Cairo Railway and River Route

Diagrammatic Records of Production, Trade & Development on the Cape to Cairo Route.

The Annual Buying Capacity per head of the Population of each of the Cape to Cairo Territories and Comparisons with that of the World and the British Empire.

1 The Union of South Africa.
2 The Belgian Congo.
3 Egypt.
4 Nyasaland.
5 Tanganyika Territory.
6 Uganda.
7 Portuguese West Africa.
8 Portuguese East Africa.
9 The Sudan.
10 Rhodesia.
11 Kenya Colony.
12 The Cape to Cairo Territories.
13 The British Empire.
14 The World.

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The Story of the Cape to Cairo Railway and River Route in 1912

Railways connected with the Cape to Cairo Route in 1887 and 1922.

- South Africa
- Nyasaland
- Portuguese East Africa
- Portuguese West Africa
- Tanganyika
- Congo
- Uganda
- Kenya and Zanzibar
- Egypt
- Sudan
- South Africa

Total in 1887: 7,000 miles
Total in 1922: 12,000 miles

The diagram shows the distances and connections along the railway routes.
The Right Hon. LORD KYLSANT OF CARMARTHEN, G.C.M.G.
Africa's Leading Shipping Magnate
PORTS

Connected with the

CAPE to CAIRO ROUTE.
The "Arundel Castle" crossing the Bar at Durban.

The S.S. "Llandovery Castle," which made her maiden voyage from London to South Africa, via the Suez Canal and East African Ports, in October, 1925.
FOREWORD

BY
THE RIGHT HON. LORD KYLSANT OF CARMARTHEN, G.C.M.G.

As one whose shipping interests are concerned with the entire seaboard of the African Continent, I welcome the approaching publication of "The Cape to Cairo Railway and River Route."

Africa, with its illimitable resources, can do with any amount of publicity. It is full of romance and immeasurable possibilities and has always appealed powerfully to men of vision, whether explorers, merchant adventurers, railway engineers or agriculturists.

Amongst the conceptions of that great man and Empire builder—Cecil Rhodes—perhaps the biggest was his idea of this central line of railway running through the heart of Africa from North to South, with laterals branching out East and West to the Coast. It resembles the insertion of a nervous system into an inanimate body, quickening the whole into sentient life, so that the vast territories of Africa may be vitalised with activity and industry.

The article to which these few remarks are intended to be a foreword, however, deals with the ports connected with the Cape to Cairo Route. The development of the African ports is a story full of interest, going back to the days of the early mariners who, in their tiny craft, ventured farther and farther South until they found, what they had long conjectured, that there was a sea route to India and the East round Africa.

Some of the little settlements then established on the African Coast have since become first class ports. In the development of a country or continent the question of transportation is of primary importance, and there are several phases of this one problem, namely: you must have roads, railways, ports and steamship connections, each one of which is inter-dependent and should keep pace with the other if trade and commerce is to flourish.

Some of the African ports are splendidly equipped, others still offer comparatively primitive facilities which retard the flow of traffic. Many big schemes of improvement are in hand, for which large sums have been voted by various Governments. I believe we will in the next decade or so see an immense advance in port and harbour development on the African coast.

The steamship communications which link up Africa with the rest of the world have been steadily developed. The materialisation of the Cape to Cairo Railway will certainly give an impetus to progress in Africa, and I hope and believe adequate attention will be devoted to provide well-equipped ports on the seaboard, the facilities at which will attract shipping and thus promote overseas trade.
German Liners off Zanzibar.

The P. & O. Liner "Medina" in the Suez Canal with their Majesties King George and Queen Mary on Board on the occasion of their visit to the Sudan in 1912.
Ports of the Cape to Cairo Route.

Doubtless rather more than half the coastline of the African Continent is more or less directly associated with the Cape to Cairo trunk system. From Alexandria and Port Said the ports of the route extend southwards along the Red Sea and the Indian Ocean to Cape Town, thence up the West Coast, washed by the waters of the South Atlantic, to the Congo estuary. With the ports of the Barbary Coast, the great West African bulge and the Gulf of Lagos the Cape to Cairo Route has no present connection and until the Trans-Sahara and Nile—Lake Chad railways have been built—probably a good many years hence—it is only with the chain of harbours and ports stretching from the Nile round the east and south of Africa to the Congo that this story need concern itself.

Naturally it is the terminal ports of the route that are of chief importance. At the Egyptian end we have Alexandria, Port Said and Suez, though the two latter have little practical connection with the Cape to Cairo system. At the Southern end there are Cape Town, Durban, Lourenco Marques, Port Elizabeth and East London, in addition to several ports of minor importance, such as Mossel Bay, Knysna and Port St. Johns. Along the eastern shore of Africa we have, from north to south, the adjacent harbours of Suakin and Port Sudan, Kilindini-Mombasa, Dar-es-Salaam, Zanzibar—though being 16 miles from the mainland it is somewhat doubtful whether it can legitimately be included—and Beira, all of which, except Zanzibar, have direct railway connection with the Cape to Cairo trunk system. Then there are a number of lesser ports, some of which may eventually attain importance as the result of railway extensions. Among such may be mentioned Djibouti, Tonga, Lindi and Port Amelia, while others, whose functions are long likely to remain purely local, are Massowah, Lamu, Malindi, Pangani, Mikindani, Ibo, Mozambique, Quelimane and Inhambane. On the Atlantic side, going north, there is the little copper-shipping harbour known as Port Nolloth, connected by a narrow gauge railway with the copper mines of the O'okiep district, and Luderitz and Walvis Bay, the two ports of the South West Africa protectorate. Swakopmund is practically moribund except as a resi-
dential and business quarter for Walvis Bay, 21 miles to the south. Angola has three principal ports, Mossamedes, Benguela-Lobito Bay and Sao Paolo de Loanda, but only in the case of Lobito Bay is there much likelihood of connection with the Cape to Cairo route in the near future. In the Congo estuary are Boma, near the mouth, and Matadi, about 100 miles inland and the farthest point to which ocean steamers can ascend. Matadi is connected by rail with Kinshasa on Stanley Pool, navigation being interrupted by rapids on this section. From Kinshasa river steamers can travel without interruption to Stanleyville far in the interior.

Although the map is freely dotted with so-called ports it cannot be said that the African continent was unduly favoured by nature in the matter of good harbours. There are vast stretches of coast hundreds and even thousands of miles in length without a sheltered port. The river estuaries, with few exceptions, are small or so choked with sand that they require large expenditure to make them available for modern shipping. While a great deal of progress has been accomplished during the past forty years, great improvements are needed at both main and secondary ports in order to secure quicker despatch of vessels, and so avoid the extensive delays that add so greatly to the cost of transport. The South African Government has spent, and is continuing to devote, large sums to harbour improvement—even to the length of contemplating the construction of an entirely new harbour on the Zululand coast, to handle the Transvaal coal traffic, if satisfactory arrangements for the improvement of Lourenzo Marques cannot be made—and elsewhere schemes of considerable magnitude are in hand or under discussion. For many years, therefore, we shall witness a steady development of harbour facilities along the African littoral which will provide much work for British engineers, contractors and manufacturers.

Since the route with which we are concerned is always spoken of as "Cape to Cairo" and not "Cairo to Cape" it will be as well to begin a more detailed survey of the ports associated with it by a description of the docks at Table Bay. The first attempt to improve on Nature in the matter of protecting the Port of Cape Town was made in 1743 when a mole—of which the remains are still visible at low-tide—was begun from the spot on which the Mouille Point lighthouse stands. Nothing further was done until 1856, when an elaborate project was put forward but failed to gain acceptance. Four years later a design, prepared by Sir John Coode, for a breakwater to form an outer basin enclosing the dock area at a cost of nearly £400,000 was approved, and the work was begun on August 17th, 1860. By 1870, the Alfred Basin with water area of 8½ acres and an outer basin protected by a jetty at right angles to the breakwater, had been completed and opened by Prince Alfred.
TABLE BAY DOCKS

The graving dock was completed in 1882. At present the Victoria and Alfred Basins have a water area of $75\frac{1}{2}$ acres. The breakwater is 3,640 feet long and the South Arm and its elbow have a total length of 2,500 feet. The length of wharfage is $2\frac{1}{2}$ miles. The entrance to the Victoria Basin is 250 feet wide and 30 feet deep and alongside the East Pier, 786 feet in length, where the fine mail steamers of the Union-Castle Line berth, there is a depth of 36 feet at L. W. O. S. T. Storage sites for 100,000 tons of coal, and 75,000 cubic feet of chilling chambers have been provided in 16 chambers capable of taking over 900 tons of fruit. The oil fuel tanks have a capacity of 20,000 tons and additional tanks and pipe lines are contemplated. Pumping plant and service pipes to quay have been installed. The port is equipped with three powerful tugs and two smaller craft, and 16 lighters with a capacity of over 3,500 tons are used for coaling purposes. The whole of the docks are well lighted by electricity, and are equipped with electric cranes and transporters.

Dock improvements at Table Bay to cost over £4,000,000 are in progress. These include the extension of the breakwater by 1,500 feet, the widening and reconstruction of quays and cargo sheds, and the deepening of the turning basin. A large grain elevator, with a capacity of 30,000 tons, was completed in 1924.

While Mossel Bay and Knysna are minor ports they are fairly well equipped for their size. The former is a roadstead with lighter jetties and slipways, while Knysna is a river estuary with a minimum depth on the bar of about 14 feet. We pass on to Port Elizabeth, an open roadstead with safe shelter and good anchorage. There are three jetties for lighters, the most southerly — Dom Pedro Jetty — having a steamer berth 300 feet long with an alongside depth at low water of 27 feet. A breakwater, begun in 1856, caused so much silting up of the bay that it was removed in 1869. Work is in progress on a breakwater 8,500 feet long to cost £1,500,000 which will permit work to be carried on at the existing jetties in smooth water; this is not possible at present during south-easterly gales. Further works to cost £3,000,000 have been designed, but there is not much immediate prospect of their being put in hand.

The cargo handling facilities of Port Elizabeth include 32 lighters with an aggregate capacity of about 3,640 tons, and three powerful tugs, with a repairing slipway of 400 tons deadweight capacity. The jetties are fully equipped with modern hydraulic cranes and railway sidings for direct transfer of cargo between lighters and railway trucks. Exclusive of warehouses let to business firms, the shed and storage accommodation is about 3,000,000 cubic feet.
Buffalo Harbour (East London), unlike Port Elizabeth, possesses an inner port in the Buffalo river mouth, but as the depth of water on the bar only averages 23 feet at L.W. O. S. T. it is not available at all states of the tide for the larger vessels visiting the South African ports, and the outer roads are very lacking in shelter. Vessels of over 8,000 tons and up to 26 feet draught can enter the river, and discharge at the quays. Larger vessels can discharge and load in the roadstead anchorage by means of the efficient lighterage plant. There are wharves on both banks aggregating about 6,700 feet with alongside depths ranging from 26 feet to 27 feet 6 inches. The mouth of the river is at present confined between training walls to increase the scour, but improvements now being carried out include the removal of the eastern training wall and the construction of a new east breakwater 2,000 feet long, while the western training wall is to be extended 1,000 feet. When these works are finished the port will be greatly improved.

Sheds and warehouses have a total floor area of 264,500 square feet. Electric cranes of from 3 to 20 tons lifting capacity, serve the quays, and ample railway sidings enable goods of all descriptions to be handled direct from ship to truck or vice versa. There is a storage area of 30 acres, equipped with a 30-ton electric gantry and with travelling cranes available for both open air and warehouse service. A 50-ton steam crane is available at the East Quay dealing with heavy lifts direct from hold to truck.

Durban, which handles a larger tonnage of goods than any of the other South African Ports, differs greatly in its physical characteristics from those previously described. It consists of a completely landlocked bay with an entrance only a few hundred feet in width, although the bay has an area of about 8 square miles with about three miles of wharf and quayage. Great difficulties had to be overcome before the bar was got under control. Extension of the inner breakwater for a distance of 2,000 feet seawards from the foot of the Bluff and prolongation of the North Pier from the end of the Point to a line level with the end of the breakwater, coupled with ceaseless activity by a very powerful dredging plant, eventually solved the problem and the average depth on the bar at L. W. O. S. T. is now about 36 feet. Until some twenty years ago the Union-Castle liners had to anchor about three miles off shore in the outer roads and land passengers and cargo by tug and lighter. The slinging of passengers from the deck of the liner to that of the tender was accomplished by means of a tall basket with a door in the side and the sensation was not appreciated by nervous passengers. In fact, this performance coupled with a long journey in more or less rough water, culminating in a thorough tossing
THE PORT OF DURBAN.

on the bar itself, made the journey from the ship to shore or vice versa a very objectionable experience, as it still is at East London. It was with widespread relief that Natalians saw their old enemy the bar finally conquered and the regular appearance of the mail steamers at the berth near the Point railway station which corresponds to the mail steamer jetty in the Table Bay docks. How much has been accomplished by those who have abolished the bar may be better realised when it is mentioned that in 1876 the depth was only 4 feet 6 inches and in 1887 only 10 feet 3 inches.

The entrance to Durban Bay (Port Natal) is 400 feet wide and the minimum depth in the approach channel is 34 feet 6 inches. The quayage at the Point is about 14 mile long, including one berth 710 feet long with an alongside depth of 38 feet 6 inches. The traffic has long outgrown the wharfage capacity of the Point and a deep channel has been dredged to Congella, at the head of the bay, where there is a timber wharf nearly 4,000 feet in length, and other important works, including a graving dock 1,166 feet long, 110 feet wide and 38 feet 6 inches deep and a large maize elevator. On the Bluff side where modern coaling plant is installed there is a quay wall, 1,585 feet long and a timber wharf which is being replaced by 780 feet of quay wall. The coaling appliances consist of belt conveyors and bucket transporters electrically driven and capable of coaling three vessels simultaneously at the rate of 1,000 tons per hour. The coal is automatically weighed while loading. The dumpers have a capacity of 100 tons and 80 tons respectively. The capacity of the storage bins is 10,000 tons and sites are available in the neighbourhood for stacking 70,000 tons. Modern plant for the storage and supply of oil fuel to ships has recently been installed on reclaimed sites adjacent to the Bluff quays. The port equipment includes a floating dock with a lifting capacity of 8,500 tons (475 feet long by 60 feet internal width), 28 lighters and punts, of an aggregate capacity of over 3,000 tons, and seven powerful tugs. The shed capacity exceeds 100,000 tons and cranes to lift up to 50 tons are installed. With the exception of eleven 3 ton electric cranes, the cargo lifting appliances are of the hydraulic type.

There is no port of any description between Durban and Delagoa Bay (Lourenco Marques) though there are several lagoons on the Zululand coast, of which Kosi Bay appears to be the favourite, that are being examined by the Union Government with a view to the possibility of a final failure to come to terms with the Portuguese in regard to the port regions of Lourenco Marques.

Delagoa Bay itself is the most prominent indentation of the East African coast, being 26 miles long and 22 broad. Adequate dredging plant has eliminated the outer bar, but an inner bar, with a medium depth of 20 feet, divides the outer from the inner harbour.
The Invack peninsula shelters a large body of water studded with shoals but containing considerable areas with depths ranging from 4 to 9 fathoms.

The Hope Channel has an average depth of 24 feet at L. W. O. S. T. and the Cockburn Channel which is chiefly used, is six feet deeper. The rise and fall at spring tides amounts to about 14 feet. The inner harbour, 7 miles long and a mile in width, varies in depth from 3 to 13 fathoms. Of the three rivers which empty into this part of the bay two—the Tembe and Umbelusi—are navigable for short distances. The central quay, 1,500 metres in length, completed in 1916, provides berths for 12 large steamers. In 1914, a coaling plant enabling ships to be bunkered at the rate of 600 tons per hour was installed, and facilities have been added which bring the capacity up to 800 tons per hour, but the growth of the coal traffic necessitates considerable extensions, and has provoked a serious disagreement between the Union Government and the Portuguese authorities. The former desires to have an effective voice in the administration of the port in order to insure that the equipment shall keep pace with the requirements of the Transvaal coal trade, but the Portuguese contend that to acquiesce in the Union Government's proposals would involve infringement of Portuguese sovereignty. A dry dock to take vessels up to 4,000 tons has been sanctioned, while a smaller dock for coasting vessels up to 1,400 tons has been completed. The port Matolla area, about 6 miles from Lourenço Marques, is being developed.

Beira, at the mouth of the Pungue and Buzi rivers, is the port for a very large area, including Rhodesia, Nyasaland, much of Portuguese East Africa and the Katanga district of the Congo. It is the youngest of the East Coast harbours although the site of one of the most ancient—Sofala—is only a few miles to the south. Beira sprang into existence in 1892 when it became necessary to find a shorter route from the sea to Matabeleland and Mashonaland than the long journey by train and on wagon from Cape Town. The river estuary is well sheltered and contains anchorage for a large fleet, while the Chiveve Creek affords a convenient inlet for lighter wharves. Much will have to be done in the near future to increase the port facilities and deep water wharves figure in the plan to be adopted. The growth of the hinterland traffic, which has been materially increased by the completion of the Trans-Zambesi Railway and the consequent transference of the trade of Nyasaland and the Zambesi valley from Chinde to Beira, together with the prospect of developing a coal bunkering and export trade as the result of the exploitation of the Tete coalfield on the Zambesi now begun by the Belgian Company, render port improvement a matter of great urgency.
Of the ports between Beira and Dar-es-Salaam—Quelimane, Port Amelia, Lindi and Kilwa—one or more may eventually be connected by rail with Lake Nyasa and Lake Tanganyika, in which case they will expand considerably in importance. Quelimane harbour is available for ocean-going vessels and is protected by the Qua Qua bar. Passengers are landed by means of motor launches. Port Amelia possesses the best harbour, and with an area of about 40 square miles is one of the most spacious on the coast. Lindi has a good harbour and the town is increasing in importance. Ibo and Mozambique are both on islands, and from Lumbo, on the mainland opposite the latter, a railway is being built towards Lake Shirwa. Mozambique Harbour is protected by the two smaller islands of St. George and St. Jago. A large part of the exports from the smaller harbours along the coast are assembled here.

Dar-es-Salaam, the coast terminus of the Tanganyika Central Railway, is small but well protected and is approached by a narrow channel. It is visited by many dhows as well as by the various lines which have steamers on the East Coast service. As the nearest port to Lake Tanganyika, with which it is connected by rail, and the chief centre of the Tanganyika Territory, it should grow in prosperity with the development of its hinterland. The floating dock was sunk by the Germans during the war, but was raised in 1922.

Tanga, at the Coast end of the Usambara railway, serves the Kilimanjaro highlands and is at present connected by rail with the Uganda railway via Taveta and Voi, but if the recommendations now under consideration are adopted this connection may be broken. In that case Tanga would have a very limited hinterland and would lose most of its trade to Mombasa-Kilindini.

Of Zanzibar it suffices to say that it is a lighter port with a well protected harbour and enjoys excellent steamship connections with Europe and India. Much of its trade consists of transhipment from steamers to dhows of traffic for a long stretch of the East Coast for which it is the entrepot. A deep water wharf, which will enable ocean going vessels to come alongside, is under construction.

The finest sheltered harbour on the coast is Kilindini which lies on the south side of Mombasa Island. It is three miles long, 2,000 feet wide and has a depth of 20 fathoms, while the anchorage is always accessible. As the port of Kenya Colony and Uganda and the terminus of the Uganda railway, its trade is of considerable extent. The present facilities consist of a lighter wharf and the new Mbaraki pier, built on the initiative of Major Grogan, which was subsequently acquired by the African Wharfage Company on a short lease and has recently been purchased by the Kenya
Port Sudan and its Modern Equipment.
Government for £350,000. The wharf is being extended at a cost of over a million sterling, and will then give a total of 1,760 feet of wharfage with quays 50ft. wide. The Magadi Soda Co. has also built a deep water wharf which accommodates one ship at a time. Mombasa itself, on the opposite side of the island, is used principally by dhows and small coasting steamers.

Though Djibouti, at the southern end of the Red Sea, is connected by rail with Addis Abbeba in Abyssinia it will be some years before it is directly in touch with the Cape to Cairo route. Passing northwards, there is the Italian port of Massowah, in Eritrea, and then we come to Suakin and Port Sudan, the former being an ancient harbour which existed long before the railway to Berber was built and is still used by native craft. At Port Sudan, which dates only from the construction of the railway, there is a modern wharf provided with the latest cargo-handling appliances. Here the train comes alongside the steamer. The quays are built on a sandspit which is connected with the mainland by a drawbridge.

Suez, at the head of the western arm of the Red Sea, consists of an outer roadstead—Port Tewfik—and a large basin known as Port Ibrahim. In this basin are wharves capable of accommodating a number of vessels and there is a dry dock over 400 feet long. The outer harbour is protected by a breakwater. The harbour works were constructed from spoil excavated from the Suez Canal. Both Port Ibrahim and the dry dock are to be enlarged.

Port Said, built partly on the sand excavated from the Canal and partly upon silt brought down by the Nile, is not far from the site of the ancient city of Pelusium. The eastward flow of this silt is checked by the Western Mole of the Canal entrance and much of Port Said has its foundations on land so reclaimed. The harbour has an area of about 570 acres and requires constant dredging. There is a floating dock capable of lifting ships of 2,500 tons, and extensive repairing shops. At present cargo is handled by lighters, but work is in progress to transform the area between the existing harbour and the railway station into docks which will provide wharf accommodation for steamers. The scheme also includes the establishment of water communication with Lake Menzaleh to allow lighters to bring produce from the region of the lake to Port Said for transhipment to steamers. A service of stern-wheel paddle steamers has in fact recently been started, and native craft are also at work. Hitherto Port Said has been merely a coaling port at the entrance to the Canal, but this scheme has converted it into a competitive Egyptian port.

Alexandria is not only the chief gateway to Egypt but one of the oldest ports of the Continent. British capital and enterprise have developed its shipping facilities as its trade has expanded.
The new entrance channel has been dredged to enable the largest vessels to reach the port and large extensions of the quays are in hand. It is Alexandria, rather than Cairo, which should, strictly speaking, be regarded as the northern terminus of the great trunk transport system of Africa, and it is from Alexandria that the connection between the Cape to Cairo route and Europe is made, at any rate, pending the time when through expresses will run via Palestine, Syria and Constantinople, linking Egypt with the railway system of the European Continent.

Turning southwards again, and proceeding up the west coast, there is little to be said of the ports south of the Angola boundary. The coast is arid in the extreme. At Port Nolloth the rainfall is about 2½ inches per annum and further north about one third of an inch. Consequently the provision of water is one of the chief problems to be solved. At Port Nolloth it has to be brought five miles by rail in tanks while at Luderitz and Walvis it is necessary to condense sea water. Port Nolloth harbour is at the mouth of the Kamas river and is visited by small steamers from Cape Town, which carry back copper and bring supplies for the mining district in the interior. Luderitz (formerly Luderitzbucht and called Angra Pequena by the Portuguese) is on a well sheltered bay and is connected with the railway system of South Africa. Vessels discharge into lighters, and there is a jetty and landing pier. A new jetty and slipway are under construction. It serves the diamond fields of Pomona and Kolmans Kop together with the southern portion of the interior plateau. Large fish canning factories have been started since the British occupation, and these promise to be successful. Walvis bay is also a well protected anchorage but its cargo handling facilities are confined to a jetty and lighters. A new wharf is, however, being constructed, and dredging operations are being carried out which will enable cargo to be landed and shipped at the wharf. Before the war it was merely a small whaling settlement and one of the least desirable residences to be found on the planet. Its prospects are greatly improved by the construction of the line from Windhoek to Gobabib, and if the scheme to extend this line to Mahalapye, on the Rhodesian Railways, is carried out, it will bring Bulawayo into direct connection with Walvis Bay. A second scheme is to extend the railway from Grootfontein to Wankie, near the Victoria Falls, and thus convert Walvis Bay into a coaling port. This would involve widening the gauge of the existing railway. A cold storage works is being erected at Walvis Bay.

The Germans, deprived of the only harbour worth a name on the coast of their colony north of Luderitz, attempted to make a port at Swakopmund, 21 miles to the north, and built a jetty. The roadstead was very exposed, and soon after
the occupation by South African troops the railway was extended along the shore to Walvis Bay. As Swakopmund is a well built town we have now a curious situation, the township and its port being widely separated. It is attractive as a summer resort, but as a port it is likely to disappear in favour of Walvis Bay.

Mossamedes, the southernmost of the three ports of Angola, is also in the arid belt. It is connected by rail with the highlands in the interior, where there is a settlement of Boers on the Humpata plateau some 6,000 feet above sea level. There does not seem much immediate possibility that it will achieve a direct connection with the Cape to Cairo trunk line.

The central port of Angola was formerly Benguella but as steamers have to lie two miles off shore, it was decided, when the Benguella Railway was planned, to make its coast terminus at Lobito Bay, 22 miles to the north. Lobito Bay is said to be the best harbour between the Congo mouth and Cape Town. Deep water extends to within a few feet of the shore and steamers lie alongside the wooden jetty, over 500 feet long, and discharge direct into railway trucks. A wharf is now under construction which will be 1,300 feet long, with a depth alongside at low water of 36 feet and fully equipped with all appliances for the handling of cargo. A sandspit 1 3/4 miles long and about 1 1/4 miles from the coast makes...
an efficient natural breakwater. When the Benguella Railway makes connection with the main Cape to Cairo line near Tshilongo in Katanga, Lobito Bay will become the nearest port for the rich mines of that province. Terms have recently been arranged for its completion to the Belgian Congo frontier by the end of 1928.

Sao Paolo do Loanda, about midway between Lobito Bay and the Congo estuary, is the capital of Angola and the coast terminus of a railway extending some distance into the interior. This railway, which originally rejoiced in the high sounding title of the Royal Trans-African, was to have traversed the Continent to some point in Portuguese East Africa, but although efforts are being made to extend it to the Congo border it will be some time before it effects a junction with the north and south trunk route. The line is now being reconstructed and the gauge widened, but the work proceeds slowly.

Work on harbour improvements at Loanda was in progress when in March, 1925, the contractors ceased operations because the Government had fallen behind with their payments. The work actually done includes the addition of 220 feet to the original quay wall, the construction of a new Customs warehouse, the reclamation of about three hectares of foreshore, the laying of four miles of additional railway along the water front, and the construction of a steel floating pontoon and gangway for landing passengers.

It will be seen from the foregoing descriptions of African ports, which are necessarily brief on account of their number, that conditions vary considerably, from primitive landing stages to first class ports equipped with the latest machinery and appliances. The constant developments that are taking place in agriculture, industry and transport, makes it necessary that existing ports should increase their capacity and efficiency, and there is no doubt that many of the present minor ports will grow in importance as the territories for which they are the natural outlets develop. New lands are being opened up, railways are extending in numerous directions, and motor transport is taking an increasing part in transport work, and it follows that the sea-borne traffic will be greatly augmented, resulting in a demand for better traffic facilities which it is the duty of the ports to provide.
The predominating influence of the Mohammedan belief throughout the northern part of the Continent is clearly evidenced by this map, as well as the vast Central African region where the natives may be classified as heathens. The number of Protestant mission stations testify to the manner in which missionary work is being pushed forward throughout Africa.
### POPULATIONS
**OF THE CAPE TO CAIRO TERRITORIES**

Compared with that of the United Kingdom.

Total Population of the Territories: **51,175,570**

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**British Territories.**

**Other Territories.**

Total Population of the Cape to Cairo Territories: **51,175,570**
### PROPORTION of White to Native Population in Cape-to-Cairo Territories.

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<tr>
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<th>Native</th>
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<tr>
<td>1</td>
<td>Total Native Population</td>
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<td>2</td>
<td>Total White Population</td>
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<td>3</td>
<td>White Population in Belgian Congo, Portuguese East and West Africa, Kenya Colony, Uganda, Nyasaland &amp; Tanganyika Territory</td>
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<td>4</td>
<td>Native Population in Belgian Congo</td>
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<td>5</td>
<td>&quot; &quot; Portuguese E.&amp;W. Africa</td>
<td>6,700,000</td>
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<td>6</td>
<td>&quot; &quot; Kenya Colony, Uganda, Nyasaland and Tanganyika Territory</td>
<td>12,361,000</td>
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<td>7</td>
<td>White Population in British South Africa (including South West Africa)</td>
<td>33,340</td>
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<td>8</td>
<td>Native Population in Union of South Africa</td>
<td>25,061,000</td>
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<td>9</td>
<td>European Population in Egypt and the Sudan</td>
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<td>10</td>
<td>Native Population in Egypt and the Sudan</td>
<td>7,813,100</td>
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</tbody>
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**Total White:** 1,786,330  
**Total Native:** 49,386,330
SOME LEADING AFRICAN BANK BUILDINGS.

The fine building of the Standard Bank of South Africa, Ltd., at Pretoria, South Africa.

The offices of the Banque du Congo Belge at Kinshasa-Leopoldville, the capital of the Belgian Congo.

The National Bank of Egypt Building at Cairo.
A Financial Retrospect of the Route.

African Banks and Banking.

Within the limits of a single chapter it is only possible to give the briefest of outlines of such a comprehensive subject as African Banks and Banking. The subject naturally divides itself into two sections, for a considerable portion of the Northern part of the continent was commercially developed long before civilisation reached its southern shores. According to history the ancient civilisations resting on the Mediterranean originated principles of banking, which apparently included acquaintance with the selling of bills, the lending of monies, and exchange of currencies. The advantages of even a limited method of banking appear to have been carried by those adventurers to all the lands with which they trafficked, particularly to those countries contiguous to the then overland routes to India. The Portuguese during their quest of a sea route to India found on the eastern coast of Africa communities possessing an organised system of commerce. To the south of Africa knowledge of banking was undoubtedly brought by the white immigrants, who began, after 1652, gradually to settle at Table Bay.

South Africa.

The development of banking in South Africa may be justly said to have kept pace with the remarkable industrial and mining activities of the country, although it is unlikely that there are any records which would determine the exact date when local banking became definitely separated from the ordinary trading of merchants and importers. The receiving of deposits, and the advancing upon stocks and securities, originated and expanded with the requirements of local trade, until finally there grew up establishments dealing only with money and monetary obligations.

A sidelight on early banking days in the Cape was provided by a correspondent in the Johannesburg "Star," who wrote:

The earliest bank in our country was instituted by the special commissioners from the Netherlands, Mynheeren Nederburgh and Frykenuis, as a temporary expedient to tide over bad times. It was in point of fact an agri-
cultural land bank, the capital being raised by simply issuing more inconvertible paper money than already existed. These commissioners had a difficult task to perform. The Cape's expenditure was vastly in excess of its revenue, and the colonists declared they could not and would not pay further taxes.

The arrival of the British with plenty of cash and a considerable army to feed relieved an intolerable state of things, but Lord Caledon (the Governor) in 1807 gave it as his opinion of the Loan Bank that while the intention was laudable the practice had been doubtful. "None of the loans," he said, "were ever repaid, and not only had the necessitous borrowed the money, but others who were paying 5 per cent. for it found it lucrative to lend it in turn at much higher rates and on a class of securities the bank would not have considered." The British Government, however, continued to finance the institution, adding a discount branch for the commercial classes, for some 25 years longer.

Between 1827 and 1833 there were signs of the necessity of retrenchment and the Government bank applied the screw. The public, of course, expressed its dissatisfaction loudly, and suddenly discovered that the management, being that of officials, did not understand commercial and industrial requirements, while the "Commercial Advertiser" endeavoured to lead a movement for a private bank.

An unsuccessful effort of this kind had, I believe, been previously made in 1825.

However, nothing was done until 1837, when Mr. John Bardwell Ebden and others instituted "The Cape of Good Hope Bank" with a capital of £75,000 and unlimited liability—it became limited at a later date. The slave compensation money soon afterwards reached the Cape, but speculative dealings at heavy discount had already passed the proceeds from the country slave-holders to a comparatively few operators at Capetown. Agricultural investments were not looking promising, and the Government was not wanting any loans from anyone; so the people to whom the money came set to work to create joint-stock companies in insurance, trust ventures and more banks; the second one, the South African Bank, was formed at Capetown; commercial activity had followed the troops to the kaffir frontier and a third, the Eastern Province Bank, was established at Grahamstown. These three early banks, unfortunately, were bad models in almost every sense except that they were honestly intended and their promoters men of standing.

The prospectuses which set forth their principles were amusingly ingenuous, and would certainly be the reverse of convincing to-day, probably because the estimable promoters (in common with their clients) knew next to nothing of the theory
and practice of sound banking. The proprietors in each case consisted of a few dozen well-to-do people, and the amount of the capital was not at all impressive. Two or three other commercial groups in Capetown were equally capable of doing the same thing, and probably did not relish the situation of having to bank with their rivals in trade; so in a very short time Capetown had also a Colonial Bank, and a Union Bank, and Paarl, Swellendam, Worcester and other places started their own banks. In the early forties Port Elizabeth had two banks and the Eastern Province contracted what a Bay paper then referred to as the “bank mania.”

Inside of 20 years there arose no less than 30 different banks in various parts of the Colony, and the danger of so many small concerns was enhanced by the fact that there was no adequate legislation to check either fool or knave. In 1862 when the 30 institutions eked out a living by charging 2 to 5 per cent. for cashing one another’s banknotes among a white population of only 150,000, the “Anglo-African” ridiculed the rage for such institutions amongst mere villages, “some banks being so small that many individual men in their districts could shut them up if they cared to.”

When the first British capitalised Bank for South Africa, “The London and South African Bank,” was floated in London in 1861, the existence in South Africa of some thirty local banks was recorded, while in addition in remote districts, some private firms carried on a limited banking business in conjunction with their ordinary trading operations. The Standard Bank of South Africa was established the following year—1862—with the co-operation of important Port Elizabeth merchants. In 1873 the Oriental Bank extended its activities from India to some towns in the Cape Province, Natal, and the Orange Free State, but transferred its South African business in 1879 to the Bank of Africa, which was constituted in London for the purpose. The National Bank of South Africa was created in 1890 under a concession from the then South African Republic, while the South African Reserve Bank was formed under the authority of the Union Government in 1920.

Many absorptions, amalgamations, and disappearances have occurred since the London and South African Bank commenced business, and to-day outside of the South African Reserve Bank, not regarded as a competitor of the commercial banks, the banking business of the Union is carried out by:

The Standard Bank of South Africa, Ltd.
The National Bank of South Africa, Ltd.
The Nederlandsche Bank voor Zuid Afrika.
The Stellenbosch District Bank, Ltd.
The South African Reserve Bank is a consequence of the stringency in metallic coinage which followed the unpegging of the exchanges by the Allies after Armistice. The value of all currencies—except that of the United States, which was able to keep open its Mints—thereupon depreciated bringing about a currency premium on gold. The export of gold was prohibited by the Union Government, but the gains of smuggling were so greatly in excess of the risks, that although the Banks imported substantial amounts in gold coin, it disappeared immediately it passed into circulation. The Government were reluctant to suspend the convertibility of the Bank Note, but finally appointed a Select Committee, which advised the temporary suspension of convertibility, a recommendation which was acted upon, as was also the advice to establish a Reserve Bank, which would have the sole right to issue notes. The South African Reserve Bank accordingly came into existence in the latter part of 1920. The Bank is empowered to carry on all ordinary business except that it may not engage in trade or otherwise have a direct interest in any commercial, industrial, or other undertaking. It may not purchase its own shares, or the shares of any other bank, or grant loans upon the security of same. It may not advance money on mortgage of fixed property or on notarial or other bond or session thereof or become the owner of fixed property except so far as is necessary for its own business premises. It may not make unsecured loans or advances, nor draw or accept bills otherwise than on demand. It may not accept money on deposit for a fixed term or allow interest on credit balances on current account. All Banks transacting business in the Union are required to establish and maintain, in addition to the gold reserves required to be maintained, reserve balances in the bank equal to at least thirteen per cent. of their demand deposits and liabilities to the public in the Union other than notes, and three per cent. of their time deposits and liabilities to the public in the Union. It is claimed that the South African Reserve Bank, possessing the power to purchase mercantile bills with a maturity not exceeding 90 days, will be able owing to its right to issue Bank Notes (which are legal tender) secured to an amount of not less than forty per cent. of gold and as to the remainder in commercial paper or trade bills, and possessing the further right (with consent of the Government) of reducing its reserves below the ordinary legal limit, materially to assist the commercial Banks, should occasion arise, during times of commercial stress or financial panic.

The Standard Bank of South Africa has the distinction of being the only bank domiciled and controlled in London, carrying
on banking operations in practically every town of importance in the Union of South Africa, Rhodesia, and adjacent countries. It is fortunate in having had an official historian, from whose "History of the Standard Bank of South Africa," the following summary of banking events in South Africa has been extracted. As the doyen of the existing South African Banks its history covers the period during which the expansion of the country has been most marked.

As previously mentioned, the Bank was formed in London in 1852, the year after the London and South African Bank had been constituted. The original capital of the Bank was £1,000,000 divided into 10,000 shares of £100 each, £25 paid. In January, 1863, the Bank, through its agents at Port Elizabeth, commenced business by discounting bills, which were paid for by drafts on London. In the following month the Commercial Bank of Port Elizabeth was absorbed, and later the Colesberg Bank, and the British Kaffrarian Bank, were taken over.

From 1866 to 1871 there was a period of lean years of comparative commercial inactivity. In 1867 the Bank acquired its own premises in Clement's Lane, having started in Moorgate St., from where it had soon removed to 101, Cannon Street.

The period of 1870 to 1879 covered the discovery of the diamond fields, the starting of the Donald Currie line of steamers, and a change of policy by the Imperial Government in the direction of expanding rather than contracting its responsibilities. In 1875 the Bank received the appointment of Bankers to the Government of the Cape Colony.

Several local banks disappeared in the seventies. The Agricultural Bank of Queens-town drifted into difficulties and closed its doors in 1872. The Albert Bank at Burghersdorp was taken over on the 1st January, 1874, a date which also saw the absorption of the Fort Beaufort and Victoria Bank, while later in the year the business of the Caledon, Malmesbury and Swellendam Banks were also taken over by the Standard Bank. In 1877 the Transvaal was annexed, the Bank opening branches at Pretoria, Lydenburg, Potchefstroom and Middelburg, in which year was absorbed the business of the London and South African Bank.

The period 1880 to 1889 covered the Boer war which resulted in the retrocession of the Transvaal to the Republic. In 1881 the Cape experienced another severe commercial setback, which among other troubles, brought about the insolvency of the Cape Commercial Bank in 1882, a year memorable for the number of failures and embarrassments announced. Trade remained in a generally depressed condition until the revival of the diamond fields and discovery of the Rand, Jo-
hannesburg being founded in 1886. In 1890 the Chartered Company was established in 1896 occurred the Jameson Raid followed in 1899 by the Transvaal Republic declaring war against this country. The year 1890 saw the collapse of the Cape Union Bank, the Paarl Bank, and the Cape of Good Hope Bank, a considerable part of the business of which was secured by the African Banking Corporation, established in 1891, in addition to which it assisted in consolidating banking interests by taking over the Kaffrarian Colonial Bank, the Western Province Bank, and the Worcester Commercial Bank, being itself absorbed by the Standard Bank in November, 1920.

The second Boer war caused a stoppage of the gold mines for nearly 2½ years and that of the diamond mines for many months, while the great waste and destruction left commercial conditions in South Africa much depressed, from which a gradual recovery occurred until the outbreak of the Great War in August, 1914. During the latter portion of this period and for the two years which succeeded the Armistice there was a great demand for South African products, which undoubtedly led to considerable speculation and overtrading, followed by the period of depression which does not appear to have yet run its course.

The National Bank of South Africa, Ltd., was originally constituted in 1890, under a concession from the Volksraad of the then South African Republic, assuming its present incorporation in August, 1902, by an order in Council. It has at all times been inspired by a consistent belief in the future of Africa, and has taken no insignificant part in the development of the industrial and mining industries of the continent. Since its incorporation many important changes have taken place, emblematic of its constantly expanding business, and widening circle of influence. What may be regarded as the three principal milestones of its history are the absorption of:


The Bank of Africa, Limited, in 1912, and

The Natal Bank, Limited, in 1914.

The National Bank of the Orange River Colony had been in existence for over 32 years, and had a valuable and extensive connection. The Bank of Africa, as recorded elsewhere, was formed to take over the South African business of the Oriental Bank, and until 1901 was managed by Mr. James Simpson, of the Chartered Bank of India, Australia, and China. In 1891 Mr. Austen Chamberlain, until recently leader of the Unionist party in the House of Commons, joined the Board, and remained a director until ten years later he took office under the Government. In 1904 the Rt. Hon. Sir Michael E. Hicks
Beach became a director, and, as Lord St. Aldwyn became chairman, a position he continued to fill until the bank was taken over by the National Bank of South Africa.

The third important absorption was that of the Natal Bank in 1914. The Natal Bank had occupied a very prominent place in its own quarter of South Africa for a very long period, having been established as long ago as 1854. The colony of Natal was then struggling into being. Its European population was small in numbers, but included able and enterprising men of business who had firm faith in the potentialities of the country, and anxious to facilitate its development founded the Natal Bank. The head office of the Bank was at Pietermaritzburg, and for many years the sole branch was at Durban, offices at Ladysmith and Newcastle (Natal) being subsequently added. In 1886 a branch was opened at Pretoria and later branches were opened in the Transvaal, encouraged by the discovery and development of the Rand Coalfield. In 1890 a London Office was established in Leadenhall Street, where the business out-growing the accommodation necessitated a move to St. Swithin's Lane, where it remained until absorbed by the National Bank of South Africa. The Natal Bank experienced many vicissitudes in the course of its long career of usefulness. Many Natalians may remember the crisis of October, 1890, when, after the failure of the Cape of Good Hope Bank, the Natal Bank suffered a severe run from many of its customers, which, however, was successfully met, the restoration of confidence being materially assisted by the Colonial Government placing a large deposit with the Bank. It was of course in Natal that the Bank was best known. It had grown up with the Colony, and played an honourable part in its development. It acted as the banker of the former colonial Government, and after the Union, as banker of the Union Government.

For many years the London business of the National Bank of South Africa, Limited, was carried on at 73, Cornhill, but in 1903 the business was removed to larger and more commodious premises in London Wall, in the same magnificent block of buildings in which are housed the British South Africa Company, the Central Mining and Investment Corporation, Ltd., and a host of other important commercial and financial groups. The offices of the Bank occupies a commanding corner position, one side facing London Wall, and the other looking on to Finsbury Circus, an oasis of greenery, in the summer time, in the very heart of London.

The position occupied on the continent of Africa is indicated by the fact that it acts as Bankers to the Government of the Union of South Africa in the Transvaal, Natal, and
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

THE UNION COINAGE.

The above coins are:—Silver: Two and a-half shillings, florin, shilling, sixpence, threepence. Copper: Penny, halfpenny, farthing.

SCHEDULE.

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<th>Metric Weight</th>
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Standard fineness: Eleven-twelfths fine gold, one twelfth alloy.

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<td>Threepence</td>
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Standard fineness: Eight-tenths fine silver, two tenths alloy.

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<tr>
<td></td>
<td>Imperial Weight</td>
<td>Grams.</td>
</tr>
<tr>
<td></td>
<td>Grains.</td>
<td></td>
</tr>
<tr>
<td>BRONZE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penny</td>
<td>145.8333</td>
<td>9.44984</td>
</tr>
<tr>
<td>Half Penny</td>
<td>77.5</td>
<td>5.66990</td>
</tr>
</tbody>
</table>

Standard fineness: Mixed metal, copper, tin, and zinc.
Orange Free State, and also acts as Bankers to the Imperial Government in South Africa.

The ramifications of the Bank may be gauged from the possession of 107 branches or agencies in the Cape Province, 41 in Natal, 61 in the Orange Free State, 108 in the Transvaal, 2 in Swaziland, 7 in Rhodesia, 4 in Portuguese East Africa, 8 in South West Africa, 2 in Tanganyika Territory, 2 in Kenya Colony, one in Nyasaland and one at Mombasa, owning in addition its own offices and branches at New York, Antwerp, Mauritius and Bombay, with agencies at Amsterdam, Paris, Rome and elsewhere.

On the 30th June, 1922, the right of the Commercial Banks to issue their private Bank Notes lapsed, the sole right of issuing Bank Notes as legal tender reverting to the South African Reserve Bank. A gold refinery has been completed at Germiston, and a Mint at Pretoria. All gold shipped from South Africa can, therefore, be forwarded abroad in the form of refined bars instead of unrefined bullion. The Mint at Pretoria commenced the coinage of silver and copper coins early in 1923, and is now issuing gold coinage with the disappearance of the currency premium.

Under the coinage Act, recently gazetted, the Minister of Finance may cause to be made and issued silver and bronze coins of the weight and fineness shewn opposite. A tender of payment of money, if made in coins which are British coins, Transvaal coins, or Union coins of current value, or of the value in the table opposite, shall be legal tender:

(a) In the case of gold coins, for the payment of any amount.
(b) In the case of silver coins, for the payment of an amount not exceeding forty shillings, but for no greater amount.
(c) In the case of bronze coins for the payment of an amount not exceeding one shilling, but for no greater amount.

A coin shall be deemed to be not of current weight if it has become diminished in weight by wear or otherwise:

(a) In case it is a British coin, so as to be of less weight than the weight specified as the least current weight in the law of the United Kingdom applicable to the coin; and
(b) In case it is a Transvaal coin or a Union coin, so as to be of less weight than the weight specified as the least current weight in the schedule to this Act or as determined by any proclamation under the Act.

**RHODESIA.**

Both the National Bank of South Africa Ltd. and the Standard Bank opened branches in Rhodesia upon the occupation of the country by the British South Africa Company. The National Bank of South Africa have branches at Broken Hill, Bulawayo, Bwana M’Kubwa, Gatooma, Gwelo, Salisbury and Umtali. The Bank Notes of the Union are accepted as legal tender.
BELGIAN CONGO.

The banking system of the Belgian Congo as it is to-day operated, may be said to owe its inception to the venerated Congo pioneer, Colonel Thys. His approach to Belgian financiers with a scheme to establish systematic banking in the Colony led to the establishment in 1909 of the Banque du Congo Belge, and which now has a capital of twenty million francs.

Founded as a limited company, the Colonial Government encouraged the new organism, and in 1911 concluded two important agreements with it, one giving authority to operate as the bank of issue, the other entrusting to it the business of the Colonial Treasury. The note circulation which started in 1912, amounts to-day to some 45,000,000 francs.

This agreement resulted in the bank abandoning certain classes of business, and to cover these actions and to meet the financial needs of the colony, a separate company was formed, namely, the Banque Commerciale du Congo, which transacts all classes of banking business. The present capital of this company is 5,000,000 francs.

At its inception the Banque du Congo Belge confined its business to the chief colonial ports of entry, but in the course of a few years exigencies of trade justified the opening of branches in various up-country stations, and to-day the bank operates over thirty branches and agencies in the Congo and in the mandated territories of the Ruanda and Urundi, thus supplying banking facilities to all important centres between Boma-Matadi on the Atlantic and Dar-es-Salaam on the Indian Ocean.

Trade with countries bordering on the Congo, which accompanied the establishment of the Belgian banks, increased considerably during the years of war; and since then, in spite of resumption of relations with Europe, business between the Congo and these countries has gone on increasing. This current of business caused the Standard Bank of South Africa to open a branch at Elizabethville. Similarly, trade movements westwards, where railway facilities will shortly open up increased trade connections from the Atlantic seashore, caused the Portuguese Banco Nacional Ultramarino to open an agency at Kinshasa in 1919, the object in this instance being to facilitate business with Angola and Portugal. Again, the Banque Française de l'Afrique Equatoriale also opened a branch at Kinshasa in 1922, and carries on business for traders in the French Congo.

The latest arrival in the Congo is the Banque de Bruxelles, which is financially interested in several Colonial enterprises, and which opened its first branch at the beginning of 1923. The six Colonial branches of this bank have now been taken over by the Crédit Général du Congo.
CURRENCIES IN EAST AFRICA

EAST AFRICA.

The changes which during the last few years have occurred in the currencies of East Africa, have evoked much differences of opinion. To attempt to deal with the causes which led up to the various changes would occupy considerably more space than can be spared, and it must therefore suffice to state that trade conditions previous to and immediately following the Armistice resulted in a demand for silver, which caused the price of that metal to touch the record figure of 80½d. per ounce (February 11th, 1920). This naturally enhanced the external value of the Indian rupee, at that time the currency of East Africa, so that its value in Sterling rose to 2 10 27/32d. As all payments in East Africa were calculated on a rupee basis the increase in the value of the rupee meant a serious decrease in the local value of the Pound, and represented a great appreciation in the cost of labour, etc. An attempt was made to fix the exchangeable value of the rupee at one tenth of a pound, but the endeavour was unsuccessful, and finally first a florin and then a shilling was fixed upon as legal currency. The following brief summaries of the different Ordinances may be useful for reference.

19th May, 1898. The silver rupee of British India becomes the standard coin of the East Africa Protectorate.

10th February, 1905. The sovereign becomes a legal tender at the rate of 1½ rupees for one sovereign, and authorising the issue of subsidiary coins representing decimal parts of the rupee as well as the issue of currency notes.

30th June, 1906. Varying the remedy allowances for subsidiary coins.

13th October, 1910. Penalising the defacement of currency notes.

23rd January, 1911. Regulations re currency notes.

13th April, 1918. Legalising the currency notes of British India as legal tender.

26th April, 1920. Authorising the issue of a florin, which shall be legal tender.

10th August, 1921. Authorising the issue of a British East Africa shilling, which shall be legal tender.

7th November, 1921. Making certain changes in subsidiary coins.

Uganda from a Banking point of view has followed in the footsteps of Kenya Colony, and the many changes in the currency of the latter colony during the past year or two have been reflected in this Protectorate. There is perhaps one point on which Uganda differed from East Africa and that is in the use of “Cowries” which were a medium of currency with the Natives up to about 1908-1909. 1,000 shells being the equivalent of a rupee. As far as is known “Cowries” were never
in circulation in East Africa, at least not after the establishment of regular Banks.

The National Bank of India opened in Entebbe, Uganda, in October, 1906, and until 1912 was the only Bank in the Protectorate. The Standard Bank of South Africa, Ltd. commenced operations in Kampala during 1912. There are now branches of the National Bank of India in Entebbe, Kampala and Jinja.

I am indebted to Mr. Hans Pfeng, late manager of Deutsche Ost Afrikanische Gesellschaft for the following information.

By treaty between the Imperial German Government and the Deutsche Ost Afrikanische Gesellschaft of Berlin, dated 20th November, 1890, the latter was granted the right of coinage for the colony of German East Africa. Subsequently, in the years 1890 to 1902 coins of the following denominations and to the following total amounts were minted.

<table>
<thead>
<tr>
<th>Denomination</th>
<th>Total Amount</th>
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<tbody>
<tr>
<td>2 Rupee pieces</td>
<td>Rs 101,708</td>
</tr>
<tr>
<td>1 Rupee pieces</td>
<td>2,148,037</td>
</tr>
<tr>
<td>½ Rupee pieces</td>
<td>179,171</td>
</tr>
<tr>
<td>¼ Rupee pieces</td>
<td>131,672</td>
</tr>
<tr>
<td>Copper pesas</td>
<td>642,067</td>
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</tbody>
</table>

By treaty of 15th November, 1902, between the Chancellor of the German Empire and the Deutsche Ost Afrikanische Gesellschaft the latter renounced the right of coinage. By Imperial ordinance, dated 23rd December, 1903, it was enacted that silver coins should be minted for the East African Colony of the value of 2, 1, ½ and ¼ rupees (2 Rupee pieces were never coined by the Government, those issued by the Company being amply sufficient for the needs of the country). By Imperial Ordinance, dated 30th October, 1904, it was enacted that Bank Notes may be issued in the Colony on grounds of a concession to be granted by the Imperial Chancellor.

On 15th January, 1905, the Deutsche Ost Afrikanische Bank was granted a concession according to which the Bank was entitled to issue Bank notes to the face value of 5, 10, 20, 50, 100, or several hundreds of rupees.

The currency of the Colony was regulated by the Imperial Chancellor’s Ordinance, dated 29th October, 1908, which provided the coinage of pieces of money of the following denominations:

- Silver 2, 1, ½ and ¼ Rupees
- Nickel 10 Heller
- Copper 5, 1 and ½ Heller

A contract between the Imperial Government and the Deutsche Ostafrikanische Bank regulated all the banking transactions between those two parties and a contract between the German Foreign Office and the Bank provided for transfers of money from Berlin to Daressalaam and vice versa. The Bank at Berlin was to accept transfers to Daressalaam to the amount of not less than 5,000 at the rate of 1.3425 marks to
Mr. JAMES RANKINE LEISK, C.M.G.
Director of Barclays Dominions, Managing Director, The National Bank of S. Africa.
the rupee in case the cash in hand at Daressalaam would allow this.

A proclamation by the Governor of 14th June, 1910 ordered the demonetization of copper pesas.

The Governor of the Bank of Abyssinia has been good enough to provide me with the following short note on Banking in that country:

"Up to quite recent years it can scarcely be said that any development at all had taken place, and the only remark that occurs to me on that period is that from olden days the inhabitants had by custom adopted the Maria Theresa dollar as their monetary medium. In about 1897-8 the Emperor Menelik introduced a relatively small amount of coins bearing his effigy, but custom was from the commencement too strong for these, and such of the coins as still remain in circulation are accepted grudgingly in the main centres, and outside not at all.

In that period, information as to which is more or less vague nowadays, the trade with abroad in the products of the country, hides, beeswax, coffee and ivory, must have been small indeed, the population in general having tasted the luxury and convenience of foreign products such as machine made cotton goods, burning oils, etc., etc. The main imports at that time seem to have been arms and cartridges.

In 1900 the beginning of the new era may be said to have arrived, when the French railway from Djibouti linked up the Abyssinian town of Dire-Dawa, and its neighbouring trade centre of Harrar, with the coast.

Then in 1906 the Bank of Abyssinia opened its doors at the capital (Addis-Ababa) and Harrar, and the business of the country began to take on a more modern look.

In 1912 the railway made a start with the extension of its line from Dire-Dawa to Addis-Ababa and the line finally reached the latter town towards the end of 1915.

Meantime the Bank had extended its activities to the West and established an office at Gore, the main trade centre for commerce with the Sudan; and the enclave of Gambia, the terminus of the Sudan Government steamers from Khartoum, began gradually to develop its trade in coffee exported to Khartoum, receiving in exchange salt, cotton goods and generally the European products which the natives were learning to appreciate.

One event of some little importance will be noticed in the Bank report for 1915, viz., the introduction of bank notes. While these are current in Addis-Ababa, the wholly untutored minds of the peasants fail to comprehend how paper can be money and cling to the traditional silver dollar. Even if they could admit that paper could be money, they would vaguely reason that paper could
not be buried safely in the ground, since it would spoil. The amount of the bank note issue is $214,000 at which figure it has remained since the commencement.

The exchange of the silver dollar with abroad is broadly subject to the silver market, but the exchange is further complicated by a prohibition against export of coin and by certain restrictions against transport of coin even between one district and another. The exchange with abroad has been as cheap (from the Abyssinian point of view) as $5 per £stg. 1 (in 1919) and as dear as $12 per £stg. 1 in 1915. At present the rate is about $10 per £stg. 1 with a cheapening tendency. The trade of the country naturally suffers from the possibility of violent fluctuations.

THE SUDAN

The modern development of banking in the Anglo-Egyptian Sudan only started after the re-conquest of the country in 1898. Shortly after this, branches of the National Bank of Egypt, the Bank of Egypt, Ltd., and later the Bank of Athens, were established in Khartoum. The Bank of Egypt failed in 1911 and the Bank of Athens closed their branch not long after. In 1913 the Anglo-Egyptian Bank, Ltd., at Port Sudan and Omdurman.

The currency and coinage of the country is (with one or two minor differences of small importance) the same as in Egypt, that is to say, National Bank of Egypt notes, which replaced the sovereign as the principal legal tender during the war, and still remain so—Egyptian silver and currency notes. English George V shillings and florins are also legal silver currency at the rate of five piastres a shilling.

EGYPT

It is reasonable to suppose that Cairo, being one of the few important trading centres of early Egypt, must have had a comparatively well-defined banking system. Down to the present day it is said that nearly every one in Egypt is a money-lender; the truth underlying the statement is evidenced by the number of private banks which exist. Before these were established merchants used to send groups of gold and silver to European and other markets in exchange for merchandise.

Early in the nineteenth century the commerce of Egypt was small and was confined to trade with France, Italy and the Levant; and its subsequent expansion owed much to the stimulus given to it by the founders of such influential private banking houses as those of the Suares, Cattaoui and Menasse families.
The oldest public bank in Egypt was the Bank of Egypt, Ltd., which liquidated in 1910. It was followed by the Anglo-Egyptian Bank, Ltd., the Imperial Ottoman Bank, the Credit Lyonnais, the Comptoir National d'Escompte de Paris, and the National Bank. Within the last fifteen years a number of banks such as the Ionian Bank, Ltd., the Bank of Athens, the Banco di Roma, (now Banco di Roma per l'Egitto e il Levante), the Credit Franco Egyptien (now Commercial Bank of Egypt) the Banque Belge pour l'Etranger, have sprung into existence. There are twenty, if not more, financial institutions of various kinds operating in Egypt. In addition to those mentioned above, the more important include the Banque d'Orient, Bank of British West Africa, Ltd., and Cox and Co., Bankers, the two latter now merged in Lloyds Bank, the Caisse Hypothecaire d'Egypte, the Credit Foncier Egyptien, the Land Bank of Egypt, the New Mortgage Bank of Egypt, the Agricultural Bank, the Societe Anonyme des Monts de Pierre Egyptiens, Banque Mistr, etc. Some of these, as their names imply, are mortgage banks; and many of them were created solely for the purpose of carrying on land and stock operations.

There is a great difference between the banking of to-day and that which was carried on in Egypt prior to the British Occupation. Then the business of local financial institutions both public and private consisted largely in satisfying the capricious demands of rulers and high Government Officials. Nowadays, the whole tone of banking has improved. Business is conducted more and more upon European lines; there is more real banking and less speculation. The country is settled; its wealth has been enormously increased owing to the development of its agricultural resources by companies formed with European capital, and as a result the banks advance capital with more confidence, knowing exactly where they are as regards security. The deposit business, again, has increased largely as compared with that in the early eighties, when a bank with deposits for £10,000 considered itself unusually fortunate.

It is with the mortgage banks that the fellahen have the most extensive dealings. The Agricultural Bank, from its official character, naturally takes a leading place among institutions of this class; while another important concern of the bank is the Credit Foncier Egyptien. The mortgage banks advance about 60% (sixty per cent.) on the estimated value of cultivable land. The periods range from ten to fifty years, and interest is charged at a reasonable rate 6 to 8% if not more.

Before the Great War there was also much movement in gold at the time Government began to cast the taxes in Lower Egypt. A certain proportion of these
taxes is allocated to the Caisse de la Dette Publique to ensure the service of the public debt. Formerly the money was collected by the Government in the Interior, and was forwarded to the Caisse at Alexandria, with the result that sovereigns were withdrawn from circulation, and had to be replaced at once by gold imported from abroad in order that business in the provinces might not be disorganised. Arrangements were subsequently made, by which the money was paid into various branches of the National Bank of Egypt; the National Bank crediting the receipts to the Credit Lyonnais, the bankers for the Caisse de la Dette Publique and the Credit Lyonnais in turn collecting the Customs receipts and crediting them to the National Bank. By this means, the transport of gold—an expensive and tedious business—was obviated, and a great economy was effected by the substitution of a cheaper (credit) currency. As the gold is replaced now in Egypt by Bank-Notes issued by the National Bank of Egypt (the Government Bank) the collection of taxes is effected in Notes, a part of which is remitted to the Bankers of the Caisse de la Dette Publique viz. the Credit Lyonnais.

The currency of Egypt consists of gold, silver, nickel and bronze, together with Notes issued under authority by the National Bank of Egypt. The Egyptian monetary system is on a gold mono-metallic basis, the unit being the Egyptian pound, which is divided into 100 piastres. As a matter of fact, however, Egyptian gold coins have not been minted for many years, and few remain in circulation. Their place is taken by English Sovereigns, French Napoleons and Turkish pounds, the mean par values and fixed rates of exchange of the coins being as follows:

<table>
<thead>
<tr>
<th></th>
<th>Mean par value.</th>
<th>Legal tariff rate.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sovereign</td>
<td>87.75 piastres</td>
<td>98.45</td>
</tr>
<tr>
<td>Napoleon</td>
<td>87.15 piastres</td>
<td>97.50</td>
</tr>
<tr>
<td>Turkish Pound</td>
<td>87.75 piastres</td>
<td>97.50</td>
</tr>
</tbody>
</table>

The silver coins are 20, 10, 5, 2, and 1 piastre pieces, the nickel are 1 piastre, 5 millièmes 2 millièmes and 1 millième, pieces, and the bronze coins are the millième and half-millième pieces, now out of use.

The notes in circulation are for £E100, £E50, £E10, £E5, £E1 and 50 piastres issued by the National Bank of Egypt under decree, and Government authority.

Cheques find comparatively little favour in Egypt. As on the Continent, Bank Notes are chiefly used, and the number of cheques drawn upon a local bank is small compared with what would be drawn upon a London bank of the same size. In the case of English clients dealing with banks registered under English law, however, the Bills of Exchange Act of 1882 would come into operation.
Section II.

Geological Features of the Route.

THE CAPE TO THE ZAMBEZI.
TANGANYIKA TERRITORY.
KENYA AND UGANDA.
THE NILE CONGO DIVIDE.

Mines & Minerals from the Cape to Cairo.
A General Survey of Mineral Deposits on the Route.

THE COAL DEPOSITS ALONG THE ROUTE.
THE BELGIAN CONGO MINERAL DEPOSITS.
MINERAL OIL AREAS OF THE RED SEA COAST.
A Great African Geologist.

Professor J. W. GREGORY, D.Sc, F.R.S., etc.,

Who may be considered as Britain's foremost Geologist. Professor Gregory was the first to unravel the structure of Central Africa and to explain the origin of the Rift valleys which form such prominent features in the centre of the Continent, and an article on which subject he contributes to Volume I. of this Work. His books are frequently referred to in this Section.
The Geology of South Africa.

By C. W. HOBLEY, C.M.G.

General knowledge of the geology of the Southern portion of the continent has now reached an advanced stage although much detailed work remains to be done. No other part of the continent has received such close attention and the only portion which can be compared with it is Egypt and possibly a few isolated mineral areas such as Katanga.

The outstanding pioneer in the field of research was A. G. Bain. Bain was a road maker in Cape Colony in the fifties of last century; he took up at the age of forty this branch of investigation and before his death in 1864 he gave the world a correct outline of the succession of rocks in the Colony and their characteristics. A little later E. J. Dunn and G. W. Stow made valuable contributions which increased knowledge.

Then came Atherstone, Molengraaff, Draper, Kynasten, Hatch, Corstorphine, Schwarz, Mellor and many others. The present Director of the Geological Society, Dr. A. W. Rogers, F.R.S. and his able staff, among whom may be mentioned Hall, Wagner and Du Toit are year by year clearing up the problems which still remain.

Much confusion was produced in the early days owing to workers in various areas giving different names to what eventually turned out to be the same series, but that trouble has now died away and what may be termed an accepted nomenclature of the formations has been adopted and it bids fair to dominate the whole of Africa from the Cape to the Equator, for workers in tropical Africa usually endeavour to correlate the older formations in Central Africa with those of S. Africa rather than those of Egypt and the Sudan.

A table of Strata will be found overleaf which gives the correlations in the various areas as determined by Hatch and Corstorphine and it may be taken as being the present accepted view.

The oldest sedimentary rocks in the South West of South Africa are known as the Malmesbury beds and the traveller encounters them immediately upon landing at Cape Town for they occur on Signal Hill, Lion's Head and round the flanks of Table Mountain and Southwards towards Fish Hoek. They stretch Northward from False Bay to beyond the Berg River, form the Drakenstein and Olifants R. mountains, their
<table>
<thead>
<tr>
<th>European Equivalent</th>
<th>Southern Cape Colony</th>
<th>Northern Cape Colony</th>
<th>Orange River Colony</th>
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<tbody>
<tr>
<td></td>
<td><strong>Superficial Deposits.</strong></td>
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<td></td>
<td><strong>Umtamvuna series</strong></td>
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<td>Cretaceous System</td>
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<td><strong>Sunday's River beds</strong></td>
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<td><strong>Wood bed</strong></td>
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<td><strong>Zwartkop sandstone</strong></td>
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<td><strong>Enon conglomerate</strong></td>
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<td>Rhetic</td>
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<td><strong>Upper Volcanic beds</strong></td>
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<td><strong>Cave sandstone</strong></td>
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<td>Karroo System</td>
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<td><strong>Red beds</strong></td>
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<td><strong>Molteno beds</strong></td>
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<td><strong>Burgersdorp beds</strong></td>
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<td><strong>Dieymodon sandstones and shales</strong></td>
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<td><strong>Pariesaurus do.</strong></td>
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<td><strong>Upper shales</strong></td>
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<td><strong>&amp; sandstones</strong></td>
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<td><strong>Lower shales</strong></td>
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<td>Permo-Carboniferous</td>
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<td><strong>Upper shales and conglomerates</strong></td>
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<td><strong>Karoo or</strong></td>
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<td><strong>Dwyka conglomerate</strong></td>
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<td><strong>Lower</strong></td>
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<td>Devonian</td>
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<td><strong>Upper Cave sands</strong></td>
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<td><strong>Karroo or</strong></td>
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<td><strong>Red beds</strong></td>
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<td><strong>Stormberg</strong></td>
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<td></td>
<td><strong>Molteno beds</strong></td>
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<td><strong>Beaufort series</strong></td>
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<td><strong>Red beds and sands</strong></td>
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**Note:** The table continues with similar entries for each geographical region.
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**Table Mountain Series**

- Schists, slates, quartzites, conglomerates and Intrusive granite
- Swazi System
- Schists, slates, quartzites, conglomerates and Intrusive granite

**Potchefstroom Series**

- Pretoria series
- Black reef series

*Sometimes called Transvaal system.*

**Klipriviersberg amygdaloid System**

- Boulder beds and volcanic breccias; Elsburg series

**Bird Division**

- Upper Kimberley series
- Main reef series
- Doornfontein slates
- Hospital Hill quartizes
- Hospital Hill slates
- Speckled bed
- Red slates
- Ripple marked bed
- Water tower slates
- Orange grove quartizes

**Doornfontein Division**

- Lower Red slates
- Ripple marked bed
- Water tower slates
- Orange grove quartizes

**Swazi System**

- Schists, slates, quartzites, conglomerates & Intrusive granite

Note.—A dotted line, thus indicates an unconformity.
The actual extent is of course much greater, but they are widely covered by newer formations. Petrologically these beds consist of fine clay slates and quartzites, both of which tend to be micaceous; North of the Cape however, the beds become considerably altered, changing to phyllites, mica and sericite schists via Tulbagh and Worcester. In some places, e.g. in Van Rhyn’s Dorp division, beds of crystalline limestone appear among the slates. The most easterly outcrop of this series is between Mossel Bay and Knysna.

One very dominant feature is the occurrence of great intrusions of granite, which have been forced through these beds, but not into those above—the commonest type being a biotite granite with orthoclase felspar, but variants occur. There is much of this granite in the Cape Peninsula; for instance, it runs from the Lion’s Head to Ska Point and great masses of it are found at Stellenbosch, Paarl, Saldanha Bay and other places.

The Swazi System applies to a great series of rocks found below the Witwatersrand system of the Transvaal, unconformable to it, and they are generally accepted as being the Northern representatives of the Malmesbury System and they bulk large in Swaziland and the Transvaal, and also much farther to the North. They consist of a great mass of quartzites slates and schists accompanied as in the South by vast intrusions of granite and gneiss and in the Transvaal they have been divided into the following three main subdivisions in descending order:

1. Igneous rocks generally basic in character and intrusive in subdivisions 2 and 3.
2. Granite and gneiss and allied rocks intrusive in No. 3.
3. Conglomerate, quartzite, slates in some areas, in others what are probably the same rocks are metamorphosed into phyllites, mica, hornblende, chlorite and talc schists and beds of crystalline limestone also occur.

The granites play an important part in the great region wherein the Swazi System is exposed, for a large portion of Eastern, Northern and N. Western South Africa is granite country. A coarse grained grey type is most common, but red and dark coloured varieties occur and in texture it varies from fine grained to porphyritic and pegmatitic and aplitic modifications are frequent.

Banded, foliated and gneissose forms are inextricably mingled with rock of normal type. Biotite is the commonest mica, but large and small flakes of muscovite are often found, tourmaline and garnet are common in places and the pegmatite series in Swaziland carry cassiterite.

The later intrusive rocks in this group are not of great importance, in some places they take the form of epidiorites and in others they are ultra basic and appear as serpentines.

Newer dykes also often traverse these rocks, they are usually dolerite and may be viewed as marking the volcanic activity of Karroo times.
THE WITWATERSRAND SYSTEM

As regards the distribution of this system, in the Transvaal they occur in the Pietersburg and Barberton districts and at Mt. Mari, in the former area, there is a curious magnetite quartz schist which is also found in the S.W. Transvaal on Harts R. The banded ironstones of Rhodesia may also belong to this horizon; they are best developed between Gwelo and Selukwe and are also to be seen in Bulawayo, Belingwe, Hartley and Victoria districts.

Rocks petrologically very similar to those above described, are found along the Orange R. from Hope Town to the sea, in Namaqualand and in Natal to the N. of the Umtamvuna R. at Inchanga and in the Nkandhla division of Zululand.

Studt maintains that the Swazi system can be correlated with the N'zilo beds of Katanga, the Muchinga granites and schists of N.E. Rhodesia and the Batoka granites and schists of N.W. Rhodesia, thus carrying the occurrence of the system into the heart of the continent. On petrological grounds it would further appear likely that the series of metamorphic rocks which crop out at intervals over great areas on the Eastern side of Africa from Portuguese E. Africa to Kenya Colony also belong to this group.

If this is so, we may truly regard this System as the ancient framework or foundation upon which the bulk of the continent is built. In many places these rocks carry mineral deposits, e.g. gold at Barberton, in Swaziland and in Rhodesia. Copper is also found in these in the N. Transvaal, in Namaqualand and S.E. Rhodesia. As before mentioned tin occurs in certain places.

We must come to the Witwatersrand System, a great and complicated series of rocks which on the Rand reach a thickness of some 23,000 ft.

Lithologically they consist of hard conglomerates, grits, quartzites and slates; the conglomerates are formed of rounded and sub-angular fragments of quartz and quartzite cemented together in a compact mass by the deposition of secondary silica; iron pyrites is abundant and is generally found in crystals strewn throughout the mass in layers parallel to the bedding plane. This conglomerate is the famous gold bearing banket of the Rand and the gold content is so fine and is so masked by the pyrites that it is rarely visible. The general view which persists at present is that the beds represent a great delta or maybe a beach deposit, but that the gold was not deposited concurrently with the sand and gravel, but was introduced later. The origin of this metal has, however, excited a vast amount of discussion and there are various schools of opinion each with a hotly contested theory.

There is, however, one thing certain and that is that the richness of the yield steadily decreases with depth. This is, of course, usually the rule in mining and surface enrichment and cementation zones are well known phenomena. In the case of the Rand, however, the depths are now such that those zones have long been passed through and still the values
decrease. If the beds are a delta or beach deposit this would be explain-
able, for the gold would steadily tend to decrease the farther one receded
from the old shore line, but the conglomerates still persist, and they
usually denote proximity to a shore line. The whole question is, however,
one of great complexity and space forbids it being fully argued out here.
The best exposition extant is that of E. J. Mellor in the Proceedings
of the Institute of Mining and Metallurgy, 1916, and other papers by
this geologist.

The Witwatersrand system is divided into two divisions.
The Lower division in the Transvaal commences at the bottom with
the Orange Grove quartzites which are followed by the Water Tower
slates, the Red slate, the Hospital Hill slates and quartzites and the
Doornfontein slates and quartzites, a total of some 12,600 ft.

At the top of the Orange Grove beds there is a hard belt of slate
highly impregnated with magnetite.
The well-known Hospital Hill series are curious; they are plicated
and minutely faulted to a remarkable degree, whereas the quartzite
beneath and the slates above are normally bedded, and it is thought
that after deposition some chemical change took place which increased
their mass and the beds had to bend, crumple and break to adjust
themselves to the space available. It is possible that the so-called Broken
Beds of the Purbeck series at Lulworth in Dorset may offer an analogous
example of this kind of action.

The Upper division of this system consists of conglomerates, grits
and quartzites with a few slate beds, the quartzites forming the bulk of
the division.

At the base we get the Main Reef series, which although thin are
of great importance as they contain the bulk of the gold deposits; as
previously mentioned they consist of compact conglomerates cemented
together by quartz, the pebbles varying in different areas from the size
of a pea to an ostrich egg. Although they exhibit a great amount of
false bedding, the conglomerates persist in a remarkable manner over a
large area and they have been located and worked along a belt some 46
miles long. There are three gold-bearing zones of which two are in
most cases payable; the Main reef proper is the thickest and has a low
gold output and therefore has to be worked on a large scale to yield a
profit.

Above the Main reef group come the Livingstone reef series, the
Bird reef and then the Kimberley series.

Interbedded with the slates and quartzites of the Witwatersrand
system are sheets of diabase which occur in both the Upper and Lower
divisions; they represent old lava flows, for they maintain the same
horizon over considerable distances. Dykes of quartz diabase and
epidiorite also intersect the beds.
The best known occurrence of the Witwatersrand system is exposed
in the centre of a great eroded anticline formed of the overlying
Potchefstroom system and known as the Rand; for a distance of 60 miles the newer beds have been swept away disclosing the Witwatersrand rocks below and they are also seen in Swaziland and Natal. Their original extent must have been great but the anticlines have generally been removed by denudation.

The Witwatersrand System is not found at all in Cape Colony.

Overlying the Witwatersrand System but unconformable to it is found a series of acid and basic lavas, tuffs, breccias and conglomerates which are grouped together as the Venterdorp System. The lavas are well run in the Heidelberg district and extend to the Vaal River, in the Marico district N. of the Dwarsberg, near Reitzburg in the Orange Free State and North and S. W. of Mafeking. At Kimberley the amygdaloid, slate and conglomerate found in the De Beers and Kimberley shafts belong to this series and it is curious that the outcrop of this system in the valley of the Vaal River in S.W. Transvaal and Cape Colony coincides with the area in which the river diamonds are found and it is possible that they have been derived from the amygdaloid lavas of this age.

The System falls into two divisions: —

The Zoetleif series, with a quartzite belt at the bottom often called the Elsburg series.

The quartzite is followed by a zone of quartz porphyry and trachyte and capped by conglomerates, quartzites and great masses of vesicular lava with amygdaloids.

Above this group come the Pniel series, with quartzite and conglomerate at the base and containing sills of diabase. Then comes a diabase zone and above that again a zone of porphyritic lavas of various types with some quartzite; among these rocks come the Klip River amygdaloids.

In the neighbourhood of the Rand the whole system has a thickness of about 8,000 ft.

Some consider that the Cango conglomerate at the base of the Cape System in the Cape Province is the attenuated representative of the Venterdorp system in that area. This conglomerate is declared by Rogers to contain boulders which by their shape and marking owe their origin to glacial action.

Studt considers that the Kundelungu, Lufira and Kambove beds of Katanga to be contemporaneous.

Whether any representative of this system is found in Central Africa is not yet known.

Under the Potchefstroom, sometimes termed the Transvaal system, are grouped about 18,000 ft. of conglomerates, quartzite, flagstones, cherts, limestone, and the system is in the Transvaal divided into three divisions.

At the base come the Black Reef group consisting of quartzites, slates and conglomerates.
Above these we find a well marked zone of magnesian limestone often very cherty in character and called the Dolomite series.

At the top of the system come the Pretoria series of quartzites, flagstones and slates.

The Dolomite group is of considerable importance as it forms the great water reservoir of the Transvaal and many rivers have their origin in this belt, e.g. the Mooi, Molopo, Harts, Crocodile, Malmani and others. Being partially soluble, underground water has, by its passage, dissolved out many marvellous caverns in various places, aptly called "Wondergaten" by the Dutch. Dolomite of the same type and probably the same age is found in Great Namaqualand and at Otavi in S.W. Africa.

The Umkondo dolomites and associated beds of S.E. Rhodesia probably belong, however, to the Waterberg System.

The dolomite zone is sometimes mineralised and gold is found in quartz veins which penetrate the dolomite in the Lydenburg and Marico districts. Copper galena and manganese also occur. The Pretoria series, also, contain ore deposits; the iron ores near Pretoria belong to this horizon, and gold, lead, copper and cobalt are also found, but not in great volume.

The Cango beds of Cape Colony are thought to belong to the Potchefstroom System and the Griquatown beds and Campbell Rand beds, of the Northern portion of Cape Colony, are also considered to be facies of this horizon.

And in S. Rhodesia this system is believed to be represented by the Lomagundi beds which according to Maufe reach a thickness of about 34,000 ft. in that region.

The Lomagundi series is mainly found in the area West of the Hunyani Range Escarpment near Sinoia and they occur in a syncline about 30 miles wide leaving a strike of N.N.E. and the gold is much fractured and faulted.

The lowest division is known as the Hunyani Range series and is composed of conglomerates and grits at the base followed by sandstones and quartzite, then comes 600 ft. of dolomite, followed by a thick deposit of slate and then about 4,000 ft. of slates and quartzite.

Above this division come the Angwa Plains series made up of alternating beds of sandstone, conglomerate, limestone and slate with intrusions of diorite and altered andesite.

Then come the Mountain sandstone group followed by a thick belt of striped slates, generally reddish brown and purple.

The system is topped by the Piriwiri series of no less than 22,000 ft. in thickness and generally consisting of micaceous and sericitic slate, soft sandstone and graphitic shale. These rocks in S. Rhodesia contain deposits of gold and copper, but not with great persistence. The geology of this region has been well described by the late A. J. C. Molyneux.
THE WATERBERG SYSTEM

The next system in the Transvaal consists of a great thickness of sandstones and grits, with occasional conglomerates lying unconformably on the Pretoria beds of Potchefstroom system.

At the Cape, the lowest beds are the Table Mountain series, some 1,000 ft. thick consisting of conglomerates, sandstones and quartzites with occasional bands of slate, which lie flat upon the much crumpled Malmesbury Beds and the old granites.

They are succeeded by the Bokkeveld series of sandstones, quartzites and slates which are notable because they contain the oldest fossils found in S. Africa, and these enable geologists to correlate them with European horizons. The fossils are mainly trilobites, Homalonotus, Phacops, etc., with Cephalopods such as Orthoceras, Gastropods such as Pleurotomaria and Bellerophon and Brachiopods, of well-known genera such as Lingula, Spirifer and Orthis. These and other types definitely settle the age of these rocks as Devonian, and they form the first bench mark available for comparative purposes.

The Upper group, the Witteberg series, consists of sandstones, quartzites and slates often characterised by a curious fossil or pseudo-fossil called Spirophyton, which many regard as a kind of furcoid, but others again are convinced that it is of inorganic origin. If it is inorganic it is a most remarkable and unique imitation of organic growth.

In the Transvaal this system covers a large extent of country in the North of that Province and it is divided into two divisions.

The lower is characterised by a great volcanic series of lavas, tuffs and conglomerates with interbedded sedimentary zones in all some 8,000 ft. thick. Above these come about 2,000 ft. of slates and soft sandstones.

The Upper division consists of some 5,000 ft. of sandstone, grit and conglomerate.

In the Transvaal the system appears to be very barren in organic remains.

According to Studt the Waterberg system is in Katanga and N.W. Rhodesia represented by the Lubilash beds and he is of opinion that rocks of the same horizon cover a great area in Angola and the Middle Congo, but his evidence for this correlation does not appear to be given.

In the Northern Transvaal there occurs a great and varied area of igneous rocks called the Bushveld Complex. It stretches from 15 miles W. of the Marico R. to 25 miles W. of Lydenburg and is estimated to cover 15,000 sq. miles.

The rocks have on the whole a plutonic character, but in some places are associated with eruptive rocks. The only probable focus of eruption which has been discovered is the crater-like depression known as the Salt pan 25 miles N. of Pretoria.

The age of this great mass of igneous rock has excited considerable discussion, but it is now generally accepted that it represents a mass of
laccolithic or bathylithic intrusions between the Pretoria series of the Venterdorp System and the sandstones of the Waterberg System.

The rocks consist of red granites, both coarse and fine grained, nepheline syenites, basic rocks such as gabbros and norites and, in the Marico and Rustenburg districts, ultra-basic rocks, peridotites and pyroxenites are found.

In the Lydenberg district chromite is found as a segregation product of the basic rocks, copper and silver lodes are found and tin has also been discovered in veins in the red granite.

The intrusion of that wonderful feature of Southern Rhodesia, the chromite and asbestos bearing Great Dwyka of norite, which runs for 350 miles from N.N.E. to S.S.W. through the country, is probably a Northern representation of this great period of volcanicity.

We now come to one of the most interesting series of sedimentary rocks in S. Africa, interesting partly because it contains deposits of that essential mineral, coal, and partly because the beds at the base of the series contain evidence of a radical change in the climatic conditions of the Southern half of the continent during the period of their deposition. The system—the Karroo System—was first named by Bain as long ago as 1856, and very aptly named, for these rocks attain their greatest development in the Karroo region.

The system has been divided into three groups, Upper, Middle and Lower.

The Lower or Ecca series is again divided into three sections and in Cape Province the bottom member consists of a thin zone of shales and sandstones; north of the Cape Province this zone is, however, rarely seen.

Ignoring this shale, the first important member of the Karroo system is the Dwyka conglomerate which, in the Cape Province, attains a thickness of as much as 2,000 ft. and covers an enormous extent of country. It was first thought to be of volcanic origin, but Stow as long ago as 1873 maintained that these beds were of glacial origin and since then this premise has been entirely accepted, for boulders with the characteristic striae have been found, floors of older rocks with unmistakable glacial grooving and with roche moutonnées have been discovered, the varying directions of flow of the old glacier system have been mapped and the deposit is accepted as evidence of one of the most wonderful examples of extensive glacial action in the world's history; in fact the deposit is a fossil boulder clay. The phenomena occurred in late Carboniferous times and the cause has yet to be discovered, for none of the varied explanations adduced afford a satisfactory explanation. It is curious to note that evidence of a prior glacial epoch in the era represented by the Potchefstroom System has come to light.

The glacial phenomena to a less degree appear to have extended North as far as about Palapye Rd., between Mafeking and Bulawayo; North of that, although basal conglomerates occur they do not appear

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THE KARROO SYSTEM

to be glaciated and at Wankie the basement beds are usually sandstone. The Rhodesian facies of the Karroo rocks have been well worked out by Molyneux and Lightfoot.

Above the conglomerate, we find sandstones and shales, the shales being dark grey or black, due to the admixture of carbonaceous matter and the sandstones are often bluish grey and extremely hard; among the shales a peculiar white band is sometimes found, the identification of which is of some value when prospecting this series. These are the richest coal bearing beds, and although the thickness and the succession of the various zones vary a great deal in different areas, the coal seams follow this horizon over great areas with remarkable persistency. The coal of S. Rhodesia is Lower Karroo in age; similarly that of Natal and farther North in the Zambezi valley, and again in the Luangwa valley, the coal is all Lower Karroo. The age of the coal is proved by the plant remains, and these present certain distinctive characters, for the commonest types are the fern-like Glossopteris and Gangamopteris unknown in Europe, but common in beds of the same age in places as far from each other as India, Australia and S. America, and these fossils are thus considered as evidence of continuity of land surface between these places and South Africa in Karroo times.

The coal was apparently everywhere laid down in great inland lagoons of fresh or brackish water.

At the top of the Lower or Ecca series, come a zone of sandstones with occasional shale beds in the Eastern Transvaal, and in the Vryheid district these beds attain a thickness of 600-700 ft.

The Middle Karroo or Beaufort series is divided into three zones of alternating sandstones, mudstones and shales, and in the N.E. of the Cape Province, they are as much as 2,000-2,500 ft. thick.

In Rhodesia they are probably represented by the Upper Matobolo Bed and escarpment grits (described by Molyneux) and these consist of shales with calcareous nodules, ironstone and fine clayey sandstones; the escarpment grits are coarse red sandstones.

The three zones of the Beaufort beds are characterised by the occurrence of the remains of three kinds of primitive sancians—Pariesaurus in the lowest, Dicynodon in the middle and Theriodonts such as Lycosurus in the upper; ganoid fissures also occur in these beds from the Cape to Rhodesia.

The Upper Karroo or Stormberg series is divided into four numbers, the Molteno beds at the base, then the Red Beds, the Cave sandstone and at the top the Volcanic Beds.

The Molteno beds have attracted some attention in the Cape, for the only workable coal in that area has been found to occur in that horizon; it does not, however, compare in quality with the best coal of the Transvaal or Natal. The main bulk of this group consists of gritty sandstones and occasional beds of conglomerate.
The Red Beds are not of great importance and generally consist of purplish and reddish sandstones, shales and mudstones with occasional patches of conglomerate.

The Cave sandstone is, perhaps, the most prominent member of the sedimentary rocks of this group, for it forms a conspicuous cap on many of the plateaux of the Stormberg district and the Eastern portion of Orange R. Province. It is massively bedded, yellowish cream in colour and its outercrops weather into fantastic shapes and in many places the masses of it are undercut into caves.

The close of the Karroo period was marked by great volcanic activity and in the Stormberg and Drakensberg, lavas to the thickness of 4,500 ft. were poured out. These rocks consist of diabases, andesites and amygdaloid melaphyres.

The causes of this activity must have been very widespread, for on the Zambezi we find at the Victoria falls no less than five successive flows of olivine dolerite generally known as the Batoko basalts; again in the Tuli district of S. Rhodesia, we find volcanic out-pourings of the same age.

The period of time represented by the Karroo system is vast and probably extends from near the close of the Carboniferous to somewhere about the top of the Triassic period, probably including the Rhaetic zone.

Representatives of the Jurassic rocks appear to be absent in South Africa, but with the opening of the Cretaceous era great changes in the distribution of the land and water in the Southern Hemisphere took place and the land area formerly extending far to the East and South of the South Africa as we know it to-day began to subside and a gulf appeared, the Northern part of which is now represented by the Mozambique Channel; on its Western and Northern margin beds of Cretaceous age were deposited and these are found at intervals from Mossel Bay up to Zululand. Local oscillations of land, however, occurred, for not all the deposits are of marine origin.

The representatives of the Cretaceous system in S. Africa fall into two divisions, the older, called the Uitenhage series, occurring in patches from Worcester in the West of the Province to Mossel Bay and Algoa Bay on the S.E. coasts and they correspond to the Wealden and Neocomian of Europe.

The newer division, called the Umtamvuna series, is found along the coast of Zululand up to near Delagoa Bay and again farther North, and it corresponds with the Upper Cretaceous from the Gault to the Upper Chalk.

The Uitenhage series has four divisions commencing with the Enon conglomerate at the base, followed by the Zwartskop sandstone, the Wood bed and the Sundays River marine beds.

The Enon conglomerate near Oudtshoorn forms striking hills and it consists of quartzite boulders and pebbles set in a reddish mixture.

The Wood Bed is a glauconitic sandstone attenuating with beds of brown sandstone and conglomerate and often contains many calcified tree
THE CRETACEOUS AND TERTIARY SYSTEMS

trunks. As is well known glauconite is a typical mineral in beds of the same age in Europe and it is remarkable to find it persisting on the same horizon as far away as S. Africa.

A great assemblage of fossils has been collected from their beds; forms, cycads and fresh water mollusca marking the intervals between the marine invasions, cephalopods and other marine mollusca, also echinoderms, marking the periods when the sea flowed through the centre of the Cape Province.

The Upper Cretaceous or Umtamvuna series as previously mentioned occurs on the East coast, from Umtamvuna R. Northward at intervals to St. Lucia Bay in Zululand, then again near Sofala and also in the Northern part of Portuguese East Africa.

They do not appear to be anywhere underlain by the Lower Cretaceous so presumably the sea had not reached this part of Africa at that time. The Upper series, however, are of undoubted marine origin, for a great collection of marine types of mollusca have been made.

Cretaceous fresh water mollusca have been found in a bed of chalcedonous sandstone underlying the sands of the Kalahari desert.

The Tertiary group is almost absent from S. Africa, but small occurrences are found along the coast of Zululand, overlying the Cretaceous rocks and some of the mollusca found in them are said to be Eocene; other authorities again consider these beds to be either late Pliocene or Pleistocene.

For further details the reader is referred to The Geology of South Africa by Hatch and Corstorphine, The Geology of the Cape Colony by A. W. Rogers and the publications of the Geological Survey of the Union and of S. Rhodesia. The first mentioned work has generally been followed in the compilation of the account here given and it is desired to acknowledge its assistance.
### Correlation of the Rock Systems of South and Central Africa—after F. E. Studt

<table>
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<th>Approximate European Equivalent</th>
<th>South African Systems</th>
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<th>N. W. Rhodesia</th>
<th>N. E. Rhodesia</th>
<th>S. E. Katanga</th>
<th>N. W. Katanga</th>
<th>Lower Congo Basin</th>
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<tr>
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<td>Luano Beds</td>
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<td><strong>Waterberg System</strong>&lt;br&gt;Waterberg Beds and Volcanics</td>
<td>Forest, Sijarira and Samkoto Beds</td>
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<td></td>
<td><strong>Witwatersrand Series</strong></td>
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<td>Pre-Cambrian</td>
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The Geology of Northern Rhodesia and Katanga.

Political divisions are of such an artificial character that in considering the structure of the African continent it is obviously impossible to confine oneself to the formations which are within any particular territorial boundary. Northern Rhodesia and Katanga can thus conveniently be taken together. The main difference between the Northern and Southern halves of the continent is this:—In the Northern portion, i.e. from 15 deg. to 35 deg. N. Lat the Cretaceous and Tertiary deposits loom large and constitute the greater part of the terrain, but generally speaking South of that these later deposits are only found on the fringes of the continent, thus showing that the Northern half was submerged to a greater extent in those times than the Southern half. The general succession of the older rocks in South and Central Africa given in descending order is shown in the facing table.

The various formations of the region having been tentatively correlated with the better known rocks of South Africa it is important to examine the tectonics of the area upon which are dependent its present physiography and to a great extent its mineral riches.

There are two main systems of earth movements, an older and a newer. First of all the Nzilo Beds, which are believed to be the representatives of the Swazi system, are folded upon axes which generally run N.E.; these movements were prior to the deposition of what may be called the Transvaal system equivalents; for the slightly disturbed Kabele Beds are seen resting on the highly contorted Nzilo group near the Mutundele confluence.

In the Luvua basin the folding of the Nzilo Beds has the same axial direction, so also have the Muchinga Schists and quartzites in the escarpments bordering the Luano Valley. At the latter place the cleavage planes have only a dip of 15 deg, but the bedding planes have a dip of 70 deg, which is evidence of two periods of stress and movement.

The granite masses which are intrusive in the Nzilo Beds are also pre-Wemashi in point of
time for pebbles from these granites are found in the Wemashi conglomerates. It is possible that the granite intrusions were the cause of this severe folding and of the metamorphism of the series and moreover the source of the tin deposits, for in Cornwall, as is well known, tin is only found near the great granite bathyliths. If we take the Wemashi Beds as being Middle Silurian we may view the intrusions as of Ordovician age and consider them to synchronise with the phase of volcanic activity marked by the Venterdorp series in the Transvaal and Bechuanaland.

When we get a little higher in the series, however, we find the folds of the Kambove beds with a strike of E.N.E. and in the Eastern portion of the country the strike becomes first East and then South East. This South Easterly strike is maintained for 270 miles to near the East Luvenbe River where it becomes S.S.E. and it then swings back abruptly to the North East again.

The curve of the strike course is connected in some way with the intrusive Kifubu granites which mark an era of volcanic activity of later date than the deposition of the Kundelungu Beds and it probably occurred in Mid-Devonian times. The copper deposits appear to be connected with these later granite intrusions.

The major earth folding appears to have ceased towards the end of the Devonian period.

After the cessation of the movements above described there was a period of quiescence during which the Lubilash Beds were deposited, then about the middle of the Carboniferous era, but before the rocks of Karroo age began to be formed there commenced what Studt terms "a series of very prolonged radial dislocations"; these movements he considers continued throughout the Permo-carboniferous period and possibly through Secondary times. They were accompanied by extensive volcanic outbursts and the subsidence of large areas of country.

It is to these subsidences that we owe the preservation of the Karroo Beds from the effects of erosion, and as the Karroo Beds contain the coal seams this is a matter of great economic importance. The Luano depression in North Rhodesia is a vast affair, being about 150-160 miles long and 15-25 miles wide. The level of its floor varies; in the centre of the area near the Lukenshashed - Lusenfwa confluence it is only 1,300 ft. above sea level, but near its extremities the floor rises to about 2,500 ft. This great depression is surrounded by lofty escarpments leading to the plateau country and often 4,000 ft. above sea level.

The Luano Beds in the depression occur as flat synclinal basins having a pitch along their strike from the higher to the lower portions of the valley; they are considerably faulted
and the faults are as a rule more or less parallel to the main escarpments, but transverse faults also occur. In some places "horsts" of the older schists which underly these Luano Beds protrude through the floor of the valley—probably the cores of older antlines.

The faulting bounding the area is complex but generally consists of a number of close and parallel step faults. Their total throw amounts to several thousand feet, and in some places along the escarpment remnants of the basal conglomerates and other beds have been hung up on the steps of the faults at a higher level than the upper beds in the floor of the depression. The Luano Beds, too, are often folded to some extent, this being due to compression as the subsidence progressed.

Another great depression is what may be termed the Upemba "graben" in the Lualaba Valley, and this is roughly parallel to the Luano fault valley and may be considered as being contemporaneous with it.

The faulting along the flanks of the Upemba valleys is of the same character as that which occurs in the Luano region and consists of step faults with a varying throw along a zig-zag line and the valley is bounded by steep broken escarpments, but the sharpness of the outlines has been greatly reduced by denudation. At about 10°30' S. this depression forks to the South forming two areas named by Studt the Mutengule and the Mteni branches, and between the two is a partially subsided "horst" rising about 500 ft. above the floor of the Mteni Valley.

The Mutendele sunk land is four to five miles wide and in it the Lubilash sandstones have been faulted down against the Wemashi conglomerate which is about 1,500 to 2,000 ft. below its level on the Biamo plateau. The Mteni branch is from two to five miles wide extending for about 45 miles and here the rocks of the Wemashi and the Kambove Beds are found 1,000 ft. below the level of the plateau to the South East, and 600 ft. below the level of the Lualaba plains above the Nzilo gorge; these plains have been dropped some 1,200 ft. below the level of the Manika spur.

The Lualaba coal bearing beds occur in small patches surrounded by escarpments of Nzilo quartzites and schists in the valleys of the Kasopi, China, Kawando, and Luwishu tributaries of the main river just North of Lat. 10°0. South of that latitude the Lualaba river runs through a large area covered by alluvial deposits in which a chain of lakes is dotted. These are probably the relics of a large continuous lake which covered the floor of the main "graben" in the pluvial period which corresponded with the Glacial era of Europe.

It is important to discover whether the Upemba sunk land extends N.E. to Tanganyika and whether it has any relation to
that depression; some authorities consider that the Eastern escarpments of this depression extend to that lake South of the Lukuga valley and the Lukuga coal beds lie in its floor, and Studt seems to suggest that this depression may even cross the Tanganyika rift and extend into Tanganyika Territory up the valley of the Malaragazi River. Behrend, however, is of opinion that this depression turns due North about Kabamba Lake and then follows the course of the Lualaba to the North at least as far as Kongolo. According to his view the Lukuga coal bearing beds are in a subsidiary rift which strikes N.N.W. roughly parallel to the trend of Tanganyika.

The remaining marked tectonic feature is the Mweru sunken land. Lake Mweru is said to lie between a pair of parallel faults evidenced by lofty cliffs and the marshy area to the North East called Mwantipa or Elephant Marsh is also enclosed by cliffs with hot springs on its Eastern flank. The fault on the West side of Mweru seems to be continued Southwards along the Eastern flank of the Kundelungu plateau.

This depression seems to die away near Elisabethville; this feature is again, however, not shown on Behrend’s map.

It is not easy to correlate these depressions with what is known as the Great Rift Valley series for the latter are so much newer and at the earliest cannot be said to have commenced before Cretaceous times and the bulk of the movements undoubtedly took place in the Tertiary period. The Southern and older rifts appear to have many characteristics in common with the later series and one is therefore led to infer that they were caused by the same forces which for some reason operated at an earlier date in the Congo and Zambezi area than they did further North. The well-known Nyasa-Shire-Urema valley depression, however, belongs to the later series of earth movements for it cuts across an older depression which runs from Mt. Waller to the Ruhuhu. In an article of this length it is impossible to describe in full detail the lithological characteristics of the various formations and their correlation with the deposits in other parts of the continent must be to a great extent tentative, for the valuable evidence of fossils is absent until we come to the Karroo Beds which have yielded Permocarboniferous flora in the Lukuga area.

The Swazi or Nzilo system in this area, however, generally consists of a series of quartzites and phyllites but the beds are often metamorphosed by intense folding into schists and granulites and also altered by granitic and basic intrusions.

They are often micaceous and contain tourmaline and when greisenised they yield tin. The phyllites are often banded and ferruginous.

In North West Rhodesia these beds have been named the
Chansonsa quartzites near the Luano valley and they consist of compact red and white quartzites with quartz conglomerates and some red phyllites. In the East Muchinga Mountains the same rocks have been highly metamorphosed and become micaceous with kyanite, andalusite, garnet, and tourmaline and the phyllites have become sericitised.

The Transvaal system is probably represented in the area by the Kundelungu series followed by the Lufira, Kambove, and Wemashi Beds, and the basal beds consist of carboniferous conglomerates, greywackes, and shales followed by beds of dolomite interbedded with shales and sandstones; they carry copper and iron deposits. The upper beds consist of a series of red shales followed by sandstones and quartzites. The Mafingi Beds of Northern Nyasaland described by Andrew and Bailey probably belong to this group, and also the Tanganyika sandstones which are 3,000 ft. at the south end of that Lake.

The Waterberg system is correlated with the Lubilash Beds and the rocks of this period are believed to cover large areas of the country in the extreme west of North Rhodesia, Angola, and the Middle Congo Basin. They generally consist of soft reddish sandstones, and coarse conglomerates with intercalated layers of quartzites and shale.

Then comes the Karroo system represented by the Luano Beds of North East Rhodesia, and the Lualaba Beds of Katanga (about S. Lat. 9.45 deg.). They are characterised by a basal conglomerate or breccia varying from 80 to 200 ft. thick, then about 4,000 to 400 ft. of alternating shales and sandstones with coal seams capped by 200 to 900 feet of clays and sandstones. They occur in low lying areas characterised usually by a distinctive flora.

No account of the geology of this region would be complete without some reference to the mineral deposits of Katanga and North Rhodesia.

The copper deposits are confined entirely to the rocks of the Transvaal system and generally to the dolomites of the section of it named the Kambove Beds.

The copper belt is about 250 miles long, and 50 to 60 miles broad, and follows the general strike of the rocks. It is often characterised by broad bands of fault breccia. In depth the deposits follow the cleavage of the rocks which often cuts across the original bedding at a considerable angle. At Kansanshi, however, the rocks are not cleaved and the strata have been thrust up into a dome and long parallel fissures occur filled with copper ore. These fissures are wedge-shaped and decrease in width with depth. At the Bwana M’kubwa mine the strata are apparently vertical with an interbedded ore bearing body; it may be, however, that this is only a fissure parallel to the bedding plane.
At the Star of the Congo Mine the rocks are cleaved and the ore zone at depth is parallel to the cleavage. The ore deposits are generally lenticular in plan; at the south east end of the belt they occur in proximity to a mass of intrusive granite.

The folding of the Transvaal rocks of Katanga appears to be connected with the great granitic intrusions and the copper deposits are a result of these intrusions which first fractured the rocks and then provided the mineral bearing solutions.

Gold is found to some extent in association with the copper ores. It has been discovered in the rocks parallel in distribution to the cupriferous veins and accompanied by palladium, platinum, and vanadates of copper and lead.

At Kambove: the first camp on the discovery of the famous Copper Deposits in 1904.
GOLD, COPPER AND TIN DEPOSITS

At Ruwe the gold seems to occur in two dyke-like bars of rock which is now decomposed to a red clay and was probably originally a basic igneous rock which cut across the strata.

Gold is, as may be expected, found in the streams, particularly at Kambove, Likasi, Musonoi, and Ruwe. The quartz veins in the Nzilo Beds and the lower Kambove Beds are often auriferous but are rarely rich enough to warrant exploitation.

There are large quantities of iron ore in the area, usually haematitic and often carrying manganese. The ore bodies are interbedded with the rocks and are very persistent, they can be easily traced on the surface for many miles. These beds all occur in the dolomite series and not far removed from the copper deposits. South of Katanga they become magnetic and schistose and in the north they give place to beds of limonite.

At Kasekelua in the Lufupa River basin an important cupferous pyrolusite is found in the Wemashi conglomerate. Lead and zinc occur in large quantities at the Broken Hill Mine in North West Rhodesia, the rock as far as it has been explored is a dolomite breccia cemented together by ore, mainly oxides and phosphates, but lead-zinc vanadates also occur.

The tin deposits which have recently excited considerable interest are found in the old Nzilo rocks in the Urua district, similar deposits in the same rocks have come to light in the South East Katanga and North East Rhodesia. As in Cornwall the tin is near the granite bathyliths in veins in quartz mica schists and tourmaline rock. Some of the veins are pure quartz and others are pegmatites carrying lithia mica. In the South East they are associated with a greisenised rock which carries topaz.

There are also alluvial gravels carrying tin derived from the veins. Cobalt ores are found in certain places in association with the copper ores.

Uranium ores are now beginning to be discovered in various places, but information as to their horizon is scanty.

The papers published by F. E. Studt, and J. Cornet on this origin have been freely utilised in compiling this account and are gratefully acknowledged.
Diagrammatic
Geological Map of Tanganyika Territory.
The
Geology of Tanganyika Territory.

By DR. E. O. TEALE, F.G.S.

TANGANYIKA Territory (formerly German East Africa) is the most extensively explored, as regards geological investigation, of all the regions of Eastern Equatorial Africa. Nevertheless, only the merest outlines of its main geological features are known and large portions of this vast country amounting to about 365,000 square miles in total area have never been visited by the geologist. Less than thirty years ago, apart from the disconnected scraps of geological information gathered from the early traverses of Burton, Speke, Livingstone, Cameron, Stanley, Elton, Thomson, Fischer and a few others, our knowledge of the geology of this extensive area was almost entirely a blank. Now just enough is known to show that it is one of the most varied and interesting regions, geologically, of eastern equatorial Africa—a promising field for future work, certainly offering a rich harvest scientifically, and with some hope also economically.

With a few exceptions, the geological work up-to-date has consisted of reconnaissance traverses which provide a rough framework of the structure as a whole, but necessarily leave large intervening areas entirely unknown. Of the early explorers, the journey of Joseph Thomson 1875-1880, from Dar-es-Salaam to Lakes Nyasa and Tanganyika and back to Bagomoyo provided the best glimpses of the geology of the interior.

A few years later the expedition of G. A. Fischer, (1), 1882-1883, in Masai Land provided an interesting collection of rocks which were petrologically described by O. Mügge (2). These included a number of interesting types of ancient crystalline and young volcanic rocks.

In 1896 Stromer von Reichenbach published the first general account of the geology of this region, but it was not till a few years later that comprehensive traverses by competent geologists were undertaken. Of these, the work of Bornhardt (3) in the years 1895-1897 and Dantz

The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

(4) 1898-1900 were the most important, and the contributions of these men still rank among the most useful sources of general geological information concerning the geology.

Among the numerous other explorations which contributed geological information, the names of Hans Meyer, Teppelskirsch (Werner's Expedition), Uhlig and Fritz Jaeger should be specially mentioned.

In common with the highlands of Eastern Africa of which the Territory forms a large and important section, the origin of the surface features is due to the complex interaction of geological processes in which long cycles of erosion interrupted intermittently by powerful tectonic disturbances have resulted in some striking topographical characteristics. Hence we find large monotonous featureless areas or steppes, in which erosion is now at a minimum, alongside other regions which are physiographically young, subjected to active erosion and providing attractive scenery on account of the high relief. Thus there are the isolated highlands of Usambara and Pare rising above the surrounding steppes, or the imposing and much dissected mountain block of the Uluguru Mountains as seen from the Central Railway at Morogoro. The straight-line eastern boundary of the Usagara-Nguru Mountains overlooking the Mkata-Wami plains, marks in a very defined manner the eastern edge of the central plateau and highlands. More striking still however, are the lake troughs of Tanganyika, Rukwa and Nyasa, along the western portion of the Territory forming part of the western Rift line and again the remarkable features of the eastern rift between Killimatinde on the Central Railway and its continuation in Kenya Colony north of Lake Natron include a complex system of fractures, trough faults, step faults, isolated lake basins, an array of giant volcanic cones and craters and a succession of basaltic and alkaline lavas.

Another topographical feature which has always excited the comment of the general traveller and induced controversial discussions among geological observers is the "Island-Mountain-Landscape" (Inselberg Landschaft). It is a topography common in many parts of Africa and is usually found in areas occupied by crystalline rocks. In these regions, scattered isolated hills occasionally in groups, but rarely showing any linear arrangement, rise abruptly, often with bare rocky unscaleable summits, above the general surface of the peneplain on which they stand, like islands in the sea. They are clearly residual hills representing an advanced stage in a long erosion cycle and they appear to have no refer-

NOTE.—A useful bibliography including the more recent literature is to be found in the section dealing with East Africa, by W. Koert—Beiträge zur geologischen Erforschung der Deutschen Schutzgebiete. Heft 1., Berlin, 1915. Also J. W. Gregory, Ritt Valleys and Geology of East Africa, 1921.
THE CRYSTALLINE ROCKS

ence to existing river systems although some claim they are the stumps of the hard cores of intrusions which have better resisted a long period of erosion. Some consider that they are due to marine erosion but they generally occur in areas where there is no evidence of past submergence below sea level. Bonhardt suggests that they were produced first by the deep dissection of a plateau, the plateau being submerged and covered with sediment, then uplifted, and following the uplift the dissection of the area by a new drainage system transverse to the original series leaving a series of more or less rectangular blocks and developing the Island Mountain topography.

Whether or not it is necessary to have exactly the conditions postulated above, it is generally accepted that ordinary atmospheric weathering processes including temperature effects, are an important factor in the modelling or sculpturing of these hills. Naturally any differences in hardness, structure or rock composition will materially affect or perhaps favour the development of these isolated and abrupt hills, but it appears that often they have resulted from the erosion of a rock mass possessing remarkably uniform characteristics.

In the southern portion of the Territory, inland from Lindi along the route to Songea this type of topography is remarkably well-developed the less advanced stage is well illustrated in the western Nguru region.

A discussion of the Geology of the region may be conveniently grouped under the following heads—

1. The Crystalline Rocks and associated ancient Sediments.
2. Less altered, Pre-Karroo Sediments.
3. The old intrusive Rocks.
4. The later Sediments, from Karroo to Recent.
5. The young Volcanic Rocks.
6. Tectonic Considerations.
7. Economic Geology.

The crystalline rocks form the foundation of the country and outcrop probably over about three fifths of its area. Apart from a coastal zone of sedimentary rock, narrow in the north and widening out considerably towards the south, these rocks form the dominating feature of a great part of the country. The prevailing rocks of this group are the gneisses, which include types showing a wide range in mineral composition from light coloured acid varieties to dark rocks in which ferro-magnesian minerals bulk largely. No definite generalization can yet be made concerning the succession and distribution of the members of this great system. Biotite-gneisses appear to be the commonest type, but hornblende gneisses should come a very close second, and in some areas are the prevailing type. The latter are particularly common in the Uluguru Nguru and Usambara regions and here also the abundance of garnet,
Dr. E. O. Teale commenced his professional career in Australia where he spent his early years. He learnt his geology from Professor J. W. Gregory, who has trained so many good men. His first work in Africa was in the Mozambique Co.'s Territory in company with Capt. R. C. Wilson; he then entered the Colonial Office service as assistant geologist on the Gold Coast. He was later transferred to Tanganyika Territory, to carry out a geological survey of that region. Financial stringency, however, stopped this work and he is now again serving under Dr. Kitson in the Gold Coast Colony. His wide knowledge of the geological structure of Africa and his ability will undoubtedly speedily place him in the front rank in his profession.

Fault Breccia along N.W.—S.E. Fault in Karroo Sandstone, near Hot Springs to South-east of Behobeho.

Jurassic Beds consisting of limestone, calcareous sandstone, with pebble bands, dipping south-easterly, west of Kidugalo, Central Railway.
which is very widespread throughout all the crystalline areas, is particularly striking. Pyroxene is frequently also an important constituent of the gneisses of these areas.

Muscovite-gneiss is rare. A cyanite bearing gneiss is found in the railway cuttings of the Central Railway between Ngerengere and Mikessi and in the western portion of the Nguru region it is frequently met with.

Sillimanite bearing gneiss occurs in the Uluguru Mountains and near Mpapwa, close to Tubugwe. Andalusite gneiss is recorded from the Ulugurus, and some fine examples of scapolite gneiss occur in the Nguru Mountains and near Tubugwe, east of Mpapwa. Scapolite bearing rocks would appear to have a wide distribution in the Territory and in Eastern Africa generally.

Graphitic gneiss often passing into graphitic schist is abundantly developed in some areas, the best known of which are the Uluguru Mts., the hinterland of Lindi and the vicinity of Handeni.

Hypersthene bearing rocks with a wide range in composition are known from scattered localities in the Pare and Usambara regions and as Gregory has pointed out in Kenya Colony, the Charnockite series would appear to be well represented.

Amphibolites, granulites, pyroxenites and hornblende schists have a wide distribution, but little is known concerning their relationship to the prevailing gneisses.

J. Parkinson described a highly metamorphosed sedimentary series in Kenya Colony from the Turoka District, which includes quarzite and crystalline limestones.

This series probably has a great extension throughout Tanganyika Territory, for large deposits of crystalline limestone, usually dolomitic, and associated with graphitic rocks occur at intervals over a great length of strike, mainly in the eastern zone of the crystalline region. The better known of these occurrences are found on the Umba Steppe about 20 miles west-north-west from Moa, in the Handeni district, and along the eastern side of the Uluguru Mts., where in the vicinity of the deeply cut Ruvu valley many fine selections are exposed. Many other isolated occurrences of a similar nature are known. Some of these limestones show considerable metamorphism with the development of the usual silicate minerals, such as diopside, fosterite and wollastonite.

Other types of altered sediments occur as disconnected outcrops further inland. These resemble certain ancient rocks of Rhodesia and the Transvaal. They consist of highly altered conglomerates, often auriferous, quartzites, sometimes very ferruginous and passing into rocks identical with the so-called "banded ironstones" of South Africa. Argillaceous rocks, chiefly phyllites, are also known. These rocks are usually strongly folded and steeply inclined and occur mainly in the

northern portion of the country in the large granite area to the south and east of Victoria Nyanza.

They appear to be of the nature of huge blocks which have been engulfed in the granite magma, and are associated with some of the gold occurrences of the country.

In the Kinga Mts., to the north-east of Lake Nyasa and rising to over 10,000 feet, there is a series of highly inclined sediments in which phyllites prevail. These were referred to by Elton and Thomson and later described by Bornhardt. Kuntz regarded these as probably of the same age as the more siliceous beds previously referred to south of Lake Victoria and he tentatively correlated them with the Witwatersrand beds of S. Africa. F. Behrend (1918) included them with the Kabele System of the Eastern Congo and grouped them with the lower part of the Transvaal System.

Scholz divides the sedimentary rocks of the Kinga region into two distinct groups, an older and highly altered series resembling those of the Swaziland System and a later less altered group which he correlates with the Cape System. The older group would be one to be included with those of Kuntz to the south of Lake Victoria.

Regarding the dip and strike of these ancient rocks as a whole, it may be said that the general trend or grain of the country lies between north-west and north-east but there are many local variations in which the departure from this direction is considerable. In the western portion of the Territory, the strike would appear to be generally between north- and north-west and the dip in the region of the rift disturbance is usually at a very high angle. Along the eastern margin in the Uluguru, Nguru and Usambara Mountains the prevailing direction lies between north and north-east, but to the south of the Masai Steppe it is much disturbed and the trend more closely approaches an easterly direction. The great granite intrusion to the south of Lake Victoria has evidently greatly disturbed the older rocks, for a very varied orientation is also found in this area. Intense folding has certainly taken place in some regions, but in the eastern margin uniform low dips easterly or south-easterly are often a noteworthy feature; particularly in the Usambaras. Along both Rift Zones striking disturbances have been frequently recorded by Bornhardt, Dantz, Uhlig and others.

The second group discussed is the Pre-Karroo (less-altered sediments).

These formations include a series of sediments chiefly sandstones, argillaceous beds and conglomerates, which beyond induration, often show no further alteration. They are usually flat-lying or only slightly folded and are only disturbed to any extent in the neighbourhood of faults. They have been included by Behrend * with another unfossiliferous group—the Kundelungu Beds of Eastern Congo, in the Tanganyika Sys-

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THE MLAGARASI BEDS

tem. They have, however, at different times been assigned an age by various geologists ranging from Pre-Cambrian to Karroo, and their correct position in the geological succession is one of the outstanding problems of Central African geology.

The Karagwe beds, a name given by Scott Elliott * and Gregory to certain sediments in Uganda and Kenya Colony regarded as Pre-Karroo in age are extensively developed in the vicinity of Bukoba and in the region generally to the west of Lake Victoria. They extend into Uganda in the north where they have been recently examined by E. J. Wayland † who groups them in what he terms the Argillite Series and since he has found obscure plant remains in certain of the beds he is inclined to regard them as most probably Karroo in age. It is possible that when more is known about these rocks it may be found that at least two distinct series are represented.

The rocks comprising the Mlagarasi Beds are largely developed along the Mlagarasi River along the northern portion of the eastern side of Lake Tanganyika. Coarse sandstone, often reddish in colour, arkose and conglomerate prevail. Dolomitic limestone, and red, grey and dark clay shales also occur.

Lithologically these resemble the Kundelungu beds but no complete section showing the regular succession observed in the Eastern Congo region has been noted and there would appear to be rapid changes laterally in the composition of the beds. Tornau claims to have recognised typical wind worn pebbles in beds along the Mlagarasi indicating aeolian condition of deposition in part, but many of the conglomerate and argillaceous beds must be subaqueous. The relationship of these beds to the Karagwe Series is not clear and though they were originally regarded as probably Karroo, Behrend indicates that the balance of existing evidence is in favour of grouping them together with the Kundelungu beds and correlating them with the Potchethystrom (or Transvaal) System of South Africa.

The third group consists of the Old Intrusive Rocks.

The most extensive of these occurrences is granite, which is often quite unfoliated but like the Rhodesian Granite has a tendency to show foliation round the margin. It is the dominant rock north of the Central Railway line from Kilimatinde to Tabora and extending to the southern and along the eastern shore of Lake Victoria. It occurs again in the extreme south along a portion of the eastern shore of Lake Nyasa. Probably many other outcrops will be discovered when more detailed work is possible. Pegmatites are particularly abundant throughout the crystalline rocks and have come into prominence in many parts on account of

A TYPICAL WATERFALL IN TANGANYIKA TERRITORY.
the large sheets of valuable mica that they have yielded. The most notable areas in this respect are the Pare, W. Usambara and Uluguru regions. Another group, important economically, includes the ancient dolerites (diabases of German writers) and diorites often showing considerable alteration and recrystallization. These rocks also occur mainly in the northern granite area and are intimately associated with certain of the gold occurrences, as at Sekenke and Ikoma.

We come now to the fourth group—the Later Sediments, from Karroo to Recent.

1. The Karroo System. This group of sediments provides the first undoubted fossils in the country, consisting of a fresh water fauna and terrestrial flora, embracing fossil fish, fresh water mollusca and commonest of all, the typical fossil fern, glossopteris, which clearly correlates the beds with the Karroo System, the important coal producing rocks of South Africa. At least eight widely separate localities where these rocks occur are known. These, however, are distributed along two distinct zones, a far inland or western, and an eastern or coastal zone.

The western occurrences are in the form of down faulted blocks, let into the ancient crystalline complex and occurring at intervals along the line of the western Rift. From north to south the following areas are known:—Rukwa, Yenda-Malila, Songwe-Kavira and Ruhuhu. Similar occurrences continue southerly into Nyasaland and Portuguese East Africa. They represent remnants, preserved by faulting, of once much more extensive lacustrine basins. In Tanganyika Territory with the exception of Yenda-Malila all are known to be coal bearing. The largest individual area is that of the Ruhuhu on the eastern side of Lake Nyasa, but the coal seams are thin and impure. The Songwe-Kavira region to the north—north—west of Lake Nyasa has received the most attention and is noteworthy for the large number of coal seams occurring in a relatively small vertical distance. Many of these are too thin to work and the coal is of variable quality, but certain seams would be valuable if situated more favourably economically. Further details concerning the coal will be given under the economic section. Bornhardt recognised a two-fold division of the beds, briefly indicated as follows:

(i) Upper Division—Friable Coarse grained sandstones, sandy clay-shale, shaly sandstone, beds with calcareous concretions, calcareous sandstone and non-fossiliferous limestone.
(ii) Lower Division—(a) Shale zone about 20 m. thick, consisting of dark carbonaceous clay-shale and coal. (b) Thick bedded massive sandstones. (c) Basal conglomerates.

In the eastern or coastal region the following four areas are known: the Kidodi, Rufiji, Tulo and Tanga districts respectively, and these have recently received some attention with a view to testing their coal possibilities, since they are more favourably situated economically, with regard to utilizing the coal should it be present in workable seams. The Kidodi district is roughly about 50 miles south from Kilosa and forms an isolated area surrounded by gneiss. The Rufiji region lies
about 20 to 30 miles south-east of Kisaki or 80 to 90 miles in a direct line from the coast at the mouth of the Rufiji which is navigable for shallow-draught boats to the eastern margin of this area. Tulo is about 30 miles in a straight line south from the Central Railway at Mikese. This region is a northerly continuation of the Rufiji, being only separated from it by a wide mantle of recent alluvium. Conglomerates, felspathic sandstones, carbonaceous shales, grey shales and calcareous sandstones recall the lithological features of the western areas, but the complete section is not revealed, and details of structure are sometimes complicated by faults. The boundaries with the crystalline rocks are, in part at any rate, marked by faults, but the margins require closer investigation. Well preserved fern impressions of glossopteris at several localities in the Rufiji area indicate that the rocks are of Lower Karroo age.

To the east of the Rufiji and Tulo regions the Karroo beds disappear either under recent alluvium and superficial deposits or directly under Marine Jurassic rocks.

In the Tanga region the beds actually reach the coast between Tanga and Moa where they are fringed by recent coral rock and mangrove swamps. They extend inland for a distance of 15 to 20 miles to the eastern margin of the crystalline rocks. The actual contact is masked and there is no evidence as to whether or not it is a fault junction. Good sections are exposed along several of the streams flowing seawards which have cut well into the strata, notably the Sigi and Msimbazi. The intervening areas are usually covered with a mantle of superficial deposits of sand and gravel. A three-fold division is roughly recognizable.

It is noteworthy that up to the present no glossopteris has been recorded, and that the fossil plants collected by Bornhardt and recently by Mr. Wade and myself and examined by Professor Seward, agree in indicating a higher horizon than the beds to the south. They moreover indicate European, rather than South African affinities.

These rocks extend northerly into Kenya Colony, where they are represented by the Duruma Sandstone Series which also contains dark shales in which Gregory found on the Sabaki abundant freshwater mollusca identified as *Palaeonadonta fischeri* which indicate a probable Permian or Permo-Triassic age, but the fossil evidence both for the correlation of the adjoining regions and for the relationship with the typical Lower Karroo beds to the south and south-west is inconclusive.

No glacial conglomerates corresponding to the Dwyka of South Africa have yet been recognized anywhere in the Territory.

**Marine Jurassic Rocks.** This period marks an important change in the physical geography of the region. Fresh water and continental conditions which persisted throughout the vast ages in the geological history of this part of Africa up to the close of the Karroo period, gave place along the continental margin to marine conditions. An extensive foundering of an ancient land surface over part of what is now the Indian Ocean took place and the sea invaded and transgressed over land areas never before sub-
merged beneath the sea, advancing in some places inland to perhaps 100 miles from the present coast line. The outline of Eastern Africa began to assume a shape more approaching its present configuration but many oscillations occurred, and throughout the Jurassic, Cretaceous and Tertiary periods a complex alternation of marine deposition and erosion followed along the coastal zone, the details of which are imperfectly known, but the broad outlines are indicated in the fossiliferous rocks which build up the greater part of this area.

The lowest Jurassic beds, the Lias, and the uppermost, the Portlandian beds, are not known in the Territory, but nevertheless the intervening horizons are well represented, forming an important part of the surface of the coastal zone from Tanga in the north to inland, from Lindi, in the south.

The rocks comprise pisolithic and oolitic limestone, calcareous sandstones, and fossiliferous limestone. The most notable region is in the Tendaguru district north-west from Lindi where the succession contains both Jurassic and lower Cretaceous beds which are remarkable for the great abundance of the remains of colossal reptiles. The Gigantosaurus, whose bones have been found here, was probably the largest animal which ever lived on the earth, easily eclipsing in size Diplodocus, its American relative, which formerly held the record as the largest reptile, fossil or living. The thigh bone of Gigantosaurus measures 11 feet, in contrast to that of Diplodocus, which was only $3\frac{1}{2}$ feet and it is calculated that the African animal must have stood at least 20 feet high. The Tendaguru region must have been an enormous ancient reptilian cemetery, for bones in great quantities have been unearthed from this region and apparently there is still a vast amount of material still awaiting careful extraction and examination by experts.

**Cretaceous.** Cretaceous beds are extensively developed in the coastal region between Kilwa and the Rovuma, where beds ranging from Wealden to Aptien are well developed. Fossils from this series were first described by G. Müller from Bornhardt’s collections but they were later investigated in more detail by Fraas and more recently still by the Tendaguru expedition.

The original Makonde beds of Bornhardt are now much restricted, the lower portions having been removed to the Jurassic, leaving mainly the Newala Sandstones which extend inland to over 100 miles, forming plateaux which in places rise to well over 2,000 feet above sea level. They consist of extensive terrestrial deposits, often containing much silicified wood. Scholz* in a traverse through the low country to the

NOTE.—The results of the Tendaguru Expedition including the observations of Janensch, Hennig, Staff and Zwierzycki, concerning not only the description of the reptilian occurrences but containing other important contributions to East African geology form a valuable publication, Archiv. für Biologie Bd., 1914. Heft. 3 and 4.

The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

Western face of West Usambara Highlands, regarded as an eroded fault scarp about 1,000 feet high, seen from near Mkumbala. The Tanga-Moshi railway skirts the base for more than 50 miles. It forms an imposing feature along the railway route.

Calcareous Linter Terrace deposited from Hot Springs rising along fault line in Karroo Rocks, near Lake Tagalala, S.E. from Bohobeho, Rufiji Region.
south east of Mahenge between the Mahogo Mountains and Luvegu stream passed through an area for three days strewn with silicified tree stems 25-35 feet long up to 33 inches in diameter, belonging to the species *Dadoxylon dantzii* (Potonié), and weathered out of these deposits.

The following table after Hennig and Janensch gives the sequence in the Tendaguru region:

**Lower Cretaceous:**

APTIAN (7.) Makonde Facies. Unfossiliferous red and variegated sandstone and marl with Newala Sandstone beds.

NEOCHOMIAN. (6.) *Trigonia Schwarzi* Horizon. Five metres thick, fine grained brown calcareous fossiliferous sandstones with spheroidal jointing—and containing bands of coarse white calcareous sandstone.


**Jurassic:**

TITHONIAN AND UPPER KIMMERIDGIAN. (4) *Tregonia-Smeei* (beyschladi) Horizon. Twenty metres thick. Yellow and grey sandstone, chiefly with calcareous cement, generally fine-grained, but single bands, coarse to conglomeratic.

KIMMERIDGIAN. (3) Middle Saurian Horizon. Fifteen metres thick, only exposed at Tendaguru itself. Red and grey calcareous marl with Saurian remains.

OXFORDIAN (UPPER). (2) Nerinean Bed. Twenty-five metres thick (only exposed at Tendaguru itself). Fine to medium grained friable, calcareous sandstone, chiefly grey in colour.

(1) Lower Saurian Horizon. Less than Twenty metres thick. Grey and red sandy, calcareous marl with Saurians.

Upper Cretaceous beds are only known with certainty in several places, e.g. at the village of Kigua about 25 miles west of Bagamoyo where the Cenomanian horizon is represented. In Usambara in the districts of Makala, Maluri and Masanga, beds containing *Radiolite cf. angoides* may be Turonian, though Krenkel is inclined to regard them as Senonian. The beds consist of coarse sandy limestone, also grey marl and earthy limestone.

We will now examine the Kainozoic Deposits.

**Older Kainozoic Beds.** These occur close to the coast between Kilwa and Lindi rising to less than 200 feet above sea level, and consist of clays, marls and limestone bands ranging from Lower Eocene to Upper Oligocene (Aquitanian) according to Oppenheim. Kitula ridge at Lindi consists of a red Lower Eocene limestone (with *Rhynchonella polymorpha*) etc., followed by a hard grey-brown limestone with nummulites and other foraminifera representing upper, middle, and lower Lutetian.

Certain of the beds west of Kitunda in the Lindi district (containing *Lepidocyclina formosa*, *Echinolampus discoideus*, *Clypeaster*, etc.,) were regarded by Scholz as Lower Miocene, but are placed in the Upper Oligocene by Oppenheim.

**Younger Kainozoic Beds.** Among these are soft calcareous and sandy deposits penetrated in a bore at Dar-es-Salaam and regarded by Wolff as Pliocene, and certain of the marls and limestones of Mafia and the out-
lying islands should probably be included here ranging from Pliocene to Pleistocene.

The Mikindani Beds are widespread superficial deposits consisting for the most part, of unconsolidated sands, sandy clays and gravels sometimes several hundred feet thick. They were originally regarded by Bornhardt as marine, but no fossils have been found in them and the prevailing opinion of later geologists is that they are of fluvial and terrestrial origin. Gregory correlates them with the Margarini Sands of Kenya Colony but thinks that they do not all belong to one series, and portions may be older than upper Pliocene. The youngest formations are the extensive "black soil" swamp deposits and alluvium of low lying areas along many of the larger river valleys of the coastal zone, the mangrove and estuarine silts and the raised coral reefs which range from Pleistocene to Recent. Some of these deposits are worthy of very close study with reference to the complex history of the oscillations of sea level which have taken place during this period, one phase of which has produced the drowned valleys which provide this portion of the coast with a number of important harbours, notably at Tanga, Dar-es-Salaam, Lindi and elsewhere.

The Young Volcanic Rocks form the fifth group into which we have divided the region geologically.

These rocks form large sheets and masses, around volcanic vents in the northern region of the eastern Rift Zone and in the Konde region between lakes Rukwa and Nyasa in the western Rift area. The Kivu region further north is included in an area now under Belgian control.

The Kilimanjaro and eastern Rift region is the most extensive and has received the most attention from petrologists. The rocks include basic and ultrabasic calcic lavas and numerous members of the alkaline suite of rocks for which the Rift Zone of Eastern Africa is specially noteworthy. Most of the types known in Kenya Colony are represented here. The succession and relationship of the respective lavas is, however, far from simple. According to Hans Meyer, Kilimanjaro, the highest mountain in Africa, 19,712 feet, is a composite pile of volcanic rocks, being built up of the merging of three volcanoes of different ages, which stand at the intersection of a number of fracture lines radiating in various directions. Schire is believed to be the oldest, and its lavas, tuffs and agglomerates enter little into the main mass of its twin summits, of which Mawensi is older than Kibo and consequently its more eroded rough outline is in contrast to the smooth dome shaped form of Kibo.

According to Jaegar, the prevailing rock of the two peaks is trachy dolerite. Nothing is known concerning the relationship of the ijolite from the Kibo glacier which is described by Lacroix. Trachy-andesite dykes invade the trachy-dolerite and Kenyite (a basic rhomb porphyry) is a later lava which covers a considerable area. Phonolite, nepheline basalt, nepheline basanite and melilite basalt-tuff are among the other types recorded from this region.
Meru is an imposing volcanic cone, 14,950 feet in height, situated to the west-south-west from Kilimanjaro. It has a well defined but breached crater and the mountain is built up of trachydolerite, nepheline and leucite bearing lavas and tuffs. Further west towards the Rift a complex of vents and lavas is found from which many types of volcanic rock have been recorded, which include limburgite, augite, basalt, nepheline, melilite basalt, augite-andesite, phonolite, etc. In the region of the Giant Craters there is a marvellous array of volcanic vents, some of huge dimensions, notably that of Ngorongoro with a diameter of more than 12 miles, built up of the same assortment of basaltic and alkaline lavas and tuffs enumerated above.

The question of the age of the volcanic rocks in this part of Africa is a difficult one, since the oldest lavas rest directly on a gneiss in the eastern region. The Konde lavas at the north end of Lake Nyasa overlie in part the Karroo sediments, but this is of little use in settling the age and succession. Gregory reviews the question generally for Eastern Africa, and considers it possible that the earliest effusions in Kenya Colony took place in Upper Cretaceous, but in Tanganyika Territory he is inclined to place the first outbreaks at some later period in early Kainozoic times. It is clear that there has been a long intermittent succession of active volcanic periods separated by quiescent stages, extending down to recent times. Donyo Ngai is the only active volcano in the Territory at the present time. (The Kivu volcanoes are excluded). Eruptions from this vent have occurred at intervals during the recent history of the country; the latest in 1917 was described by Hobley and further discussed by Gregory.*

The sixth heading of the grouping system I have adopted in this article concerns Tectonic Considerations.

The Tectonic history of this region has much in common with the adjoining countries of Eastern Africa. It is particularly complex, but its features have a most important bearing on the development of the existing topography and geological structure of the country.

One of the striking features of a great part of the margin of the African continent, especially that of Eastern and Southern Africa, is the step-like ascent from the sea-level to the central plateaux. Sometimes these shelves are very wide, and ill-defined, but often they are sharp and clear cut, providing straight-line scarps which break the grade of the rivers descending to the sea, with the result that all have their course interrupted at intervals by rapids or falls. This scarp feature, bounding isolated mountain blocks or plateau-margins and breaking the continuity of vast featureless peneplains and steppes, forms one of the outstanding features and problems of African topography, and concerning it, opinion is still divided.

In Tanganyika Territory these characteristics though present are less simple than in some other regions. Extreme views on the one hand attribute them entirely to faulting, and on the other to erosion, either terrestrial or marine. Probably, however, most will agree that to account for the girdle of sediments round the coastal zone and for the origin of the high central plateaux, successive oscillations of the sea-level associated with buckling and dislocation of the land surface, must have taken place on a most extensive scale. The difference of opinion lies in the amount of influence faulting has had directly in producing the stepped features of the region under discussion.

Both the Eastern and Western Rift Zones cross the Territory and since its features have been so ably dealt with by Gregory it is not proposed to go into detail with this aspect of the subject. It is worthy of note in passing, however, to emphasize the fact that the portion of the eastern Rift between Kilimatinde on the Central Railway and Kenya Colony Boundary in the north, has received considerable attention from several German scientific expeditions under able observers, notably Hans Meyer, Jaeger and Uhlig. The extensive gravity observations by Kohlschutter show that compensation is incomplete along the Rift zone indicating that tectonic disturbances exist, but a discussion of these features with reference to the mechanism of the origin of the Rift is too big a subject to go into here. Gregory upholds the view that the fractures are due to tension, and Wayland has recently advanced the hypothesis that compression with overthrusting better explains the origin. It is sufficient here to state that the Tectonic origin has been thoroughly confirmed, but the Rift has been shown to consist in this Territory of a very complex system of fractures not always producing a normal rift, but sometimes resulting in a one-sided stepped character (bruch stufe is the German term, in contrast to graben for the normal rift). Much less is known concerning the extension of the Rift south from Kilimatinde towards Lake Nyasa. Apart from the Rift zones, however, there is enough information regarding many of the other regions to indicate that there are numerous fault and fracture lines, definitely proved, showing that since Karroo times the region has been subjected to considerable dislocation. Some of these are minor fractures within larger blocks which have been displaced, while others are important boundary faults.

The mapping of these faults and determining as far as possible the respective age and reference to existing topography is an important work which would throw much light on the tectonic history of Eastern Africa.

Observed faults with a northerly to north-north-easterly trend have been noted on the Central Railway close to the junction of the Jurassic sediments with the ancient gneisses. A fault along the eastern side of the Ulugurus, north-east from Mvula, has a similar bearing. The western junction of the Karroo rocks of the Rufiji region with the crystallines at Viransi is another instance. Bornhardt regarded the junction of the Jurassic rocks with the gneiss west of Bagamoyo as a fault junction; a
north-north-east fault intersects the Upper Karroo rocks to the west of the sandstones of Kilulu near Moa, and is parallel with the coast-line and the Pemba Channel. Staff considers that the Kainozoic rocks in the Lindi district are faulted against the Cretaceous.

A number of hypothetical faults which have received strong support from Dantz, H. Meyer and Uhlig, include the eastern base of the Usagara-Nguru Mountains, also a north-north-east line. In the Usambara and Pare highlands, faults with a trend varying from north to north-north-east have again been postulated for that section of the Mkomazi valley separating the Usambaras and Pares, and for the Lwengera valley and the eastern base of the Usambaras. The other bounding scarps of the latter mountains have a north-westerly bearing and are also assumed to be of fault origin. It is perhaps significant that in the Rufiji area of the Karroo rocks, numerous well defined faults have this bearing. One of these forms the southern boundary of the Kisaki-Mgeta depression and along it are strong hot springs. The fact that earth tremors are of moderately frequent occurrence not only along the eastern and western Rifts but in the Usambaras, the Ulugurus and elsewhere indicates that internal adjustments are still proceeding. Strong hot springs are common in many parts of the country; some of them occur on or near definite fault lines, or sometimes at the intersection of two sets of faults. From what is known of the old strand line and raised beaches along the eastern coast of Africa, it would appear that corresponding beaches of the same age do not always stand at the same height above sea level, hence it is probable that oscillations of the level of the land have taken place as well as perhaps fluctuations of the level of the ocean. The former would be due to local tectonic disturbances, while the latter must be caused by some world-wide control.

The seventh and final heading under which I have discussed the geology of Tanganyika Territory covers the Economic Geology of the country.

With regard to stone for building, road making, railway or other engineering work, the country is well provided with a great variety of suitable material. Limestones ranging from recent coral rock to hard Jurassic limestone are abundant in the coastal zone, and provide useful material for lime burning. Frequent occurrences of crystalline limestone in the gneissic regions serve the same purpose.

While some of the interior areas are barren on account of lack of rainfall, the country as a whole has a variety of productive soils, which in favourably situated areas offer great possibilities for the growth of many tropical and sub-tropical products. Among the various types may be mentioned the dark volcanic soils of Arusha and Moshi, the red clayey and sometimes lateritic soils of Nguru and Uluguru Regions and, elsewhere, dark loams of the marl and limestone areas of the coastal zone, and deep sandy soils on areas of Mikindani beds; extensive hill wash soils along the base of some of the scarps; widespread alluvial and silty soils often of great productivity in many of the plains and river valleys like the
Mgeta, Rufiji and Lindi region, and the calcareous sands of the coastal fringe which support productive cocoa-nut plantations.

With regard to minerals of economic interest, a great many have been recorded, but of these a large number are at present only known in quantities too small to be of value, or occur in positions too remote to bear the cost of transport. A very useful review of the minerals of the country is to be found in the Bulletin of the Imperial Institute, Vol. XII., No. 4, 1914, pp. 580-592.

Gold, mica and copal have been worked for export and the salt from the saline springs of Gottorp in the Ujjji district near Lake Tanganyika provides by artificial evaporation a considerable amount of salt, the sale of which, locally, brings in a notable return.

The auriferous area embraces a large region round the southern and eastern shores of Lake Victoria, and extending south and south-east towards the Central Railway. The occurrences include both alluvial and reef deposits, particulars of which are described by Tornau and Kuntz.*

Some of the veins, particularly those associated with diorite and altered dolerite intrusions have been phenomenally rich to shallow depths reaching to the water level, below which there has been a marked falling off to unpayable values.

Of much lower grade are a number of auriferous conglomerates and banded ironstones, but which merit very careful search and sampling. The best known mining fields are those of Mwanza, Ikoma and Sekenke. The greatest amount of work appears to have been done at Sekenke, the production of which is given from 1908-1911 as follows:—

<table>
<thead>
<tr>
<th>Year</th>
<th>Ore Yielded (tons)</th>
<th>Gold Value (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1908-09</td>
<td>3,515</td>
<td>400,000</td>
</tr>
<tr>
<td>1910</td>
<td>7,333</td>
<td>946,645</td>
</tr>
<tr>
<td>1911</td>
<td>7,132</td>
<td>886,188</td>
</tr>
</tbody>
</table>

This mine was worked by the Germans during the early part of the War, and the gold minted for local use.

Mica. Mica of good quality and large sized sheets was mined in pegmatite veins in pre-war days in widespread areas notably in the Usambaras, Nguru and Uluguru regions, and during the War under British control, the work was resumed and many new areas opened up.

The figures for the two years 1911 and 1912 are:

<table>
<thead>
<tr>
<th>Year</th>
<th>Kilograms</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1911</td>
<td>98,299</td>
<td>348,286</td>
</tr>
<tr>
<td>1912</td>
<td>153,806</td>
<td>481,407</td>
</tr>
</tbody>
</table>

Early in 1917 work was started under British control, and during three years of work under varying conditions 146 tons were exported roughly estimated at a value of £40,000. Associated with the mica in some districts are valuable uranium minerals with a high radium content. They are not in sufficient quantities to be worked for these minerals alone, but should form an important bye-product in the course of working the mica.

COAL DEPOSITS

Copal. This is a sub-fossil gum or resin dug from the surface sands of some of the coastal regions, notably in the Muera, Makonde and Noto plateaux. No large permanent supply of the material can be expected.

Of the other minerals which have not been worked, but which occur either in considerable quantities or give some promise of economic value at some future date, coal, iron, and graphite may be mentioned.

Coal. The only outcropping coal of suitable quality and thickness for economic purposes is that of the Songwe-Kavira region, at the north end of Lake Nyasa, and possibly a less known area west of Lake Rukwa. Bornhardt, who examined the former area closely, recognised two extreme types of coal—one is a gas-poor coal, burning with a short dull flame with no tendency towards the formation of coke; the other type is of good coking, gas-rich coal burning with a long flame and regarded as the most valuable and generally useful. The ash content, like most African coals, is high, and the seams show considerable variation in thickness laterally. The most promising sections were noted in the Kandete stream. In a thickness of strata amounting to 20.8 metres the proportion of it is given as follows:

1. 4.90 m. thickness of strata containing 4.84 m. of coal
2. 2.40 m. ... ... ... 2.05 m. ... ...
3. 1.20 m. ... ... ... 0.52 m. ... ...
4. 2.39 m. ... ... ... 1.36 m. ... ...
5. 2.82 m. ... ... ... 2.10 m. ... ...

In its present position, surrounded by a large undeveloped region far removed from railways and industries, the coal is at present of little value.

Rocks of the same age as these deposits and definitely correlated by their fossil contents with the productive coal bearing rocks of South Africa are known in the Rufiji and Kidodi regions. Coal, but not in economic seams, has been found in both these areas; their coal possibilities, however, can only be finally tested by boring or shaft sinking. The Tanga region is near the Coast, and most favourably situated economically, but it would appear from the known fossils to represent a somewhat higher horizon.

Iron. High grade iron ores of great extent were recorded by Dantz in the Livingstone Mountains in the Lake Nyasa region, and their relative proximity to the Songwe-Kavira coal basin will, no doubt, at some future date favour the development of these resources.

Graphite. Highly graphitic gneisses are wide-spread throughout many of the areas of the crystalline rocks, but since the vast supplies of Ceylon and Madagascar are more than sufficient for the present requirements, there is little chance of these occurrences being developed unless some very high grade material is discovered in a locality favourably situated for working and transport.

Of the other recorded minerals, the following may be mentioned: Trona, at Lake Natron in the Rift Valley, a similar deposit to that of Lake Magadi in Kenya Colony; Asbestos near Morogoro; Copper pyrites in the Uluguru, Ujiji, (N. Nyasa), and other districts; Corundum near
Mlale, Dodoma district; Molybdenite in the Usagara Mts.; Manganese minerals, Lindi District, Ikoma and Livingstone Mts.; Kaolin in the Dodoma district and near Bukoba to the west of Lake Victoria; Phenacite (Beryllium silicate) of gem quality in the Kisiwani Mts. to the east of Mpapwa; Beryl at Manaputa; Magnesite in the Vuju Mts., W. Nguru district; and Barytes in the N. Nguru region.

Arsenopyrites, Iron pyrites, Galena, Bismuthinite, Zinc blende, Sulphur Agate, Amethyst, Kyanite and Garnet Tournaline may also be mentioned.

Diamonds have recently been reported from the region between Tabora and Lake Victoria, but the discovery still appears to lack confirmation. The one crystal found in the coastal sands at Bagamoyo in 1911 has not been followed by any other discoveries.

It is perhaps worthy of note that mica-bearing peridotites akin to, though not actually identical, with Kimberlite have recently been discovered by the writer in the Nguru region.

**Oil.** Apart from the Bitumen from the northern end of Lake Tanganyika, there are no records of oil indications. In a country with such varied mineral indications, detailed geological investigation and capable systematic prospecting may be expected to yield some important results, which may have considerable influence on railway construction and general development of this portion of Africa.

**Lupa Valley Alluvial Goldfield Discoveries.**

*The new alluvial Goldfields in S.E. Tanganyika Territory*

The discoveries of rich alluvial gold bearing gravels during 1925 in the valley of the Lupa River, which runs into the South-eastern end of Lake Rukwa attracted considerable attention as this volume went to press. Situated two days march eastward from Abercorn at the southernmost end of Lake Tanganyika and according to Sir Alfred Sharpe, about four and a half days march due north-west of the Northern end of Lake Nyasa, in fairly healthy country, this auriferous formation has already been located for some thousands of square miles. Hundreds of diggers attracted from South Africa, Rhodesia, Tanganyika Territory and the Belgian Congo are already working and stated to make very good wages, several very rich patches have been found. Although the new field has not yet proved to be so far equal in average values to the great deposits at Kilo-Moto in the extreme North-eastern Congo, worked under the auspices of the Belgian Government, there is good reason for the hope that another paying African alluvial field has been found. The Tanganyika Government authorities are devoting serious attention to the new discovery and after receiving the reports of their geological and mining experts will shortly decide whether or not the field is more suitable for company work on a large scale than for individual diggers. Latest reports to hand (during June 1925) state that the auriferous yield of the gravel, though fine nuggets are often obtained, is not as regular as could be desired or was anticipated by old workers who are used to other alluvial diggings.
The Geology of Kenya and Uganda.

By C. W. HOBLEY, C.M.G.

The general features of the geology of Kenya Colony have been fairly well known for some time mainly owing to the brilliant work of Prof. J. W. Gregory who, as long ago as 1893, made a traverse of the country and who, in a remarkably short time, accurately diagnosed its structure. In 1919 he added to his previous observations, and his book "The Rift Valleys and Geology of East Africa" published in 1921 ably sets forth the information available up to that time. Maufe, Parkinson and Oswald also added to our knowledge of the area.

As regards Uganda but little systematic work had been carried out until Mr. E. J. Wayland was appointed Government Geologist, and his work is rapidly clearing up the mists which overshadowed the geology of the country between Lake Victoria and the Congo Frontier.

Commencing at the coast and proceeding inland, say via the Uganda Railway, one first finds a series of raised coral reefs which mark oscillations of the coast line level between Pliocene and Pleistocene times. The last uplift varied from about 80 feet at Mombasa to as much as 200 ft. at Kismayu.

North of Mombasa some 60 miles and about 15 inland, and again farther North some distance inland from Kismayu marine beds of Miocene age have been identified.

At intervals along the coast line but a few miles inland a range of hills, some 400 ft. in height, occur; these hills are composed of unconsolidated reddish sand with pebbles of sandstone, quartzite, chert, and occasionally gneiss. These pebbly layers are probably relics of old beach deposits but it should not be inferred that the height of the hills is evidence of a series of sediments laid down in water to a thickness of several hundred feet, for it would appear more likely that they are ancient sand dunes and were piled up by wind along the coast in early Pliocene times.

The raised coral reefs of Mombasa Island lie unconformably on a well-known series of beds called the Changamwe shales of Jurassic age and probably of the Corallian horizon, but the lower beds may be as old as Bathonian.

Below the shales occurs a very persistent limestone bed which can be traced for about 50 miles, which varies in thickness and sometimes is as much as 300 ft.; it abounds with a variety of massive fossil corals,
echinoid spines, and ostracoid shells—in fact, it is a fossil fringing coral reef. The palaeontological evidence decides its age as Bathonian and it is of especial interest for it marks the date of the first coming in of the sea along this stretch of coast line. The limestone was deposited on the edge of the coast line of the continent as it existed at the time, and the relics of the coastal cliffs can still be seen in the bold face of the sandstone ranges a little farther inland, and upon the flanks of which the limestone unconformably lies.

These sandstone ranges roughly mark the line of subsidence to the East of which lay the vanished land of Gondwana, now forming the floor of the Indian Ocean.

The uppermost of this series is called the Shimba grit, then in descending order come the Mazeras Sandstone, Mariakani Sandstone, Maji Chumvi flags and the Taru shales and grits. The first mentioned is probably of Rhaetic or Trias age, and the lowest of Permian. At mile 57/16 on the Railway the sandstone series lie unconformably upon Eozoic schists.

This series almost certainly represents the Middle and Upper portion of the Karroo formation of South and Central Africa, and our evidence for this correlation rests on the discovery of a bivalve called Palaeodonta fischeri (Amalitzky) by Prof. Gregory in some shales in the Sabaki Valley.

As in the Southern half of the continent, these beds denote a long period of terrestrial and lagoon sedimentation, desert conditions prevailing in the later portion and great fresh water lagoons in the early part of the era.

The schists upon which the sandstones rest for many miles underl_y vast featureless bush-covered plains which probably represent old land surfaces which have been peneplained down to base level, uplift in fairly recent times having rejuvenated rivers like the Athi and Tsavo. As in Tanganyika Territory and further South in Portuguese East Africa we find at considerable intervals the well known “inselberge” or island mountain type of mountain and without any apparent reason ridges of gneiss and schists occur arranged on definite axes which evidently mark lines of tectonic movement and although various theories have been set forth the genesis of these striking features is not easy to explain. In the Dabida range of Taita we have a complex of gneiss, mica, hornblende, and graphitic schists, crystalline dolomites and ferruginous beds highly folded and separated by reverse faults but all with a general North and South strike, but in various parts the strike swings about from N.N.E. to N.N.W. Apart from what may be termed the later folding in of any particular area it is probable that this series of rocks was previously folded on axes which trended East and West and in some cases this resulted in faulting; the great fault scarp along the South side of the Nandi escarpment may be quoted, and the scarp which bounds the South West side of the Usambara range between Kilimanjaro and the
THE RIFT VALLEY VOLCANOES

cost may be referred to. The abrupt fault scarps of Kisigau and at the Southern ends of the Taita ranges are also to be taken as evidence of these tectonic forces. The physiography of the Machakos tangle of hills is, too, the result of erosion upon the effects of, first, a folding in when the axes were East and West and a later deformation in which the axes were North and South. The great fault scarp of Nzawi is an example marking the latter epoch.

As the knowledge of the continent has grown, and particularly as research has spread from the South in a Northerly direction, efforts have been made to correlate the formations of Central Africa with those so well explored in the Cape region; owing to the absence of fossils such correlations being, of course, but tentative and provisional. On petrological grounds, however, there seems some reason to classify a considerable portion of the Eastern gneisses and schists with the Swazi system of South Africa.

Mr. J. Parkinson in 1913 described a series of metamorphosed sedimentary rocks which he had examined in the Turoka valley to the West of the Uganda Railway at Kiu. It is, however, believed that the facies he described is not peculiar to this locality and the same series will be found in Kitui to the east of the Athi River, then again near Machakos, and that the test of horizon will be found to be the crystalline dolomite, graphic schist and other associated beds.

Going Westward from the neighbourhood of Kiu there is a vast hiatus in which the later volcanic series monopolize the country but West of these we again find an Eozoic series of metamorphosed rocks in the Nandi region, and North of that for many miles on the West of Lake Rudolf. These may belong to an older system for many of the characteristics of the Eastern series are absent.

In N. Kavirondo in the lower levels we find metamorphosed sediments again, which may approximate to the Eastern series and the older group appears to protrude through these at intervals.

In Kisi, however, to the South of the Railway we find a distinct formation comparatively little altered and not so much folded and these probably constitute an outlier of what Wayland terms the argillite series of Uganda and which may be correlated tentatively with the Waterberg system of South Africa.

In our progress along the railway we have, however, skipped an important group of rocks and the earth movements to which their presence is due have had a profound effect on the physiography of the country.

This series may be termed the Rift Valley volcanics. The world’s history has been all along marked by periods in which earth movements were intense and others in which the forces were quiescent. One of the periods of great activity commenced in the Upper Cretaceous times and culminated in the Miocene era in world-wide volcanic eruptions and at intervals these throe's of the earth’s crust have continued until recent
times. The effect of this cycle of crustal instability has been stupendous, for as Gregory points out, the tumultuous upheavals of the earth's crust during this era raised the Alps, Pyrenees, the Atlas Mountains of North Africa, the mountain ranges South of Persia, and the Himalaya system. In the new world also the mountain chain of Western North America and the Andes date from that time. There was nothing cataclysmic about their formation for the movements were spread over a long period but at the same time such vast displacements resulted in a series of volcanic eruptions which were world-wide in distribution.

The continent of Africa by no means escaped from this readjustment of the stresses in the earth's crust, for previous to its occurrence there is much evidence to the effect that the old land surface extended far to the East of its present limits and that a great portion of the Indian Ocean is now the site of a vanished land which gradually subsided below the sea level.

According to Professor Gregory, who developed the theories of Suess, this subsidence produced tensional stresses in the remaining portion of the continent which eventually caused great fractures in its centre and produced "grabens" or sunk lands which can be traced from Palestine to Portuguese East Africa. Wayland, on the other hand, maintains that the formation of the sunk lands was due to compressional stresses.

Whatever their cause, however, there is no doubt about the existence of these great tectonic features nor their extent.

Omitting reference to Palestine and the Gulf of Akabah, we find in Africa a great depression running through Abyssinia, Lake Rudolf and Southwards through Kenya Colony on into Tanganyika Territory through Lake Nyasa and again Southwards till it strikes the Indian Ocean about Beira. A Westward and equally important branch runs through Lakes Albert, Edward, Kivu, and Tanganyika, only dying away in the region of Lake Mweru.

It must not, however, be assumed that these great dislocations followed straight lines; the main factor in deciding their course may generally be said to be the line of subsidence which is now marked by the East boundary of the continent, but divergences from parallelism to this line were caused by previous lines of weakness and by folding which had taken place at an earlier date and in a different direction.

The formation of these great fractures of the earth's crust was attended by vast eruptions of lava and the formation of myriads of volcanic cones and many of the highest mountains in the region. It has profoundly affected both the physiography and the political geography of Central Africa and in a way it may be said that the volcanic phenomena are the dominating feature of Kenya Colony.

Proceeding inland we first strike this volcanic series at Kibwezi where we see to the West of the Railway the very recent chain of cones called the Kyulu Hills; a little further on between Simba and Sultan
Hamud we cross a lava plain and see to the West of the railway a great assemblage of recent eruptive vents with Kilimanjaro dominating them on the far horizon. From Magadi junction to Nairobi we traverse, however, a great grassy plain covered by an enormous sheet of phonolite characterised by large crystals of anorthoclase and yellowish crystals of nepheline. This is the oldest of the lava series and it covers such a large area that its occurrence is not easy to understand; it was first thought to have been derived from a series of fissure eruptions but that theory now appears to have given way to one of eruption from a network of numerous vents, little trace of which now remains.

On the West side of the Athi River there is a curious outlier of this lava sheet in the Yatta plateau, a long narrow cap of phonolite which follows the East side of the Athi valley for over 200 miles without a break and the origin of which is difficult to understand. It was probably much wider formerly but erosion from the East has reduced its width and on the West it clearly follows the course of the Athi River and towers up in a cliff a mile or so from the river bank.

But to return to the railway line which forms such a convenient line of traverse; as we near Nairobi we cross a newer set of volcanic rocks, agglomerates, then phonolites, trachytes and great masses of tuff and these form the terrain which produces the fertile red soil of Kikuyu. About 30 miles North West of Nairobi, however, we come to the edge of the Rift valley and a great trough some 1,500 deep and some 25 miles wide meets the eye; the railway runs diagonally down into this stupendous orographical feature and between Kijabe and Naivasha reaches its floor. The Eastern wall is not one sharp descent but consists of a series of steps each of which marks the position of a fault.

This scarp is also buttressed at intervals by great mountains Donyo Lamwia, Kijabe, Nandarua, Settima and others. The floor of the valley is also studded by a large number of volcanic cones, some small and others attaining the dignity of great mountains 9,000 ft. high—Longoonot, Donyo Nyuki, Eburru, Ol-Ogasalik and others; Menengai crater, N. of Nakuru, is a stupendous affair quite 8 miles in diameter. The railway travels diagonally across the floor of the Rift Valley, which is generally composed of a powdery soil produced by erosion from the softer tuffs and ash beds and redistributed in the beds of a series of extensive lakes, attenuated remnants of which now exist as Naivasha and Nakuru.

A few miles beyond Nakuru the line commences to climb the Western wall of the Rift, the features of which are less sharp on this side than on the East, but South of where the Railway ascends it the wall-like structure is very pronounced. The summit is reached a few miles beyond Molo Station and the line soon begins to descend towards the Lake Victoria basin following the head waters of the Nyando R. The rock succession exhibits great similarity to that of the Eastern side and we have phonolite trachytes on top giving place to tuffs and then to great beds of normal phonolite. About Mohuroni Station the line begins to
emerge from the volcanic complex and it gradually descends on to the alluvial beds which mark a former extension of Lake Victoria and which are fringed by some Miocene beds; it then for about 25 miles runs parallel to the base of a great E. and W. fault scarp which bounds an area of Eozoic rocks known as the Nandi country. The phonolite beds re-appear at Kisumu both North and South of the Kavironds Gulf and considerable volcanic activity took place in this region as evidenced by the mountains of Homa, Gwasi and others. North and South of the Railway the volcanic rocks cover great areas in and along the flanks of the Rift and the great mountains of Kenya, Elgon, and the Aberdare chain all mark phases of a long continued instability of the earth's crust in this region. The limitations of space, however, forbid more than a very general survey.

Gregory divides the period of volcanic activity into seven phases. The oldest, which he calls the Kapitian, is put back as far as Upper Cretaceous times, and is represented by the great sheets of phonolite referred to as first occurring E. and S.E. of Nairobi; the next is the Doinyan group of about Eocene age and marked by Kenya and Settima; then in the Oligocene period he premises that the first rift valley faults were found. In the Miocene period come the Laikipian series of plateau eruptions. In the Pliocene we get the Naivashan series marked by the formation of Elgon and Eburru. In Lower Pleistocene times Kilimanjaro (at least the Kibo peak), Donyo Nyuki or Suswa and the Kyulu range are placed and in the Upper Pleistocene period come Longonot, Donyo Engai and other cones in the floor of the rift and that practically closes the volcanic history of the Eastern rift up to date for with the exception of Donyo Engai no volcanic activity exists there to-day. In the Western branch of the rift, however, activity is still present in the Virunga group North of Kivu.

Proceeding Westward from Kisumu we cross the basin of Lake Victoria and reach Uganda. The lake basin may be regarded as a synclinal depression between two great folds—that of Kenya Colony and that stretching from its Western shore to the Congo. The lake is of considerable age for Miocene beds have been found on its shores and there is little doubt that a great Northern arm once extended to Chioga and on N.E. to the Karamojo plains; the chain of lakes known as Kumana and Salisbury as well as Chioga being relics of this great extension; Wayland considers that the sedimentary beds marking the floor of this old lake extrusion were laid down before the Elgon lavas were erupted. On the West of Lake Victoria alluvial deposits are found over 100 ft. above the present lake level and it is considered that these mark the site of beaches of a former bigger Victoria Nyanza.

The Lake Victoria and its extensions mark a depression which is, generally speaking, parallel with the strike of the Rift Valley axes, so presumably may be considered as the result of the same set of forces, and a detailed examination of its shore will throw more light on its
THE KOROMOGO DISTRICT

origin. From its Western shore the terrain gradually rises until the Western rift is reached and Wayland postulates a fold of great dimensions with one limb in Uganda and the other in the Congo, the Western rift occurring on the crest of this folded region. At the South of Lake Albert it divides into two branches which reunite about Lake Edward—Ruwenzori rising up in the form of a block mountain between the two. The basement beds of Uganda are a complex of ancient metamorphic rocks and biotite gneisses, mica, sercite and hornblende schists all much folded and their folds may be considered as crenulations in the limb of the great fold.

Derived from these ancient rocks by denudation and lying unconformably on their eroded surface is a thick series of sedimentary rocks probably of fresh water origin. They are generally of a clayey character and on that account have been provisionally named by Wayland as the Argillite series; interbedded with the argillites, quartzites, conglomerates and sandstones are, however, occasionally found. In some parts these rocks are comparatively little altered and in others they become almost schistose and in the West they grade into phyllites. No fossils have been found in them, but Wayland is inclined to correlate them with the Karroo series; others again lean to the view that they may be Northern representations of the Waterberg System of S. Africa. It is said that the argillite series extend across into the Congo, West of Lake Albert, small areas being found among the minor synclines of the metamorphic series. Both the metamorphic series and the argillites are pierced by intrusions; those in the archaean complex include a pyroxene granite similar to Ceylon charnockites; gabbros and diorites also occur; these intrusions were generally pre-argillite in age; pegmatite veins also cut through the gneisses and schists. The post-argillite intrusions are of an acid and basic type, the former including quartz reefs which often carry heemmatite; granitic intrusions are also found in some areas. The basic group include diabases, picrites and pyroxenites: it is a picrite dyke which forms the sill of rock which dams up Lake Victoria and forms the Ripon Falls.

North of Elgon in the great semi-desert area known as Koromojo we find a much eroded basement of metamorphic rocks which in places present a great likeness to the series so well known in the Ukamba country along the Magadi Railway in Kenya Colony and carrying similar beds of dolomitic marble and graphitic schists.

Upon the turtle backs and scattered hills which characterize this type of country we find thick accumulations of recent volcanic rocks—nephelinites, augitites and such like, which emanated from the Elgon focus of eruption; Wayland considers that they are probably due to a series of fissure eruptions in the area, for they stretch as far as Moroto which is about 100 miles North of Elgon. Between these volcanic caps and the old rocks alluvial gravel occurs which Wayland considers to be evidence of the existence of a great inland sea in Miocene times and if this is so, doubtless further research will disclose paleontological proof.
In addition to these ancient beds of alluvium a later series of gravels is found which contain a considerable variety of stone implements and which mark the terraces of the more recent extension of the present lake system and measure the extent of the desiccation which has been in progress since the close of the pluvial epoch.

This brief survey of the geological features must close with a reference to the economic minerals of Uganda and Kenya. For some reason great mineral riches have not materialised in these countries and with the exception of the great deposit of Natron at Lake Magadi, no development of importance is in progress.

Mica has been intermittently worked in Kenya, in the Machakos district and E. of Kenya, but the quality does not appear to be equal to that of Tanganyika. Graphite has been worked in Machakos district but the recent financial depression appears to have caused development to cease. Gold has been found in S. Kavirondo, N.W. of Kenya, and in various other places, but the workings have never got beyond the prospecting stage.

There are prospects of coal in the coastal area, but efforts to prove its existence have up to date, owing to various causes, not produced much result.

Copper ore has been found in several places but apparently in not sufficient quantity, but serious prospecting has hardly been attempted.

Silver bearing galena in some quantity has been discovered near the coast, but the discovery has not been very energetically explored. Manganese ore of medium quality and considerable volume exists but recent prices deter development.

In Uganda the story is much the same. Oils have been found on Lake Albert, but little serious work has been carried out to prove if they denote a bulk supply; possibly the remoteness of the spot discourages the oil companies.

Alluvial tin and gold have been found in various places but have not been seriously prospected. Monazite sands exist, but have not been systematically explored.

Large deposits of iron ore have been discovered, but their remoteness coupled with a lack of fuel have precluded their being developed up to the present.

Taking it all round the rock systems of Uganda probably contain a greater proportion of economic minerals than those of Kenya and, moreover, the country has been less prospected.

In both countries the discovery of important mineral deposits would prove of great value at the present juncture.
Katanga Copper Fields.

PROGRESS AND DEVELOPMENT.

SOME highly interesting and important statements regarding progress and developments in connection with the Katanga copper fields, were made by Mr. Robert Williams, managing director of Tanganyika Concessions, Limited, at the ordinary general meeting in London, on July 30th, 1925.

In the course of his address Mr. Williams referred to the speech in Brussels on July 13th of M. Jadot, president of the Union Minière du Haut Katanga. He said: "M. Jadot has stated that the continuous progress of that company's activity confirmed more and more the confidence which he has always had in its destinies. The copper production of 1924 was 85,570 tons, over 10,000 tons above the estimate which I gave last year. Notwithstanding the large production, the ore reserves at the end of 1924 showed a substantial increase, with a total copper content of about 5,000,000 tons. The production of the first six months of 1925 is 43,738 tons, as compared with 36,829 tons for the similar period in 1924, the production for June this year being 8,544 tons, a rate of over 100,000 tons per annum. With the improvements made in the blast and reverberatory furnaces, and in connection with concentration of tailings, that rate of production should be maintained for the next two years, after which the new reverberatory and leaching plants now being constructed will gradually come into operation, increasing the annual production by stages until in about five years' time the full capacity of the plant for the treatment of the south eastern deposits alone will be about 260,000 tons per year.

"An interesting development is the formation in Brussels of a hydro-electric company, with a share capital of 75,000,000 francs. This company is undertaking the development of the resources of the Lufira River, and is agreeing to supply at very low rates electricity to the Union Minière for the last two units of the 90,000-ton leaching plant included in the present programme. This is the first of the great water power schemes which, in conjunction with leaching and the Benguella Railway, will make Katanga copper the cheapest in the world. Another matter of great interest is that the plant for the treatment of the cobalt alloy from Katanga is on the point of commencing production. The Union Minière expect before the end of the year to be able to place on the market
cobalt salts and metal in quantities such as to permit of a great extension of the use of cobalt in certain industries, particularly that of special steels, which are likely to have an important outlet in the near future.

"Regarding the Nile Congo Divide Syndicate, Ltd., boring operations with a diamond drill are being carried out on the extensive old native workings in the north-western part of the concession. These workings contain copper with traces of gold, and similar formation has been found at various points along the same strike for a distance of about 80 miles. A drilling programme has been laid out, with the object of proving values, and cabled reports of the first results have just been received stating: "Entered sulphide of copper at 190 ft., passing out at 280 ft.; traces continue to 300 ft. Cross-cuts from south shaft have passed through ore body 13 ft. wide." A subsequent cable states: "Lode . . . mineralised 53 ft. wide with a rich central section 15 ft. wide. Chalcopyrite is in evidence throughout. . . Mr. A. P. Thompson considers there is a rich body of ore over considerable distance. Body of ore cross-cut from south shaft is nearly 15 ft. wide, approximate estimate 12 per cent." 350 miles further west, test gold washing of alluvial gravels has given values of 1s. 10d. average, with a maximum of 2s. 9d. per cubic yard. Indications of copper have also been reported from the same area.

"With regard to the finance for the completion of the Benguella railway, you are aware that some two years ago negotiations which were practically completed with the Trade Facilities Committee with the object of securing a guarantee for a loan to the Benguella Railway Company for the purchase in this country of the steel rails and other materials necessary to complete the railway to the frontier, were broken off at the intervention of the South African Premier. Since then the railway has been extended some 200 kilometres and financed by the issue of preference shares of your company and with the assistance of the Zambesia Exploring Company. All orders were placed in British workshops as hitherto. Latterly, however, the cost of British materials as compared with Continental materials became prohibitive, without the compensating advantage of cheap finance from the Trade Facilities Committee. A new Government at the Cape having come in, with a new Premier in the person of General Hertzog, I immediately inquired whether they had any objection to a trade facilities guarantee for the Benguella Railway to enable British materials to be bought, and pointed out the bad state of unemployment here. The Union Government stated they had no objection, and I have since learned that General Hertzog has since expressed much broad-minded sympathy towards the Benguella Railway, and I take this opportunity of thanking him and his Government publicly. Having received a favourable reply from the Union Government, I at once opened negotiations with the Trade Facilities Committee in respect of the materials for the completion of the line, but was met by
strong opposition from another quarter, which made me reconsider the position. I had been negotiating with the Trade Facilities Committee for about three years. The time for completion of the railway was getting short, I was being offered by Continental firms prices far below British prices, and I wondered whether it was worth while struggling further to secure the order for British workshops which had already benefitted to the extent of about £3,000,000 sterling for materials for the Benguella Railway and the Rhodesia Katanga section of the Cape to Cairo Railway. Finally, as new shares and bonds were being issued by the Union Minière, I decided to put your company in a position of complete financial independence by an increase of capital for the purposes subsequently approved at the extraordinary general meeting of your company last March, and in case the Trade Facilities Committee should not agree to assist, I arranged terms for the purchase of the whole of the materials on the Continent, at about £250,000 under British prices as then quoted, and for payment to be made out of the proceeds of the sale at a profit of about £300,000 of the Union Minière privileged shares which your company was to take up. After you had passed the above proposals, the Trade Facilities Committee agreed to guarantee a loan to the Benguella Railway Company of about £1,250,000 on most satisfactory terms, and asked that orders should be placed as soon as possible. As a result a contract has been made for the completion of the railway to the frontier in two years, with British materials, and orders for the steel rails, sleepers, and other materials have already been placed in England, Scotland and Wales. I feel certain that this action of the Trade Facilities Committee will lead to further orders for British workshops for branch lines to various districts in Angola, and to connect the Benguella Railway directly with Livingstone, also for further sections of the Cape to Cairo Railway.

"With regard to the section to be constructed in the territory of the Belgian Congo, as I have told you on previous occasions, the Benguella Railway Co. made a contract with the Katanga Railway and the Bas-Congo Railway Companies, dated March 31, 1908. The contract has been approved by the Belgian Parliament, and provided in effect that the Belgian section should be built at the same time as the Portuguese section. With regard to the date at which the Belgian section will be completed, you have only to read Mr. Jadot's statements at the Union Minière meeting, published in your report, to see how anxious the Belgians are to complete their section.

"Your Company was registered in 1899 with the object of sending an expedition under the leadership of Mr. George Grey on a pure adventure from railhead at Bulawayo into Northern Rhodesia to discover mineral wealth which would create traffic to assist Rhodes' Cape to Cairo Railway. I had already sent an expedition in 1895, with the same object, but without result. So had others. They had all failed, and one
authority had stated at a public meeting that he did not believe any mineral wealth would be found north of the Zambesi River.

"I instructed George Grey to proceed to the great divide between the Zambesi and Congo rivers, and marked out on the map the most likely place to find minerals on that divide, and quoted in confirmation the writings of Livingstone, Cameron, and other explorers who had either heard of minerals or visited one or two old workings at or near that divide during the past 70 or 80 years, and with this idea I secured a concession from Rhodes to prospect in Rhodesia, and later on, from King Leopold to prospect in Katanga for five years over a large area. George Grey and his party travelled 1,000 miles north from railhead—he first discovered the Kansanchi mine and later opened up at an expense of about £100,000 the Katanga copper mines, proving the existence and value of probably the greatest copper fields in the world, extending over 250 miles in length, all within the area I had indicated. The Belgian Union Minière du Haut Katanga was then formed in 1906 by your company and our Belgian colleagues to develop these copper fields. I had meantime at Rhodes' request, negotiated his Cape to Cairo Railway through to the Nile with King Leopold, but after a great struggle to secure its extension to the Congo border, and although I offered Rhodes, shortly before he died, a half interest in our mineral interests to assist his railway, we failed to get that extension, as his financiers demanded further mineral interests from the Belgians. I then decided, in co-operation with my Belgian friends, to secure the Benguella Railway for your company, in view of the growing knowledge of the wealth of Katanga and the necessity for a shorter and more economic route to the sea and European markets. Directly after we secured the concession to build that railway my old friend, Dr. Jameson, a director of the Chartered Co. as well as Premier at the Cape, asked me as a special favour to negotiate the extension of the Rhodesia Railway to the Congo border and thence to the Katanga mines. I then negotiated successfully with my friend Monsieur Jadot, and your company formed the Rhodesia-Katanga Junction Railway and Mineral Co. to connect the Rhodesian Railway to the Congo frontier, from which point it was completed by the Belgians to the mines in 1910. In 1908 the first copper was produced from the Kansanshi mine, from which 2,800 tons of copper, valued at £170,000, were carried by the railway, being the largest shipment of copper from Northern Rhodesia to this date.

"It was only in 1910, eleven years after your company was registered, that, the railway having reached the Katanga mines, real development could be commenced. Smelting started in 1913, and a great plan for the extension of these smelting works was laid out. 

"I am certain that the great work that you have accomplished in Africa and the great wealth you have acquired, has been chiefly due to the humane treatment of the natives by everyone connected with our work, and I am sure that only so long as that policy is pursued will our companies prosper."
A Distinguished Mining Engineer

Mr. H. S. Denny, C.B.E., M.I.M.M., etc.
General Survey of Mineral Deposits

ON THE CAPE TO CAIRO ROUTE


The acceleration of an undeveloped country's growth, particularly when that country is situated remotely from the world's industrial centres, is not infrequently a measure of its activity in mineral exploitation. The early histories of Australia, California and South Africa, are illustrative of the accuracy of this truism and in each case the lure which caused the famous "rushes" and accompanying settlements, was the noble metal, gold. For gold holds out to the pioneer hope of rapid fortune because of its high value, ready market, small bulk, and, in its simplest alluvial occurrence, ease of winning. It rapidly provides the necessity for, and the means of, development of other industries, and these inevitably follow in its train. Where would South Africa stand to-day had it not been for its wonderful gold industry? The whole history of the country must have been quite different. The Transvaal must still have been a sparsely populated area dotted with the small and unimportant farms of the hardy Boers. Durban, Port Elizabeth, and Cape Town, could have possessed only a proportion of their present wealth and the white population must have been much smaller. The Gold Industry of the Witwatersrand has been the mainstay of the country for over thirty years and still ranks as its chief source of income, whilst slowly and surely on the foundation thus created, other industries have been built up.

Since the discovery of the famous Rand no other gold field of like importance has been found and whilst it would appear too much to expect that such another exists, there is every reason for hoping that in the known huge mineralized areas, still almost unscratched, traversed by the Cape to Cairo route, many more important gold producing centres will in due course materialize.

It is only natural that the richest and most easily recognizable deposits are those to be first attacked and it is clear that with the proving of each new field the number remaining must be smaller and the search therefore more difficult. Science and persistent effort is being devoted to the discovery of ways and means of economically handling the known large areas of poorer deposits and when
necessity insistently calls, will doubtless find means to overcome the obstacles that bar the path to the profitable working of such deposits under the conditions obtaining to-day. The gradual development of accompanying industries, such as railroading, coal, base metal, and agriculture, tends all the time to improve the economic situation for all industrial effort and the gigantic obstacles which had to be faced by the early pioneers of new countries like South Africa, have been largely removed, making present day effort less hazardous and more encouraging to schematic financial enterprise.

In gold and diamond production South Africa leads the world to-day, and who shall say that in copper, iron, coal, asbestos, and chrome, the African continent shall not also take the lead amongst the world's producers?

The countries traversed by the Route are:

(1) Egypt.
(2) Anglo Egyptian Sudan.
(3) Uganda Protectorate.
(4) Belgian Congo.
(5) Northern Rhodesia and Bechuanaland Protectorate.
(6) Southern Rhodesia.
(7) South Africa via Mafeking and Kimberley.

Taking these countries in the order given, the mineral production, including petroleum, is briefly as follows:

(1) and (2). In Egypt and the Sudan in 1915 the gold production was a little over 7,000 ozs. but it has gradually dwindled until it is now practically negligible.

The petroleum production in 1918 was 281,885 tons and in 1919 224,300 tons, but since that time it has never reached 200,000 tons.

Phosphate rock in 1920 was over 100,000 tons but for 1922, 1923 and 1924 it only averaged a little over 50,000 tons.

Manganese iron ore was first produced in 1918, amounting to 27,498 tons, and in 1924, 105,580 tons.

Lead and zinc were produced up to 1915 but then ceased and have not been continued.

There is a small production of nitrate shale but this shows considerable falling off in the last few years.

(3). In the Uganda Protectorate during 1923, geological surveys were initiated but the work of investigation has not yet been brought to a conclusion and the possibilities of exploitation are for the moment undetermined. There is no record of any mineral output worthy of notice in this area.

(4). In the Belgian Congo copper, diamonds, coal, gold, iron, tin, cobalt and radium are produced. The area is very rich in minerals and the Katanga section in the past few years has become famous for its production of copper, which in 1920 amounted to 18,961 tons (unrefined) and gradually increased to 36,577 tons in 1923.

According to the geological
MINERAL PRODUCTION ON THE ROUTE

report published, the copper deposits are of enormous extent in the three dimensions of length, depth and width. There appears to be every promise of continuity and expansion in this industry.

The diamond production was only 15,000 cts. in 1913 and increased to 244,878 cts. in 1921, averaging approximately the same figure in 1922.

The coal production in 1922 was 29,000 tons and over 50,000 tons in 1923.

Cobalt bearing minerals are being treated in electric ovens at Luishia and a product consisting of a mixture of cobalt, iron and copper, is shipped to Belgium.

Tin ore—cassiterite containing theoretically 78.7 per cent. of tin—averaged for the years 1920-24 inclusive, approximately 700 tons per annum.

Uranium was discovered at Chinkolobwe some years ago and in 1922 a tonnage amounting to 238 of this mineral, was exported to Belgium. In 1923 478 tons of uranium were exported and from this the Oolen Works in Belgium produced 48 gms. of radium per annum.

(5). In Northern Rhodesia lead and silver are the chief mineral products.

The output for 1924 was 6,613 tons of lead and 234,805 ozs. of silver. There is a small production of gold, copper and vanadium.

(6). In Southern Rhodesia the gold production has averaged for 1912-24, inclusive, approximately 700,000 ozs. per annum, and silver 170,000 ozs. Apart from this the production of asbestos has increased from about 2,000 tons in 1915 to approximately 26,000 tons in 1924.

Chrome ore in 1912 amounted to 69,000 tons and in 1924 to 172,000 tons.

Coal in 1912 amounted to 216,140 tons and in 1924 to 650,000 tons.

Copper in the last ten years has averaged approximately 3,000 tons per annum.

There is a small production of diamonds, arsenic and mica, in addition to the above.

(7). In gold and diamonds The Union of South Africa leads the world and its pride of place in this regard is not seriously challenged at present by any other country, the gold production in 1924 amounting to 9,575,040 ozs. and diamonds to over 2,000,000 cts. Coal to over 11,000,000 tons and silver to over 1,000,000 ozs.

In addition to the above there is an appreciable production of asbestos and other minerals.

A glance at this brief summary will serve to bring into prominence two cardinal features, these being

(1) The wide range and importance of the mineral production.

(2) The predominance of the Southern half of the Continent over the Northern, in metal production.

Before the developments of
the railroads in South Africa, that is, before the Kimberley and Witwatersrand fields were open, the output of the Southern section of the Continent was negligible in gold and practically non-existent in diamonds, and if a comparison had been made between North and South Africa, in those days, the features of difference now so marked, would not then have existed.

Accessibility and climatic conditions are responsible for the fact that railroad development first gained strength in the South and as the indications of mineral wealth came in as a result of pioneer work in prospecting, geological survey, etc., so the development of the mineral industry followed and with it came the inevitable railways.

That transport is not only necessary, but absolutely vital to the economic development of a country, has been proved time and time again, and requires no emphasis. In recent years the extension of the southern railroads to Central Africa, has been witnessed, and there are now in progress several lateral lines from the east and the west towards Central Africa, the completion of which will assuredly bring in its train astounding discoveries of undisclosed mineral wealth.

The Annual Report of the Tanganyika Concessions, gave an estimate of 5,000,000 tons copper in the ore reserves of that vast undertaking, while in the Katanga Fields of the Belgian Congo, operated by the Union Minière du Haut Katanga, the estimated ore reserves are almost fabulous.

Between Katanga and Khartoum in the Sudan, there is a vast stretch of country full of possibilities, the examination of which only can be systematically made when the projected railroad has made economic transport feasible. For these reasons it is obvious that the opening up of the through Cape to Cairo route must have a direct and incalculably important bearing on the mineral exploitation and development of the territory which it traverses and controls, and to which it brings communication with the outside world.

In common with the rest of the world, Africa will have its labour troubles, but in this respect, with its enormous population of indigenous natives, it has the material at hand for the purpose. The housing and protection of the necessary European labour force, and the establishment of proper living conditions so frequently neglected in tropical countries, will perforce have to be taken up more seriously in the future, and this is a problem that must be faced in the development of Central Africa. Given a diplomatic, experienced, and practical administration, both the native labour and the white labour question will present no insuperable difficulties and assure the development of the untold wealth of this great territory.
The Coalfields of Africa on or near the Route.

INTRODUCTION.

It is not possible to overestimate the importance of the coalfields of Africa. Their absence would have impeded the development of the interior of the continent for an indefinite period.

Railway development so far inland has only been made possible by the discovery of coal deposits farther and farther into the interior. The Rand gold industry could never have developed to the extent it has if Nature had not graciously provided a coalfield in close proximity. It is true that gold is one of the few minerals which can be extracted with a profit in remote spots, but low grade ore like that of the Rand could never have been economically mined without cheap fuel.

It is also true that railways have been built in countries devoid of coal, pace, Egypt and the Sudan, but the handicap is terrific, and it will often be found either that the freight rates are well nigh prohibitive or the general revenues of the country have to carry the deficit.

North-western Europe and the United States in a great measure owe their economic ascendancy to the occurrence of coal and iron in close proximity.

In Europe the coal deposits occur in the geological system known as the Carboniferous, which consists of a series of rocks of great thickness and thus represent a vast period in the world’s history.

This era opened with a great deposit of limestone often 4,000 to 6,000 feet thick and of marine origin which is followed by great beds of grit varying from 1,000 to 5,000 feet thick. Then come the coal-bearing beds which consist of sandstones, shales, fireclays, coal seams and ironstones varying from 2,000 to 12,000 feet in thickness.

Above the coal measures come the rocks of the Permian system; in some places they are unconformable to the lower system and in other places no break can be observed.

Now in the various countries of the Southern hemisphere and also in India and Borneo we find a distinctive series of coal-bearing rocks which have in all those regions many features in common, particularly as regards plant remains. Arguing mainly upon similarity of the fossil flora geo-
logists have come to the conclusion that the occurrence of similar plants in rocks so widely apart as India, South and Central Africa, Australia and South America that in those times there must have been continuity of land between these areas. Moreover, for many reasons there seems to be little doubt that a vast subsidence occurred over the area now covered by the Indian Ocean, and the vast region now submerged is generally referred to as "Gondwanaland."

In the southern half of Africa the series of rocks marking this period is known as the Karroo system and its lowest member is a bed of conglomerate or rather breccia which is generally acknowledged to be the product of extensive glacial action.

This conglomerate is called the Dwyka and is found over a large area in South Africa as far North as Bechuanaland; North of that although conglomerates may occur they bear no trace of glacial conditions. Above the Dwyka come the coal beds.

It is not difficult to picture the conditions which prevailed during this period, and the reader is asked to visualize a series of great depressions filled with brackish or fresh water and probably connected by channels. These depressions covered an enormous area in the Southern half of the continent, and the presence of such a large extent of water and the different arrangement of land and sea in that era conduces to a climate much moister than we find to-day and which resulted in an exuberance of vegetable growth which now is equalled in few parts of the world. This vegetation was of a peculiar character paralleled in a measure by tropical swamp growths of to-day; but it differed to a marked extent from the flora from which the coal in Europe was derived and the three plant forms which are typical of the lower coal beds, i.e., those which are more nearly contemporaneous with the coal beds of Europe are characterised by several genera unknown in the Northern region, e.g., Glossopteris, Gangamopteris and Noeggerathiopsis, particularly the first named.

In the Zambezi coalfield it is said that flora of a European type has also been found. If this is so, it is proof of a land-bridge and possibly continuity of water connection with the Northern continent at that period.

The actual origin of the coal seams is a question which has led to much discussion, for the following reasons:—In Europe the clays underlying the coal seams contain many traces of the roots of the plants which grow in the swamps and which when they died formed the coal. In Africa such underclays are seldom seen and traces of any roots are the rarest occurrence; consequently it has been argued that the coal is derived from great accumulations of vegetation which drifted into the lagoons and gradually subsided on to their floors.

As detailed knowledge of the coalfields accumulates this theory is becoming shaken and for many reasons which need not be detailed here opinion now inclines to the view that in many places the seams were the
result of growth and decay of vegetation on the spot. Dr. Mellor has discovered indications of what are termed “seat-stones” or “underclays” beneath the coal seams in the Witbank field, and he is of opinion that the rarity of these occurrences is due to the fact that in S. Africa the “seatstone” is usually sand instead of clay as it is in Europe and this would not be so conducive of preservation of the roots of the coal-producing flora as is the clay.

It, however, does not follow that all the seams are deposited in the same way and it is thought that some of the upper seams may be due to accumulations of drift material. Be this as it may the coal was deposited in vast amounts over a very large area, but as the greater portion was removed by subsequent denudation and all that now remains is what was, so to speak, pocketed in subsequent folds, or, as at Wankie, preserved by being dropped down below the erosion level by faulting. As time went on the climate of Africa gradually became drier and coal ceased to be formed and any small occurrences of the later stages of the era were of poorer quality than the earlier seams.

The commencement of the coal period in South Africa has generally been decided to coincide with the Upper Carboniferous times of Europe, and the deposition of what is called the Karroo system went on through the Permian and Trias, closing about the Rhaetic period. The flora of the Upper Karroo beds differs considerably from that of the earlier portion and is characterised by what may be termed the Voltziopsis facies.

A great South African Colliery at Witbank, Transvaal.
The accompanying table shows the correlation of the Karroo beds in the various countries according to recent geological research.

## COMPARISON OF THE COAL BEARING FORMATIONS IN S. AFRICA WITH CONTEMPORARY EQUIVALENTS IN OTHER COUNTRIES.

<table>
<thead>
<tr>
<th>Europe</th>
<th>South Africa</th>
<th>Brazil</th>
<th>India</th>
<th>New South Wales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Jurassic Rhaetic</td>
<td>Drakensberg beds Cave sandstone Red beds Molteno beds</td>
<td>Volcanic Intrusions St. Bento sandstone</td>
<td>Rajmahal beds</td>
<td>Wianamatta beds</td>
</tr>
<tr>
<td>Trias Karroo formation Ecca series</td>
<td>Stormberg beds St. Bento series</td>
<td>R. Rasto beds</td>
<td>Kota Maleri beds</td>
<td>Hawkesbury beds</td>
</tr>
<tr>
<td>Permian Upper Beaufort beds Lower Beaufort beds</td>
<td>New Estrada series</td>
<td>Upper Gondwana series</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Carboniferous Dwyka series</td>
<td>Upper shales Boulder beds Lower shales</td>
<td>Inty shales Pigeon shales Pretty River beds Orleans conglomerate Sandstone shales</td>
<td>Lower Gondwana series</td>
<td>Upper Coal Measures</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Talcher beds</td>
<td>Upper Marine series</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Greta series</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Marine series</td>
</tr>
</tbody>
</table>

The quality of the coal in South Africa is inferior to that of Britain and America and some 78% falls into Class B (Bituminous) of the classification adopted by the International Geological Congress on the World's Coal resources. About 18% however comes in Class A, Semi-anthracitic, and the remainder into Class D, Sub-bituminous inferior grade.

According to present information the calorific value of the South African coal supply works out approximately as follows:

<table>
<thead>
<tr>
<th>Calorific value</th>
<th>%'tge of ton'ge</th>
<th>Calorific value</th>
<th>%'tge of ton'ge</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.0 to 10.0</td>
<td>7.6</td>
<td>11.5 to 12.0</td>
<td>14.3</td>
</tr>
<tr>
<td>10.0 to 10.5</td>
<td>15.7</td>
<td>12.0 to 12.5</td>
<td>14.8</td>
</tr>
<tr>
<td>10.5 to 11.0</td>
<td>18.2</td>
<td>12.3 to 13.0</td>
<td>5.4</td>
</tr>
<tr>
<td>11.0 to 11.5</td>
<td>23.4</td>
<td>13.0 to 13.5</td>
<td>0.6</td>
</tr>
</tbody>
</table>

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COAL WEALTH ALONG THE ROUTE

Estimates of coal resources at this stage of development and of geological knowledge are bound to be to some extent hypothetical, for generally speaking the "proved" portion of each coalfield is comparatively limited.

A rough estimate of the amount of coal on or near the Cape to Cairo route may, however, be given with due reserve.

<table>
<thead>
<tr>
<th>Area</th>
<th>Resource (Estimation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Union of S.A.</td>
<td>56,200,000,000</td>
</tr>
<tr>
<td>N. &amp; S. Rhodesia</td>
<td>1,000,000,000(t)</td>
</tr>
<tr>
<td>Zambezi basin P.E.A.</td>
<td>135,000,000</td>
</tr>
<tr>
<td>Katanga fields</td>
<td>200,000,000</td>
</tr>
<tr>
<td>Total</td>
<td>57,535,000,000 Tons</td>
</tr>
</tbody>
</table>

As regards the Union of S.A. the distribution of the coal resources is as follows:

<table>
<thead>
<tr>
<th>Province</th>
<th>Sq. miles</th>
<th>Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transvaal</td>
<td>5,000</td>
<td>36,000,000,000</td>
</tr>
<tr>
<td>Natal</td>
<td>1,000</td>
<td>9,400,000,000</td>
</tr>
<tr>
<td>Zululand</td>
<td>1,250</td>
<td>6,000,000,000</td>
</tr>
<tr>
<td>Orange Free State</td>
<td>Approx. 1,000</td>
<td>4,800,000,000</td>
</tr>
<tr>
<td>Cape Province</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basutoland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swaziland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>56,200,000,000,000 tons</td>
</tr>
</tbody>
</table>

It is now proposed to give a short account of each of the coalfields of the portion of Africa on or accessible to the route by one of the branch railway ribs.

CAPE COLONY.

The coal deposits of this Province have disappointed the expectations of the early days for the amount of workable coal is not great. Only about half a dozen collieries are working:— the Cyphergat Mine at Molteno is perhaps the best known. Before the war the output was about 66,000 tons p.a. but of recent years it has greatly dwindled and now is quite trivial.

The Karroo beds in this portion of the Union are thicker than in any other part of S. Africa, being estimated to be 15,000 ft. from base to summit, but they are disappointing as regards their coal contents. There are two distinct coal bearing formations—the lower or Ecca beds and the upper or Stormberg beds. The only coal seam of any value occurs in the Molteno beds, the lowest member of the Stormberg series.

(t) No allowance has been made for the possible extension of this coalfield under the basalts to the Northward of the fault.
Thin coal seams also occur in the Beaufort beds but they have not proved to be of any economic importance. The Cape Province coal from Molteno is not of high quality as it contains a very considerable percentage of ash and sulphur.

The coal bearing beds are, moreover, much disturbed and further intrusions of dolerite have damaged a proportion and rendered mining expensive and difficult.

THE ORANGE FREE STATE.

There are two working coalfields in the Orange Free State, namely the Vereeniging and the Vierfontein. Both of these are situated near the Northern portion of the coal bearing area.

Only the Northern portion of this coal basin is well known but Wybergh estimates that the probable coal bearing area in the north west of this Colony may be as much as 7,080 sq. miles carrying more than 100,000 million tons of coal, but he is careful to point out that only 515 sq. miles of this is definitely known to carry coal.

In the Vereeniging area coal may be taken as proved over 80,000 acres estimated to carry some 10,000 million tons of coal of Calorific value varying from 8.0 to 11.0.

As regards the Vierfontein area, the existence of coal has been more or less proved over 51,000 acres and the proved and estimated reserves may be quoted at over 700 million tons of coal of Calorific value varying from 9.5—10.0.

The coalfields belong to the lowest group of the Karroo series and lie very flat but dip slightly in a S.S.E. direction.

In the Vereeniging mines there are two principal seams and a trace of a third. The Karroo beds here lie on a floor of dolomite which is usually overlain by a few feet of Dwyka conglomerate, then come about 6 ft. of secondary conglomerate and shale and following these beds we get the lowest coal seam which is usually about 8 ft. thick and is often separated from another seam 2 ft. to 3 ft. thick by a sandstone parting a few inches thick.

Above this some 10 ft. of conglomerate and shales occur and then 8.0 to 10.0 ft. of coal.

Continuing upwards we have a shale parting of about 2.0 ft. thick and another seam of 6 ft. to 12 ft. thick. In the shales above the last mentioned seam traces of a third seam occur. The lowest coal is the best quality in the area, but its grade is not so high as in some other of the S. African fields.

In the Vierfontein area there is only one seam 7ft. oin. to 9ft. oin. thick which has sandstone for a floor and roof, the quality of the coal is similar to that of Vereeniging.
THE WITBANK COALFIELD

Apart from these coals of the Ecca series, there are traces of coal in the Beaufort beds at Senekal and other places but of no practical economic importance.

In the South East of the Orange Free State these seams of coal also occur in the uppermost or Stormberg beds of the Karroo series, but these occurrences are unlikely to prove of great value.

Some hold the opinion that the Natal coal beds run under the Drakensberg range into the Eastern portion of this State, but it has not been proved up to date.

Owing to the absence of a detailed survey the amount of coal underlying the Free State is uncertain and a few boreholes have been put down outside the areas in which coal is at present mined. The output of the collieries in this State in 1920 amounted to 960,000 tons.

THE TRANSVAAL.

The coal basins in the Transvaal are three in number, viz.: The Witbank coalfield, the Springs—Heidelberg coalfield and the Ermelo coalfield.

The Witbank field comprises an irregularly shaped area covering about 400 square miles and lying on the main line from Johannesburg to Delagoa Bay but mostly to the South of it and a few miles west of the Oliphants River.

It may be considered the richest coal district in South Africa, and its occurrence only a little over 100 miles from the Rand is of vital importance to the economic success of that goldfield. This coalfield also supplies most of the coal which is shipped from Delagoa Bay.

As in many other parts of South Africa the coal measures rest on the glacial conglomerate or Dwyka, in some mines however the Dwyka conglomerate has apparently been denuded before the deposition of the coal series which then rest directly on rocks of the Waterberg or Pretoria System.

Above the Dwyka and below the actual coal seams secondary conglomerate and grits up to 20 ft. in thickness are found, grit beds are also found between and above the coal seams. Beds of sandy shales are also found in the neighbourhood of the coal seams and often grade into actual coal.

The lowest seam varies in thickness from a few inches up to 8ft. 6in. and it also is often split up into two members by a sandstone parting. It is on the whole a coal of higher average value than the other seams.

The next seam at Witbank known as No. 2 seam is the most widely extended of all, partly because it is high enough in the coal measures to be unaffected by irregularities in the floor of the older rocks upon which these beds have been deposited and further it has been less subject to denudation than some of the upper seams.

It may be divided into two portions, the upper usually containing shale bands difficult to separate, and further the quality of the lower half
is better. Consequently it is the lower portion which is worked and it has a thickness varying from 3 ft. 10 in. to 14 ft. 10 in. and averages about 7.6, it usually gives a calorific value of 11.19.

The proved amount of this portion of No. 2 seam is some 808 million tons with a probable further amount of 1,000 million tons, half of which is believed to be of poorer quality.

Seam 3 is usually very thin but is of good quality, it is not worked. Seam 4 is about 50 feet above Seam 2, its area is restricted owing to denudation having removed it from part of the field. It is a thick deposit often as much as 18 ft., as in Seam 2 the lower half is better than the upper and about 704 million tons have been proved with a contingent reserve of 340 million tons, it has so far been very little worked.

Seam 5 occurs over a still more restricted area, it is of good quality but rather sulphurous. It may contain some 58 million tons.

The estimated total amount of coal in the Witbank field is 6,456 million tons of calorific value varying from 9.0 to 13.5.

The output of the Witbank coalfield in 1920 was no less than 5,335,000 tons.

The second coal basin of the Transvaal is the Springs-Heidelberg Coalfield.

The Springs area proper is small and its coal is of indifferent quality but its proximity to Johannesburg, only some 20 miles away, has ensured its development, and latterly the mines of the East Rand have developed in the direction of coalfield. The Witbank field has generally eclipsed it but a considerable amount of its coal is still used for the production of electric power.

In most of the collieries there is only one seam varying from 14 ft. to 20 ft. thick, the lower part only being worked. In some of the mines, however, there are as many as four seams.

In the Visch Kuil-Delmas area to the North East of Springs there are normally three seams varying greatly in thickness. Mining in this area has not been very successful.

In the Heidelberg area at Grootvlei the main seam is of great thickness varying from 25 ft. to 53 ft. 9 in., but only the lower 7 or 8 ft. of it is worked and a good quality steam coal is produced having a calorific value of about 11.25. It is estimated that some 8,000 million tons may be found in this field, but it is not yet all proved.

The output of the Springs-Heidelberg coalfield in 1920 was some 829,000 tons.

The third Transvaal coal basin is the Ermelo Coalfield.

A coal basin occurs round Ermelo which of late years has been worked to a considerable extent and some good coal is being produced; as to the west the lower seam is said to be the best. Geological details of the series are unfortunately not to hand and the area has not yet been mapped, this basin however is of considerable size for it extends northwards to Breyten and may extend still further north and join with
the basin round Belfast, where a 22 foot seam has been discovered. This seam is said to extend some 15 miles north of that town, the coal of Belfast is, however, said to have a low calorific value.

The Ermelo and Belfast areas are very conveniently situated for export via Delagoa Bay, and on this account doubtless have a bright future.

Thick seams of coal are also alleged to occur in Swaziland but have as yet not been systematically prospected, some of it is said to be anthracite and, if so, this is probably due to the proximity of the dolerite dykes or flows which are prevalent in the vicinity of the line of earth movement running north and south through the Eastern portion of that country and marked by the Lebombo Mountains.

It is not known whether the Swaziland coal is continuous with the Ermelo basin—some however hold that it is part of the Somkele coalfield which extends North North West beneath the Lebombo range.

NATAL COALFIELD.

The Natal coalfield has been long known, and coal is said to have been discovered as long ago as 1838, but it was not till 1870 that mining was commenced near Dundee, no great development, however, took place until after the railway reached there in 1888 when mines were started at Newcastle and Dundee and in 1889 the output was only 25,000 tons, which slowly increased until in 1898 just before the Boer War it reached 400,000 tons. In 1920 the output was about 3 million tons, 1.4 million of which was either loaded as bunker coal or exported overseas from Durban. The coal traffic is now such an important matter for the S. A. Railways that the railway has been electrified from Dundee to Ladysmith in order to facilitate the coal export business and cheapen rates.

The coal mining in Natal for many years centred round Newcastle and Dundee, but during the last few years the coal measures have been followed Northwards and a number of collieries have been opened up in the Vryheid district and the coal has been proved again Northward still to Somkele between St. Lucia Bay and the Umfolosi River. The coal from the latter area is distinctly anthracitic.

The Natal coal generally is the best in South Africa and much of it possesses the valuable property of coking well.

Coal mining in Natal has been much hampered by the frequent occurrence of dolerite dykes and sills which besides interfering with mining have damaged considerable areas of coal and the anthracitic nature of the coal in some mines is due to this cause.

Unfortunately this important field has not yet been mapped, nor has the information in possession of the mining companies ever been brought together.

In the Western part of the coalfield stretching from Newcastle to Elandslaagte two seams appear to be present, the upper one varies from 5ft. 8in. in thickness at Newcastle to about 4ft. at Elandslaagte.
In the N.E. portion of the field around Vryheid and Hlobane there are, in some places, two seams and in others three. At Enyati and Buffalo there are two, the upper being about 8 ft. cin. and the lower 4 ft. to 5 ft. 3 in. At Veelsgeluk, N. Natal Navigation and Hlobane there are three seams—the upper varying from 4 ft. to 6 ft., the middle from 3 ft. to 4 ft. and the lower 4 ft. to 7 ft. At Tendegaagain the three seams split into four giving a total thickness of coal varying from 12 ft. to 16 ft. The Vryheid section of the field is said to produce the best coke in S. Africa.

The coal reserves of the Natal coalfield have been estimated at 6,000 million tons but as this official estimate was made as far back as 1911, it is essential that it be revised with the help of the mass of information now obtainable from the numerous mines.

SOUTH RHODESIAN COALFIELDS.

The Wankie field is the most important field far inland, and it is situated on the Cape to Congo Railway between Bulawayo and the Victoria Falls, the mine being 212 miles from Bulawayo and 68 miles from Victoria Falls Station in a valley 546 ft. lower than the Falls. The coal deposits were discovered in 1893 by a trader named Giese, but production was not possible till the railway reached there in 1904. Since then there has been a steadily increasing output of coal and the output for the year ending August, 1922 was 302,000 tons of coal and 109,000 tons of coke, a decrease of 11,700 tons of coal and 13,800 tons of coke on the previous year, this being due to the commercial depression.

Apart from the railway system of Rhodesia and the Rhodesian mines, the Katang copper field is entirely dependent on this mine for coke and it supplies the Union Miniere with 60,000 tons of washed coal and 96,000 tons of coke per annum.

The coal beds owe their preservation from denudation to the fact that they are faulted down en bise between two great faults, the Deka fault on the North and another not quite parallel with it on the south.

The position is as follows:—To the south we have a granite mass which is part of the floor of the old rocks, the southern fault cuts through the granite mass and the Karroo rocks are dropped down on the north side of the fault. A little south of the Deka river comes the Deka fault and the Batoka basalts are dropped down anything from 500 to 1,500 feet till their outcrop bounds the Karroo beds on the North. The Batoka basalts are believed to be of Stormberg age and, therefore, newer than the coal-bearing beds.

The coal-bearing series from their base upwards, consist of about 200 ft. of sandstone with beds of shale and coal, then 80 ft. of black shale and coal, with 50 to 80 ft. of fine clay above the coal seams; these beds are followed by 100 to 200 ft. of white sandstone with the beds of coal and
THE TULI AND SABI FIELDS

shale, and hereabouts is the close of the Ecca series. This concludes the actual coal-bearing strata and we next find 750ft. of grey and green shales called the Madumbisa beds, and these probably correspond to the Beaufort beds of S. Africa. Higher still we find 300ft. of coarse grit and conglomerate called the Escarpment grits, followed by 100ft. of fine red sandstone called the Forest sandstone, and the two latter with the Batoka basalts are probably the representatives of the Stormberg system and so bring us into Triassic times.

The coal seams are divisible into three groups, but the whole of these are not present over the entire area. The uppermost coal seam when present is often separated into several divisions, all but one being too thin to work. The middle coal is known as the Five Foot seam, it lies 23ft. above the main seam and occasionally contains bands of sandstone. It has not been worked.

The main coal is the lowest and it varies from 7ft. to 13ft. 6in. in thickness and is free from shale and stone bands. This is the only one being mined at present.

The coal is as good as any in the Southern half of Africa, and the average of a number of tests gave a calorific value of 13,23. Like all African coal the ash content is fairly high, varying from 9% to 13%. The sulphur content is somewhat high, ranging from 1.5% to as much as 4%, but usually not more than 2.5%. The coal reserves in the Wankie field calculated on a very conservative basis are approximately 600 million tons without allowing for workable coal in other than the main seam.(1)

Due North-East of the Wankie field there is a large area in which coal is known to occur and these are usually referred to as the Lubu, Sengue and Marungabusi areas. They have not been adequately examined, neither has a small coal area called Angwa near the Zambezi and due north of Ayrshire.

The first mentioned group are roughly estimated to contain 144 million tons of coal.

On the Southern and South-Eastern edge of Rhodesia lie the small coalfields of Tuli and Sabi, the former being divided into three sections, viz., Umsingwani, Singwesi and Massabi, and estimated to carry about 43 million tons.

The Sabi field is said to contain nearly 8 million tons. The coal in these fields is believed to be of a higher horizon than that of Wankie, being either Upper Beaufort age or Lower Stormberg; little information is, however, available as to its quality as no serious mining has been attempted there.

(1) Ed.—H. B. Maufe, Director of Geological Survey, S. Rhodesia, estimated that Wankie coalfield probably contained 601,200,000 tons, but the Wankie Colliery Co. have since assessed the coal in their concession at 6,000,000,000 tons. No reason is given for the increase in the estimate.
KATANGA COAL DEPOSITS.

The coal resources of this region as at present known do not promise to loom large in the future development of the continent.

Two occurrences have however been recorded; one is on the Luona River, West of Bukama and here there is a small elliptical basin about 3 miles long by 1½ miles wide in which remains the lower portion of a syncline of Karroo rocks. There are two seams and the total thickness of the coal is 10 to 13 feet and it is estimated that the basin contains about 25 million tons of which some 15 million tons will be available. The coal is unfortunately not of very high quality, the ash content often amounts to 25% but can probably be reduced by washing and that operation would also remove most of the pyrites contained in the coal.

One of the greatest needs of Katanga is coke for the copper furnaces and unfortunately the coking properties of this coal are indifferent, but extensive experiments have been made and it is reported that by mixing 75% of Wankie coal and 25% of Luona coal a fair coke was obtained and it is hoped that by washing the coal still better results may be gained.

Apart from this, however, the discovery is of considerable importance for the coal can quite well be used for steam raising and in this way will prove of value for producing electric current at the great generating station of La Panda belonging to the Union Miniere and it will be of much use for the railways.

The other coal occurrence in Katanga is in the Lukuga valley near Lake Tanganyika where a small basin of Karroo deposits exist. It was discovered in 1911 by an engineer belonging to the Societe Geomines.

Five seams of coal have been identified varying in thickness from 1 ft. 7 in. to 5 ft. 6 in. The three lower seams are very variable in range and thickness but the two upper ones are more regular.

The coal unfortunately is poor stuff for it contains 23% to 45% of ash and the beds contain many shale bands. Further it will not coke and the ash is unfortunately fusible which feature renders it somewhat unsuitable for steam raising purposes.

As coal in the Congo territory is so scarce its existence cannot be ignored so extensive experiments have been conducted and it is now proposed to wash the coal and briquette it and by that means it is hoped to render it available for use on the railway from Albertville to Kabalo and on the Tanganyika lake steamers.

ZAMBEZIA COALFIELD.

Coal has for many years been known to exist in the Zambezi valley, for as long ago as 1857 Livingstone recorded the fact that coal cropped out in the Moatizi and Revugwe valleys near Tete. Since then the area has been superficially examined by various explorers.

A systematic exploration of the region has however, been recently carried out by a party of Belgian engineers and geologists under M. R.
THE NEW TETE COALFIELD

Anthoine for the Societe Belge Miniere et Geologique du Zambezi, which are now exploiting the deposits.

They report that along the Zambezi valley there occur a series of basins in which Karroo beds are to be found. Some contain very little coal, for instance the basins they have named Sinjal, Nyakale and Msitu are said to contain insufficient to warrant development and in the Ngoma basin the seams are too much disturbed to allow of profitable working.

Near Tete on the other hand there is said to be one extensive basin containing a large amount of coal of good quality and easily workable, the seams crop out in many places with a dip of 10° deg. to 15° deg. The horizon of the coal measures in this region is declared to be Upper Ecca, at the top of the Lower Karroo and just below the Beaufort beds, if this is so they are newer than most of the Transvaal coal deposits but they may be coeval with the Wankie deposits.

The total extent and volume of the coal has not yet been determined, but as far as the investigations have gone they are declared to have proved the existence of about 105 million tons.

It is reported that no less than 15 seams are present and that no less than six are of workable thickness—varying from 9 ft. to 25 ft. of good coal. The amount available in the four sections of the Tete basin is estimated at 105 million tons.

The best coal in the above seams is reported to have an ash content of 11% to 16% and to contain 22% of volatile constituents. Picked samples are said to have given as much as 8,000 calories per kilo, but it is unlikely that bulk samples will give results anything approaching this high calorific value. The sulphur content is also said to rarely exceed 1% and the coal also belongs to the coking variety.

Commercial trials of the fuel in locomotives and stationary engines are reported to have been satisfactory and it therefore appears highly probable that a valuable new coalfield is now on the eve of development and one which will enable Beira with the help of the Beira-Zambezi Railway to become an important coaling port in the near future. The discovery will moreover assist commercial development in the Mozambique Coy.'s territory and in Nyasaland.

NORTHERN RHODESIA AND NYASALAND COALFIELD.

These two countries may conveniently be taken together as they are coterminous and in neither has the coal been fully explored nor has any serious development taken place.

In Northern Rhodesia coal bearing beds have been discovered in three localities.

Firstly, in the Zambezi Valley, below the Victoria Falls, between there and the Kariba Gorge, on the north side of the river and to the east and west of a tributary called the Lufira River. This field is of considerable
extent; it is said to contain two seams, one of 4 ft. and another of 3 ft. and a rough estimate gives its coal capacity as 38 million tons, but it may well contain much more.

Secondly, the Luano field, which is some distance North of the junction of the Kafue River with the Zambezi and about East of Broken Hill. It lies in some fairly low ground at the foot of the Muchinga Escarpment and is traversed by two tributaries of the Luangwa River, the Mulungushi and Lusenfwa (the former, however, joins the latter before reaching the Luangwa).

The succession here has been carefully studied by the late Mr. Molyneux and he reports that the base of the Karroo series, which rests on the gneiss and schists which form the Muchinga scarp, is marked by beds of coarse conglomerate, covered by about 100 feet of red sandy clay.

Then come what Molyneux terms the Lower Matobola beds or the coal series, and which are about 400 ft. thick.

The coal seams are apparently very numerous, in fact upwards of 100, but many are only a few inches thick. The two thickest are, however, 6ft. and 8ft. and the sum total of the coal adds up to over 18ft.

Tests of calorific value or analyses have unfortunately either not been made or are not available.

The coal, however, seems to have some curious characteristics and to be made up of dull layers alternating with black shiny bands of higher grade which splinter in a curious manner, resembling the "cenie" coal of Scotland.

The coal-bearing beds contain the characteristic Ecca flora, e.g., Glossopteris indica, Schizoneura, and Gangamoopteris, and also the fresh water mollux Palaeumutela. The coal content has been roughly assessed at $22\frac{1}{2}$ million tons.

COALFIELDS OF TANGANYIKA TERRITORY.

Coal-bearing beds of Karroo age have been located in several parts of Tanganyika Territory.

(1) At Manda (late Wiedhafen) on the east side of Lake Nyasa, a series of sandstones and coal seams are found in the Ruhuhu valley, being preserved from denudation by step and trough faulting; some dozen thin seams have, according to Bornhardt, been located, but the coal by the analyses available is of poor quality.

This coalfield lies in an old trough which ran East and West across where Lake Nyasa lies now on the West side of that lake, and the coal beds at Deep Bay lie in the Western continuation of this old sunkland which was formed after Karroo times and before the great rift to which Nyasa owes its origin.

(2) To the North-West of Lake Nyasa there occurs another sunkland running North-West towards Tanganyika and in this line of depres-
IN EASTERN AFRICA

sion now marked by the Songwe valley, Karroo rocks are found at intervals; there are two occurrences within sixty miles from the North-West corner of the Lake, and the extent of these rocks is really greater than appears on the surface, for a greater outflow of recent volcanic rocks has covered the Karroo beds in part of the area. Another patch of Karroo rocks in the same depression is reported from beyond Rukwa Lake. The coal seams in this occurrence are reported to be eight in number varying from 15ft. 6in. to 1ft. 8in., but information as to the quality is lacking.

(3) Farther North and nearer the East coast of Africa Karroo rocks have been discovered in the Rufiji valley, and the system is there said to be represented by nearly 2,500ft. of sandstones and shales. Such coal seams as have been discovered appear to be of small dimensions and little value.

A small patch of Karroo rocks has also been found in a depression to the West of the Uluguru Mountains and is said to contain a thin seam of coal.

Further North, again, inland from Tanga and Moa, Karroo beds occur, but in this region the lower beds appear to be missing, for, judging by the fossils the shales are diagnosed as of Stormberg age.

KENYA COLONY, &c.

Along the Uganda Railway inland as far as about mile 59 beds believed to be of Karroo age are found, and on the Sabaki River Professor Gregory found shales with typical freshwater mollusca of this period. It is probable that these rocks, like those of Tanga district belong to the Upper Karroo series but the question has not been completely cleared up. As far as is known, however, no coal seams have yet been discovered although black carboniferous shales are of common occurrence.

Further North still all trace of this system is lost. Coal is said to exist in Abyssinia and to have been mined there by Menelik to supply fuel for his traction engines, but nothing is known as to its extent or geological relations.

Some beds of lignite are reported from the foot hills of the Abyssinian Plateau near Kassala, but little appears to be known as to their extent or age.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

A RHODESIAN MINERAL PRODUCER.

A view of the Broken Hill Mine in 1920.

A great Rhodesian Colliery at Wankie 70 miles South of the Victoria Falls.
Northern Rhodesia.

Its Potential Mineral Resources.

By EDMUND DAVIS, J.P.

Northern Rhodesia, which has an area of about 291,000 square miles, can be said to be only in the earliest stages of the development of its mineral resources.

Considerable areas in the more remote parts have been examined only in the most perfunctory way, if they can be said to have been examined at all, but there are others in various stages, from prospecting through development to production, the final stage naturally being reached on those properties which are on the one line of railway possessed by the country.

Up to the present the only metals or minerals exported have been gold, silver, copper, lead, zinc, vanadium, bismuth and mica, and the last two in unimportant quantities. Others which have been found, but not yet worked, are iron, manganese, tin and coal.

The total value of the minerals produced in Northern Rhodesia up to the end of February 1925 was £3,343,375 of which lead accounted for £2,482,965; copper and concentrates £622,924; zinc ore £88,653 and gold £78,940. The value of the production for 1924 was £135,879.

Up to the present no important gold mine has been developed, and the future of the country as far as can now be seen depends on its resources in the base metals, zinc, copper and lead, of all of which the consumption is increasing at a rapid rate. For 1924 the world production of copper and lead was about 1.5 million tons each, and of zinc 1 million tons. The United States production of copper was about 900,000 tons, and that of Chili and Peru—largely under American control—228,000 tons.

In a very interesting Presidential address recently given to the Institute of Mining and Metallurgy, Sir Thomas Holland pointed out that of the metals disseminated through the earth's crust there is ten times as much manganese as copper; four times as much chromium and twice as much nickel, while copper is 2.5 times as abundant as zinc and 5 times as abundant as lead.
Mr. EDMUND DAVIS.

Director of the British South Africa Company, Chairman of the Rhodesia Broken Hill Development Co., and Chairman or Director of numerous other mining companies.
Sir Thomas Holland, in fact, described zinc and lead as being among the rare elements. In that case, any discoveries of concentrations of those metals into commercially workable ores are of great importance. There is increasing reason to believe that such concentrations, especially in the case of copper, occur in Northern Rhodesia and Central Africa.

At Katanga, in the Belgian Congo, there are enormous deposits being worked by the Union Minière du Haut Katanga, whose, production for 1924 was 85,379 tons, from mines in a copper belt probably the greatest in the world; being about 250 miles long, 10 miles of which are estimated to contain 4½ million tons of copper metal.

The same geological formation continues south and south-eastwards into Northern Rhodesia, and in it have been found the deposits now being developed at Bwana M'Kubwa, N'Kana and N'Changa, the latter about 50 miles north-west from Bwana and very near the northern border; these are considered to belong to the same mineralization period as the Katanga copper belt.

The copper ores occur principally in four formations:—

(a) At the contact of shales, quartzites and dolomites (the Bwana M'Kubwa, Kanshansi and Congo deposits are of this type).

(b) The N'Kana type, when the ore bodies impregnate slates, conglomerates and schist.

(c) The Kafue type, with the ore chiefly in limestone.

(d) In granite porphyry.

At Bwana M'Kubwa there are four distinct ore bodies, varying from 25 to 100 feet in thickness, containing malachite—some of it so fine that it might be used as an ornamental stone—oxides and silicates at the surface, changing to sulphides from about 250 feet; below 450 feet it is expected to find massive sulphides. Down to 500 feet level the values are consistent, and if anything they show a slight increase. The total estimated reserves down to 500 feet are 7,500,000 tons, containing about 3:7 per cent. copper.

The N'Kana Mine, 30 miles west of Bwana where the deposit has been traced for over a mile in a mineralized zone with a width of 20 to 100 feet, has about one million tons of 3:48 per cent. copper proved. This mine is expected to yield one million tons of ore for every 100 feet in depth down to the 300 feet level.

The Bwana Company is putting up a plant to treat at first about 1,250 tons of ore daily. This is being so laid out that it can be increased to 3,000 tons capacity. The annual estimated production of the first unit is 10,250 tons copper metal a year. This plant is of considerable interest; in it the copper existing as oxides and carbonates will be reduced to the metallic state in the ore by producer gas, and the metal will then be dissolved by leaching.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

BWANA M'KUBWA PERSPECTIVE DRAWING
VIEW OF
FIRST 1000 TON UNIT OF PLANT

Key to Plant Units:
1. Receiving Bin and Gyratory Crusher
2. Coarse Crushing Plant
3. Furnace Building
4. Fine Crushing Plant
5. Leaching Plant
6. Evaporating Plant
7. Refining Plant
8. Roller House
9. Gas Producing Plant
10. Power Station
11. Store
12. Carpenter's Shop
13. Mechanics' Shop, Smithy and Foundry
14. General Offices
15. Laboratory
the ore with ammonium carbonate. The copper solution will be heated to expel the ammonia and precipitate oxide which will be smelted to metal.

All the raw materials for the production of producer gas and ammonia are obtained in Rhodesia. The first unit should be producing during this year (1925), and it is expected in 1926 to produce 10,000 tons of very pure copper, assaying over 99.9 per cent. copper.

The work being done by the Rhodesian Congo Border Concession, Ltd., promises to disclose other very large copper deposits. This company has prospecting rights over 52,000 square miles, and is carrying on its work very vigorously. It has discovered copper in three principal areas:—

(1) At N'Changa in the north-east corner of Northern Rhodesia, and 15 miles from the railway.

(2) The eastern area south of Bwana, and 40 miles east of the railway.

(3) The southern area about 120 miles south-west from N'Changa and the same distance from the railway.

The N'Changa area, which is generally shales, shows an ore bearing formation over 100 feet wide, which has been proved by diamond drilling. At 600 feet depth a drill hole has lately passed through 50 feet of ore assaying 4.85 per cent. copper. A very large tonnage should be proved, it being estimated that every 100 feet in depth will develop 500,000 to 600,000 tons of ore containing 4 to 4.1 per cent. of copper.

In the eastern area the copper ore occurs in granite porphyry, a formation different from any other copper deposit yet known in Central Africa.

The mineralized area is approximately 15 miles long by 2 miles wide, the ore being already proved in places by drilling to 100 feet. The southern area has had only preliminary work so far, but sampling has given values up to 11 per cent. copper.

The work of these companies has been referred to in some detail, as development on a large scale is being carried out on mines they control which should be the earliest large producers. At the other end of the scale are two properties, the Sable Antelope and Silver King, which are being worked by tributors, who have trained natives to do practically the whole of the work, including smelting to "black" copper containing 90 per cent. copper. The metal is carted 120 miles by ox wagon to the railway.

So far the only important deposits of lead and zinc ores have been found at Broken Hill, 374 miles north of the Victoria Falls, on the main line of railway. These deposits consist of mixed lead and zinc minerals in dolomite, and are being worked by the Rhodesia Broken Hill Development Company.
The mineralized zones are harder than the containing rocks, and form small kopjes, which consist almost entirely of oxidized ore; the chief minerals are carbonate of lead and silicate of zinc. Vanadianite, a combination of vanadium and lead, is also present.

Lead production was commenced in 1916 and has been continuous. A total output of 100,877 tons valued at £2,483,000 up to the end of February, 1925, places lead in the first position among the mineral products of Northern Rhodesia.

The present total ore reserves at Broken Hill are estimated at one million tons, sufficient to produce 12,500 tons of metallic zinc a year for 15 years, though these reserves will probably be increased as time goes on, and the Company develops some of its other properties. The zinc produced by the new plant is free of cadmium and is of exceptional purity. It already commands a premium of over £3 per ton above the price of ordinary commercial spelter.

Down to the 225 foot level the known metal contents are: zinc 188,000 tons; lead 68,000 tons; oxide of vanadium 7,700 tons. In order to obtain power for its lead concentrating plant and electrolytic zinc plant, the Muhungushi River has been dammed at about 39 miles from the mine and a hydro-electric plant put in. The water has been dammed for 15 miles and a lake created 4½ miles wide at the widest point. When full it holds 4,000,000 cubic feet of water. A first unit of 2,500 h.p., has been installed at a cost of about £300,000. At a later date this will be increased to 10,000 h.p. H.R.H. the Prince of Wales started the power plant on the 15th July, 1925.

Of the lesser minerals bismuth has been found as the sulphide in quartz veins occurring in chlorite schists, and just over 24 tons in all have been exported. It is fairly widely distributed; the most promising area is stated to be the Luano Valley, about 100 miles east of Broken Hill.

Coal occurred in the Luano Valley in the north-eastern part of the territory, where four seams totalling about 19 feet in thickness have been found, and also near the junction of the Kafue and Zambesi Rivers. The probable reserves are estimated at 60 million tons, but so far these deposits have not been worked.

Much of the area of Northern Rhodesia is covered with sand or detrital material, so that prospecting is difficult and costly. Electrical prospecting has been tried lately, and, it is reported, with some success.

In other places, where mineralized zones occur, surface weathering and leaching have washed out mineral constituents, so that estimates made from surface samples only may be misleading.

On the other hand, conditions for prospecting are generally good. Although the country falls wholly within the tropics, prac-
tically the whole of it lies about 4,000 feet above sea level, and is not unhealthy. Native labour is cheap and fairly plentiful; in fact, the demand for labour is not equal to the supply, and natives leave Northern Rhodesia to seek work elsewhere.

The immediate future mineral production of Northern Rhodesia seems to lie in the exploitation of its copper, lead and zinc deposits.

The world's supply of copper is obtained from ores which average about 2 1/2 per cent. of metal. Several of the larger American mines are working profitably on ore with 1 4 to 1 6 per cent. copper. The big Inspiration Copper Company works ore as low as 1 2 per cent. but, of course, this is only possible with large scale working. The Rhodesian ores at present proved averaging 4 per cent. copper or better should therefore prove very profitable, and should materially improve the position of the Empire relatively to the rest of the world as a copper producer. At present the Empire's proportion is less than 5 per cent. of the world production, while in 1924 the United Kingdom imported metal and ore to the value of over 12 millions sterling, of which probably only just over a million pounds worth came from Empire sources.

There was great activity, particularly in America, in the development of copper mines up to 1913, when such work stopped. The bulk of the copper now being produced is coming from those mines. Since 1913 very few large mines have developed into permanent producers, and except in Rhodesia no copper mining developments are in progress anywhere which are likely to prove of great importance. On the other hand, some of the largest ore producers of to-day are rapidly approaching the exhaustion of their reserves.

The exploration and exploitation of the Rhodesian mineral deposits on the scale on which they are now being attacked is therefore an important development to the Empire. The pioneer work of opening up and settling the country is largely being done by mining and exploration companies, e.g., at Broken Hill. Here there is a white population of 800, including 375 mine employees, and permanent brick houses and schools have been built, with facilities for recreation.
Diamond Mining in the Belgian Congo.

Rocking screens used during the World War at some of the smaller mines.

Transporting gravel to the mill. Mine shown in the distance.
Diamond Mining in the African Jungle.

Some facts about the History and Production of the Equatorial-Belgian Congo and Angola Diamond Fields.

By SYDNEY H. BALL


As a mining industry ages, it is normal for the product derived from lode mining to increase at the expense of the product of alluvial mining. Diamond mining in the past twelve years has been atavistic to the extent that it has reversed the rule. In the years 1911 to 1913, the South African pipe mines produced almost 80% of the world's diamonds, while in the two years 1923 and 1924, they produced but about 55 per cent. This is due to two factors, first to the decreased production of the pipe mines caused by the aftermath of the World War, and, second, to a markedly increased production by the alluvial mines, notably those of the Belgian Congo and Angola. These mines in 1923 and 1924 accounted for from 15½ to 17½ per cent. of the world's production by weight.

The Belgian Congo-Angola diamond field includes the area drained by the north-flowing tributaries of the Kasai-Sankuru river system, between 17 degrees and 26 degrees east longitude. The area already known to be diamondiferous approximates 150,000 square miles, making it the largest alluvial diamond field in the world. The mines now being worked form two groups, of which the most westerly is the more important. The latter extends 190 miles south, 20 degrees west from a point about 38 miles east of Luebo, the central part of the belt being 60 miles wide. Just 125 miles east of the north end of this group is a second smaller group of mines.

The centre of the diamond field is about 7 degrees south of the Equator and in consequence the climate is humid and relatively warm. Seasonal division of precipitation results in a wet and dry season. For a tropical one, the climate is by no means unhealthy as is evidenced by the few days lost by the white employees due to illness.

The first diamond was found by a prospector of the parent company, the Forminiere (Societe Internationale Forestiere et Mineure du Congo) in 1907, but due to the rather hostile attitude of the local natives, development of the field only began in 1911,
Excavations showing over-burden and gravel.

Trucks conveying gravel on endless wire ropeways at Tshisundu Diamond Mines, Belgian Congo.
and production two years thereafter. The engineers of the mother company rapidly extended the known diamond bearing region radially from the original discovery and in consequence in 1917, the Diamang company (Campanhia de Diamantes de Angola) was formed to exploit the deposits found in Angola, a Portuguese colony across the Congo border. In 1920, the Beceka (Societe Miniere du Beceka) the Kasai (Societe Miniere du Kasai) and the Luebo (Societe Miniere du Luebo) companies were formed to exploit extensions of the original field in the Belgian Congo. These companies also possess large concessions with favourable prospecting and mining rights. The parent Company is owned by the Colony, the great Belgian Bank (Societe General de Belgique) and two American financiers, Messrs. Thomas F. Ryan and Daniel Guggenheim and their associates. The Diamang is owned by the Portuguese Colony, the American and Belgian interests above mentioned and their Portuguese, French and English associates. The Beceka, Kasai and Luebo companies are controlled by the Societe Generale de Belgique.

Topographically, the diamond field is a plateau, sloping gently to the north, which has been cut rather deeply by the northward flowing rivers. The plateau in north eastern Angola is some 3,000 feet above sea level and in the northern part of the field about 1,700 feet above sea level. The rather narrow river valleys are incised from 200 to 600 feet in the plain. The streams are marked by a narrow band of heavy timber and dense undergrowth, and the ridges are covered by grass with a stunted tree here and there.

The plateau is formed of sedimentary rocks of Jura-Triassic age, which are flat lying or which dip very gently to the north. These rocks are predominantly soft sandstone, but contain some beds of shale and a few lenses of conglomerate. These were presumably in part laid down on an ancient land surface but are largely fresh or brackish-water deposits. Older rocks have been uncovered in some of the deeper valleys; they, in parts of the plateau protrude through the sandstones as hills and they cover considerable areas near the Kasai river divide where the sandstone has been removed by erosion. These old rocks, which before the Jura-Triassic rocks were laid down, had been carved into an undulating land-surface, are presumably of pre-Cambrian age. They consist of sedimentary rocks (mica and other schists, quartzites and banded jasper-iron ores) and igneous rocks (basic and acid gneisses and granites and basic igneous rocks).

The commercial diamond deposits are all of alluvial origin and are either creek gravels of the present day drainage systems or terrace or bench gravels de-
posed by the streams when at a higher level. Some of these are 65 feet above the present stream levels. The creek deposits are narrow, but often a mile or more long; the gravel is usually under a yard in thickness and the over-burden from two to six feet thick. The terrace deposits are more equidimensional in plan and both gravel and overburden are somewhat thicker. On the average, the tonnage of the terrace deposits exceeds that of the creek type. The pay gravel consists of sand and well rounded pebbles with, in instances, some large boulders. Although in places there is no over-burden, most of the gravel is covered by barren sand, sandy clay or silt, which on the average is thicker than the pay gravel. Two or three cubic metres of overburden are handled to one cubic metre of gravel. The exploitable diamond deposits already known are numerous and as development increases, more will be found. The deposits vary in size from those containing a few thousand carats to other containing over a million carats. The grade of the deposits is equally variable, ranging from a fraction of a carat to patches which will produce over 10 carats per cubic metre. In a single deposit, the diamond content may vary markedly from one month's mining to another.

Diamonds also occur, probably in commercial quantities, in some of the conglomerate lenses in the Jura-Triassic sandstone. C. Mason Farnham, in Angola, also recovered a small diamond by crushing and panning a basic igneous schist of the pre-Cambrian series.

ASSOCIATED MINERALS.

Associated with diamonds in the pay gravel are a large number of pebbles of chalcedony, agate, jasper and flint. In addition there are a number of heavy and resistant minerals which are the satellites of the diamond; of these black staurolite is by far the most abundant, but the following are relatively common; Brown staurolite, cyanite, ilmenite, tourmaline, chrysoberyl and garnet. The following occur less abundantly: Spinel, rutile, pyrite, gold, monazite, sapphire, ruby, epidote, magnetite, hematite, opal, amethyst, zircon, topaz, emerald, molybdenite, sapphire, bronzite and spodumene. If the gravel does not contain a fair percentage of these associated minerals, it is poor in diamonds. Of course, quartz, felspar and mica are abundant constituents of the sands. Next to the diamond, the most interesting constituents of the gravel are large, well-shaped flints. These are relatively abundant and occur from top to bottom of the gravel. In other words primitive man hunted along the banks of these Central African rivers when the
streams were depositing the diamond-bearing gravel.

Production of the field in metric carats follows:

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<th></th>
<th>Belgium Congo</th>
<th>Angola Diamant</th>
<th>Total</th>
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<td>Luebo</td>
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<td>Kasai</td>
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<td>1921</td>
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<td>8,075</td>
<td>4,283</td>
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<td>1922</td>
<td>589</td>
<td>13,060</td>
<td>13,439</td>
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<tr>
<td>1923</td>
<td>12,954</td>
<td>135,000</td>
<td>28,315</td>
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<tr>
<td>1924</td>
<td>18,681</td>
<td>280,000</td>
<td>44,786</td>
</tr>
<tr>
<td>Total</td>
<td>32,221</td>
<td>683,016</td>
<td>98,700</td>
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The diamonds in most cases are well defined crystals, dodecahedra, octahedra predominating. Cubes tetrahexahedra and trisoctahedra also occur. Twin crystals are common. (Interpenetration twins with the octahedral face the twining plane and also after the spinel law). Triangular vicinal faces characterise most crystals. During transportation from their source, a number of the stones were forced against other pebbles and boulders, and in consequence, cleavage fragments are fairly common. Water-worn crystals, however, are most unusual. A large proportion of the stones are transparent and colourless, others are slightly tinted brown or yellow; still, others are decided-also occur as do some globular masses or bort of more or less radiate structure. Good-sized shipments are divided into as many as 200 lots giving a complete assortment of diamonds from bort and rubbish through the browns, silver capes and bye-waters to stones of the most beautiful shades, whites, fine whites and blue whites. The latter abound and in quality are equal to the best in the world.

In size the stones vary from "sands" to stones of over 44 carats. The run of the mine stones go from 8 to 12 per carat, shipments from the more southerly mines being as a rule of larger average size than those of the more northerly mines. In the various deposits, the average varies from 30 to the
carat to 3 to the carat. On the average stones of 1 carat or over make up 10 per cent. of a shipment and those of one-half to one carat a further 20 per cent. "Closed" goods form some 30 per cent. of the average shipment.

In the Bushimaic mines of the eastern group, the associated minerals differ from those in the other deposits (titanite and garnet predominate and diopside is confined to this deposit, while staurolite is absent) and in addition the percentage of gem material is much less than in other deposits. The difference is sufficiently great to suggest one source for these stones and another source or sources for the diamonds of the other deposits. The Bushimaic concentrates resemble those of the South African pipe mines.

The original source of the Central African diamond is as yet unknown, although certain of them at least, as mentioned above, appear to have been derived from ancient basic gneiss rocks. The Bushimaic diamonds were derived from a different source and perhaps from a different type of source than the other deposits. The other diamond deposits presumably originated from a single type of source but the stones doubtless were derived from a number of different similar sources occurring over a relatively wide area. Whatever was the original source of the diamonds, they appear to have been concentrated in certain gravel lenses in the Jura-Triassic sandstone and were thereafter re-concentrated in the present stream gravels. Elsewhere the writer has emphasised the fact that the South African diamonds have been derived from three distinct sources: first, an unknown, but very ancient source (Cambrian or pre-Cambrian) from which the detrital diamonds recovered in crushing the Rand gold ore are derived; second, the andesite of the Ventersdorp Series (early Paleozoic Age) and, third, the kimberlite pipes from which, directly or indirectly, most of the South African diamonds are obtained. The Belgian Congo-Angola stones are older than the Kimberlite pipes; whether they belong to one of the two sources is unknown. In passing, there is a striking similarity between the geology of these diamond deposits and those of the Somabula Forest, Rhodesia.

CONDITIONS OF PRODUCTION.

The Congo-Angola diamond mining companies employ about 200 white men and some 2,000 natives, the white men, of course, only acting as bosses. The native as an individual is a poor workman, but in view of the wage paid, many items in the mine cost sheet are surprisingly low. That mining in Central Africa and in the United States is two distinct propositions is indicated by the fact that the Forminieres and its associated companies run a steamer up
river from the rail head at Kinasasa, some 500 miles and in addition operate not only a narrow gauge railroad but about 1,100 miles of automobile road. Many square miles of plantations are required to furnish food to the black employees and the herds of the companies contain over 10,000 head of cattle. The companies further operate a number of wireless stations.

In the early days of the district practically all transport was by native porters, but now they have been almost entirely supplanted by motor cars, motor trucks and convey of ox-teams. The advantage to the native of the company's medical service and its sanitation programme is indicated by the relative immunity from epidemics enjoyed by the company's employees as compared to the natives of other villages. The company has a trade's school, in which are trained quite competent native carpenters, masons, blacksmiths, chauffeurs and other artisans.

The first stage in mining is the determination of the diamond content of the deposit. Self-draining deposits covered by shallow over-burden are prospected by trenches and pits. Water-logged deposits and those with unusually deep over-burden are developed by pits in which special steel casing is used or by hand drills of the Empire type. Pits or drill holes, as a rule, are placed on the corners of 10-metre squares.

The reserves, it is reported, are sufficient for production at the present rate for well over a decade.

The Congo-Angola companies operate some 40 different mines. First, the deposit is cleared of trees and underbrush, and only after this has been done can open cut mining begin. The over-burden is usually excavated with pick and shovel and either removed in mine cars or wheelbarrows or thrown back into parts of the pit from which the gravel has previously been milled. The gravel is then shovelled into wheelbarrows or mine cars and trammed to the mill either by hand or on endless cables. As the bottom of the gravel is frequently rich, the bed rock is cleaned with brushes and all gravel in joint planes or in pot holes carefully picked out. Drainage is obtained by ditching or by steam or electrically operated pumps. In the mills, the gravel is first sized by trommels, the coarse and fine being discarded. Pans of the South African type (ranging in diameter from 4 to 9 feet) are then used to produce a concentrate which, after sizing, is treated in Harz jigs. Frequently the concentrates are re-treated in Harz jigs before the diamonds are picked out by hand. Due to the difference in the size of the deposits, the mills vary from experimental hand-operated plants used in development to fair-sized plants operated by steam or electricity.
MARKETING JUNGLE DIAMONDS

The company maintains at Antwerp a sales office at which the output of the Forminier, the Beceka, the Kasai and the Luebo companies is sold. The Anglo-American Corporation handles the Diamang sales. One of the factors which after the World War notably aided Antwerp to regain its position as the premier diamond cutting city of the world was the supply in its own city of Congo diamonds, ready to cut. This supply of rough goods, suitable for the diamond jewellery recently in fashion, has also been responsible for the high rate of employment enjoyed during the past two years by the Antwerp cutters as opposed to their confreres in Amsterdam.

In addition to the main diamond region, a number of other occurrences of diamonds are known in the Belgian Congo and Angola. Diamonds have been found in isolated streams over a wide area in the north eastern part of the Belgian Congo and in South-Central and Eastern Angola. In the Katanga (southeastern Belgian Congo), diamonds have been found in several streams and in addition there are a large number of pipes of kimberlite which are contemporaneous with the South African pipes. Certain of these are known to contain diamonds but none have as yet at least been proven of commercial grade.

The Mill of the Kisele Mine.
Mons. JEAN JADOT,
Governor of the Société Générale de Belgique, and President of L'Union Minière du Haut Katanga, the greatest mining Corporation of Central Africa.
THE MINERAL DEPOSITS OF THE BELGIAN CONGO.

The Katanga’s Copper Wealth.

By OWEN LETCHER, F.R.G.S., M.I.M.M.

In the entrancing story of the forging of the land and water links between Cape Town and Cairo there are no more romantic pages to be found than those which deal with the exploitation of the mineral wealth of the Katanga Province of the Congo Belge.

The world-famous copper deposits existing in the extreme Southern portion of Belgium’s great Dominion in Central Africa have been the magnetic force which has drawn these twin ribbons of steel northwards from the goldfields of Southern Rhodesia, on past the Wankie Colliery and the Victoria Falls, across the cattle raising and maize growing areas of North Western Rhodesia, through the lead and zinc mines of Broken Hill and the cupriferous area centred in the Bwana M’Kubwa mine on the Congo-Zambesia watershed and the British-Belgium frontier; on and on through Elisabethville and the Katanga mineral fields to Bukama on the Luabala River, and even further afield than that, the railway builders are now busy constructing the Bas-Congo line which will link up Katanga through Itebo with Kinshasa and which will within three years provide a through route by rail and river from Cape Town to the mouth of the Congo on the Atlantic.

Just as the Witwatersrand gold fields provided the tractive force in the northern progress of trans-continental railroad construction in Central South Africa in the early nineties of the last century so has the Congo “Copper Rand” proved itself to be the lodestone which has drawn the line northwards through South Central Africa in the first quarter of the present century. The mineral wealth of Katanga has, moreover, deviated the true north line of construction westwards so that instead of the nebulous conception of the railway from Broken Hill meandering aimlessly across North Eastern Rhodesia (as you will observe it on a good many comparatively modern maps), the trend has a definite objective towards the great western headstreams of the Congo which penetrate one of the most amazingly rich and varied mineral regions in the world. And
COPPER MINING IN THE BELGIAN CONGO.

The Great Smelters of the Union Miniere at Lubumbashi.
COPPER MINING IN KATANGA.

as an economically logical corollary to the development of this course the line is now going off at a further tangent towards the Atlantic in order to provide an exit for Katanga’s trade on the Western sea-board of that Ocean.

The tale of ambitious perseverance unfolded in the telling of the story of this enterprise in the southern heart of Africa is one of the great epics of modern times. In its entirety it is far too lengthy to be related here but it is proposed to sketch a few of the chronological land-marks of the adventurous and magnificent work which has been accomplished by Belgians and Britishers in the development of Katanga and to give a few facts and figures which may serve to illustrate the immense mineral producing potentialities of Katanga—potentialities which, by the way, are not generally recognised in Europe and are only vaguely comprehended in the Union of South Africa.

The beginnings of copper mining in Katanga are lost in that haze of unchronicled antiquity which envelops so much of the history of Central Africa. Just how many decades of centuries ago the "stones of green" were first worked we shall never probably know. But this much is ascertainable, that at the end of the 18th century Portuguese travellers noted the presence of copper areas in the region which is to-day known as Katanga, and observed there the existence of a copper mining and copper smelting industry. Livingstone, too, refers to the copper areas of the Southern Congo. In those days copper mining in the Katanga, like the ivory and slave trades, was under the denomination of East Coast Arabs and as an interesting but tragic link with the past I may refer to a spot pointed out to me in the Kambove mine. Here, according to the statement of old chiefs, a large number of natives were entombed many years ago when engaged in mining copper for their Arab task masters.

Passing down the years it is next to be noted that in 1891 two Belgian explorers and geologists, Messrs. Francqui and Cornet (the former of whom is now one of the distinguished directors of the Union Miniere) reached Katanga after a long and tedious trek with Professor Cornet and brought to the notice of His Majesty King Leopold the presence of extensive mineral deposits in this region. But at that time the railway was no further north than Vryburg, 1,500 miles away to the far south, and the astute and farseeing Belgian King (who probably had the best business brains of any monarch who has lived during recent times), although he sensed the immense commercial possibilities of the great Free State founded in the heart of Africa under international aegis principally by the king himself, declined to take any personal and active part in the exploitation of Katanga’s mineral wealth. The truth was that the king had his hands full with the prevention of peaceful penetration into the sphere of his
adoption by other powers. But the Free States' administrators established themselves in this region and when a few years after the late George Grey's prospecting expedition located the great copper fields of this portion of Africa they were found to be on the Belgian and not the British side of the divide and frontier.

At this point I cannot refrain from passing reference to the fact that although Stanley virtually hawked the Congo all round Europe he found no response to his solicitations on behalf of the establishment of an international state in this heart of Africa with its millions of slave-ridden inhabitants, except in Belgium. In no other country was there to be found a statesman or financier who would shoulder the burden of responsibility for the founding and administration of the Congo. To-day, when the country's richness has been proved by actual production and when its administration has been established on sound and efficient lines, when hundreds of European lives have been laid down in the great causes of humanity and civilisation in the Congo, there is probably no power and large financial and commercial enterprise which would not gladly accept a big interest, in fact, a major share of the Congo's responsibilities and burdens. But it was different, vastly different, nearly half a century ago when the great core of Africa was virtually unknown and untrodden. This fact is not generally admitted, neither is it adequately realised, what a magnificent work has been achieved by the Belgians in the building up of their Central African Colony and in the development of its mineral resources. It is in the Katanga that industrial and mineral development in the Congo has reached its highest point, and the scene of busy activity that may be observed there to-day is in marked contrast with the pristine view that greeted the eyes of Grey and his fellow explorers when they went north at the bidding of Cecil John Rhodes and his chief lieutenant of the far north—Robert Williams—in the years of the Boer War.

These adventurers made a preliminary exploitation of the mineral wealth of Katanga by the simple expedient of noting from the hill tops what other hills were shorn of vegetation. Each bare hill was noted as a potential copper mine, and so in the course of further development it proved to be. This is easily the richest and greatest copper field as yet discovered anywhere in the world. It is impossible to get any exact limits to its dimensions, and to attempt any estimate of the total tonnage contained in the concession would be absurd. One can only say that there are millions and millions of tons of ore which contain a higher metallic content than any other known copper fields of large size in the world. The immensity and richness of the Katanga mineral deposits was not, however, realised until a very large amount of prospecting work had been carried out by the early expeditions. And at first the outside world
The Union Minière.

was entirely sceptical as to the value of the discoveries. But when the preliminary reports of the prospecting expeditions were confirmed by eminent British, Belgian and American mining engineers, including Allan Gibb, Frecheville, Farrell and others, it gradually came to be realised that still something further new had come out of Africa.

In point of fact a discovery as important as the finding of gold in the ridge of the White Waters far away to the south had been made. In terms of the original agreement whereby the Tanganyika Concessions Company had explored the copper area, a Belgian company, styled the Union Minière du Haut Katanga, was formed in October, 1906, and in this concern Mr Robert Williams' enterprise secured a forty per cent interest. Under Union Minière auspices, development was intensified and huge tonnages of the highest grade copper ore in the world were first made available for the smelter plant at Lubumbashi, outside Elisabethville, the well laid out copper town of the Katanga Province which had been founded as in a night on the basis of the great mineral deposits which surrounded it. This smelter commenced operations in 1911 but before the stage of production was reached an immense amount of hard pick and shovel work had to be carried out and a tremendous quantity of negotiation of an international character had to be conducted. The railway had to be carried northwards to the heart of the mineral region, metallurgical difficulties had to be solved, or at least temporarily adjusted, native labour complements secured, and all the complex machinery of a large industrial establishment with its many concomitant social and political difficulties in the heart of Africa had to be built up.

Mr. Robert Williams and his Belgian colleagues schemed and literally had to scrape for the money required; how they pulled wires behind the scenes and frustrated the envious machinations of covetous powers, how the railway from Lobito Bay (the key to Central Africa), towards Katanga was started and carried up to the top of the high inland plateau, each and all provide stirring pages in the more recent chapters of the history of Africa. After the railway from the south had reached Broken Hill in the year 1906 progress on the construction of the trans-continental project was for a long time suspended and it was only through the unceasing efforts of Mr Williams that the money was found for the forging of the next link in the chain of connection between the south and the copper fields. This was the Rhodesia-Katanga Junction railway, 141 miles in length which connects Broken Hill with Sakania on the Belgian-British border. The next step was the building by the C. F. K. (Chemin de Fer du Katanga) of a line in Congo territory from Sakania to Elisabethville. This was accomplished in 1910. At a later date (June, 1913) the railway was carried on to Kambove,
and in May, 1918, it reached Bukama on the Lualaba River, the navigable head waters of the mighty Congo, 2,600 miles from Cape Town. By means of this line the Union Miniere Company were able to import coke from the Wankie Colliery in Matabeleland and to export their copper through Beira. From this latter port in Portuguese Mozambique to the Lubumbashi smelters is a haul of no less than 1,600 miles along a series of railway lines which by virtue of a small white population and no great density of trade or traffic in the regions which they serve cannot successfully operate without relatively high railway rates. Beira, too, lies on the Indian Ocean and exports from there have either to bear the toll of canal dues via Suez or else to round the Cape before reaching the great markets of Europe and America. Beira, therefore, excellent port as it is, can never be regarded as the ideal exit for Congo produce. But export via this lengthy railway route has been the salvation in its early stages of the development of Katanga.

The natural outlet of the Congo products is, of course, on the Atlantic seaboard, and, strange as it may seem, after all these years of exploitation there is not yet a direct through route to the western ocean from Katanga. The western ribs of the iron spine are now, however, being filled in. Nearly 20 years ago the establishment of Lobito Bay as the "Open Sesame" of the Southern Congo and the construction of a railroad to the interior was initiated. But, principally on account of lack of funds, the work of constructing the line from Camacupa, more than about half-way to the Belgian border, where it will be met by a line built—probably from somewhere near Firangaramo—to meet the Lobito line after it has traversed Angola from west to east.

Meanwhile, the Belgians are constructing the Bas-Congo link which, striking north-westwards from Bukama will—probably about the end of 1927—connect up the copper belt through the river port of Ilebo on the navigable Sankuru, a tributary of the Kasai and an influent of the lower Congo, with the new capital and commercial metropolis of Kinshasa, 300 miles from the Atlantic estuary of this mighty river. Another rail and water route which has been established is that which connects up the Central railway line in Tanganyika Territory, through Kigoma Bay (Ufifi) and Albertville on Lake Tanganyika through Kabalo on the Lualaba with Bukama. Each and all of these routes, whether completed or in course of construction, will have a big influence on the Katanga mineral industry and will assist in the solution of the transport problem—which is the most pressing need of this great copper field locked away in the heart of
Africa. At the present time something like one half of the working expenditure of the Union Miniere Company is contracted in respect of transportation costs, that is to say, in the importation of supplies, including coke, into the Congo and the exportation of the copper produced. Such a tremendous proportion of freight charges to total expenditure naturally entails a very heavy handicap to a base metal proposition and it is only by working an exceptionally high grade of ore that the mines can be made to pay with the price of the metal at or near its present figures.

In respect of rich—exceptionally rich—ore the Katanga copper mines are more liberally endowed than any other cupriferous proposition in the world. The ore reserves in the various mines of the Union Miniere Company at the end of 1923 were estimated to be 72,666,000 tons, containing 6.2 per cent. of metal, or a total of no less than 4,802,000 tons of copper. Of these 72,666,000 tons, 4,421,700 tons termed ‘smelting ores’ contain 18.28 per cent. and the metallic content of 40\frac{1}{4} million tons (to be treated by leaching) and of 53\frac{3}{4} million tons of mixed oxidised and sulphite ores, was nearly 6 per cent. When it is remembered that most of the great copper propositions of the world such as those worked by the Anaconda and by the Utah Copper Company in North America, the Chuquiamaata deposit in Chili and Ris Tuito in Spain, contain on the average 2 per cent. or even less metal, it will readily be appreciated that the Union Miniere Company controls what are easily the richest cupriferous deposits in the world. Moreover, they are, the most extensive, for the copper bearing belt extends for 200 miles from south-east to north-west with a width averaging about 50 miles.

Taking the value of the metal at about £60 per ton the present gross value of the Union Miniere’s ore reserves may be placed at but little short of three hundred millions of pounds sterling, or roughly about twice the value of the ore reserves containing a grade above the present limit of payability of all the gold mines of the Witwatersrand. The total quantity of copper ore contained in the whole concession in the Katanga is incomputable. One has to travel along the mineral belt to observe the immense mountains of ore and to realise that there are vast reserves of metal below the surface of the earth, as well as above ground in the hills, in order to obtain any adequate conception of the illimitable possibilities of the Union Miniere as a producer of metal. I remember when I first visited Katanga and discussed the position and prospects of the proposition with M. Cousin, the courteous and able administrateur delegue of the Union Miniere Company, at the time Director-General at Lubumbashi. With my Rand ideas and training, one of the first questions I asked him was, ‘whether the indications were that the mineral deposits persisted in depth.” M. Cousin merely smiled and
Entrance to the Union Miniere's Radium Mine in the Katanga.
The Great Copper Mines of the Congo Belge

The Smelters at Lubumbashi, near Elisabethville, Katanga, 1925

The Reduction Works of L'Union Minière at Punda, Katanga, Congo Belge, 1925
asked me to 'see for myself the various mines and deposits before I came to a decision as to whether that question really was worth asking.' And after a brief journey through the most active portion of the mineral area I readily understood why M. Cousin grinned when I questioned him as to the continuity of the copper deposits in depth.

I have already remarked on the exceptional richness of the Katanga areas and stated that under existing conditions, particularly as regards transport, the Company has to deal only with its richest areas. But although there is no lack of tonnage of this nature the Union Minière will not always adhere to this high grade policy. The eventual solution of the Company's mining and treatment problems will be in the direction of a programme of working areas of comparatively low grade contrast as well as rich areas. This will involve the erection of a leaching plant on a large scale and the harnessing of the great water power resources of the Province for the consummation of a comprehensive hydro-electric scheme. The adaptability of the Union Minière areas to such a policy already has been demonstrated. A pilot leaching plant on Panda Hill, where the Company's huge concentrator plant of 4,000 tons per diem capacity is erected, has already yielded eminently satisfactory results, and a survey of the water power available in the Lualaba and Lufira rivers has demonstrated that the N'Zilo Gorge and Koni Falls schemes of transmission are capable of yielding immense quantities of power. For the time being the consummation of this hydro-electric project has been postponed for financial considerations, principally connected with problems related to depreciation of Belgian currency in terms of sterling and dollars. But eventually these problems, like that of transport, will be adjusted and the Union Minière will be in a position to produce 100,000 tons or more of copper per annum. As it is production in the near future will beat the rate of 100,000 tons per annum. The Katanga mines commenced production in 1911 with an output of 997 tons. In 1914 the question of whether production should be maintained in the face of war difficulties and rising prices for materials had to be faced. But eventually it was decided to carry on with the programme and during the period of the great conflict the output was increased from 10,724 tons in 1914 to 27,462 tons in 1917. No doubt much of this copper from Belgium's far distant great African Dominion was used in defence of the brave little Motherland, and shell cases manufactured from Congo copper and fired from Allied cannons helped to keep inviolate a small portion of the little country whose sons have done so much in the conquest of Central Africa. The management is now grappling with the many complex problems which are concerned with increasing the output, reducing expenditure and opening up an economic exit to the coast, and there can be but
little doubt that in the not far distant future the attention of the whole world will be still further focussed on the achievements and potentialities of this remarkable mineralised region, which lies between the headwaters of two of Africa's mightiest rivers.

The principal wealth of Katanga lies, of course, in its copper wealth; but apart from these areas of malachite and chrysocolla and of deep seated sulphide areas, the Katanga contains gold, tin, cobalt and coal and there has also of recent years been remarkable development of the Chinkolobwe and other mines which contain the most important deposits of radio-active minerals as yet discovered anywhere in the world. The auriferous gravels of the Ruwe mine in the western section of the concession are not at the present time productive, although at different times in the past they have yielded considerable quantities of gold. At Busanga and Kayrimbo, however, cassiterite is being produced and the total production up to the end of December last had been 2,354 tons. Cobalt also occurs in the Union Miniere in large quantities and for some time past research work in connection with the treatment of ores containing cobalt has been in progress. A treatment installation comprising four electric furnaces has been constructed at Panda and this came into operation in May, 1924. Coal mines are being opened up at Sankishai; even the railroad, over which the Chemin de Fer du Katanga runs, is ballasted with iron ore which in Europe would be deemed good enough for blast furnaces.

It is hard to visualise all this concentration of mineral wealth and all the industrialism and civilised advance which development of this mineral wealth implies in a region which in the popular mind is still the domain of cannibals. And unless you have not only travelled through the Katanga Province but have also studied in some detail the data available in regard to this vast treasure house, between the Congo and Zambesia, it is utterly impossible to sense the productive potentialities of this region. When in New York a few months ago I discussed with some American business men the likelihood of the Union Miniere Company dominating the copper trade of the world in a few years' time, when the transport problems of that region have been solved and production by means of a huge leaching plant supplemented by furnaces is in progress, on a basis of output of perhaps a quarter of a million tons of metal and even more per annum. My American friends were rather inclined to ridicule the suggestion, but they had to admit that it might be necessary to erect a high tariff wall around their own copper deposits in the States and perhaps also to accord some measure of fixed preference to copper producing undertakings in which United States capital is invested in South America.

Certain it is, in any event, that the output of mineral wealth by the Union Miniere and its associated concerns during the next
few years will exercise at least a highly important influence on the world’s production of copper and of other minerals and metals as well. It is profoundly interesting to speculate on the measure and extent of this influence in the direction of world metal production and prices. A contemplation of the possible and probable effects of Congo development on Africa as a whole is productive of even more arresting deductions. In the decades to come it may well be that the centre of industrialism and commerce and of transportation in the southern portion of the Dark Continent which is at present focussed on the Witwatersrand will shift more than a thousand miles northwards to the Congo mineral belt.

Somewhere in this wondrously rich Province of Katanga there may well be established a critical point in the politics—industrial cosmos of the African Continent within which will be centred the lore of the Continent’s commerce and transportation systems. Belgian industry, based on the mineral wealth of this region with skilled or semi-skilled black labour and cheap power in unlimited quantities derived from the great tributaries of the Congo, may achieve this. The Witwatersrand gold fields which to-day occupy pride of place in the concept of modern South Africa will by that time have passed the zenith of their productivity and influence. Kambove or Kamatanda or Fungurume may then be an even greater establishment than Johannesburg but with a much smaller white population and an infinitely greater concourse of “les indigenes.” The Belgians have none of the politics or industrial delusions in regard to colonisation upon which revolutions and precipitate elections are fostered in the Union of South Africa. They are making the fullest use they possibly can of their native labourers. They are training them in the paths of industry and doing all they can to increase the black population. The more closely you look into this concept of a big forceful and productive undertaking in the Southern Heart of Africa the more startling do the possibilities of Belgian enterprise become. And the effect of all this civilised energy in spaces which only half a century ago were decimated by the slave raiders, and which were the particular domains of wild beasts and wild men upon the Cape to Cairo transportation system through Africa, cannot fail to be of the very foremost importance. For Katanga is re-shaping our present day concept of Africa, and with its lines of communication radiating northwards and southwards and to both oceans which tap the shores of the African Continent, the copper fields of the interior are destined to provide the heart of the network of trans-continental communications.
Mineral Oil Areas of the Red Sea Coast.

The importance of Northern Africa as a producer of petroleum rests principally on the oil fields in Egypt, and in a less degree on the small production in Algeria. Production in Egypt is at present confined to two localities on the mainland near the group of islands where the Red Sea extends into the Gulf of Suez. These coastal fields, comparatively small in extent but of considerable yield, are Gemsah (or Jemsa) and Hurghada. Between them the two areas, which are both being developed by Anglo-Egyptian Oilfields Ltd., produced in 1924 a total of 162,813 metric tons of crude petroleum, mainly from the Hurghada field.

Although the two localities mentioned represent the main production at present obtained, both sides of the Gulf of Suez are dotted with areas over which various persons and joint-stock companies have or had licenses to prospect for oil. The junction of the Red Sea and the Gulf of Suez is the district most favoured by prospectors, apparently because geological opinion has indicated it as oil-bearing in certain parts, and Hurghada and Gemsah, in this neighbourhood, have proved productive. Even some of the islands, such as Jubal, Gaysum and Ranim, have been selected for prospecting, and in certain cases drilled, though without success so far.

The beginnings of the present petroleum industry in Egypt date back more than 15 years and are due to British enterprise. In June, 1907, the Egyptian Oil Trust, Ltd., was registered; and rather more than two years later it acquired from another company four Government drilling and prospecting concessions near Gemsah. Wells were drilled and oil struck. Independently of this enterprise the Suez Oil Company, Ltd., was founded in September, 1910, to acquire two areas of 25 square miles each on the Gulf of Suez, close to the holdings of the Red Sea Oilfields, Ltd., a company founded in January, 1910, which took over certain concessions from the Egyptian Oil Trust. The operations of these various companies attracted the attention of the Royal Dutch & Shell
OIL POTENTIALITIES OF EGYPT.

group, who in July, 1911, founded the Anglo-Egyptian Oilfields, Ltd., to take over properties from the Red Sea Oilfields, Ltd., the African Prospecting Syndicate, Limited, and the Egyptian Oil Trust, Limited. Licenses over other areas have since been obtained, and the Zeitieh property acquired from the Egyptian Oil Trust has been abandoned. Development at Gemsah was continued and extended by the new group, and in 1913 production amounted to 13,500 tons. The Hurghada area was acquired in that year. The next year showed a phenomenal increase to 111,000 tons, and this would doubtless have been exceeded in 1915 but for the war, which restricted operations and production for the next two years. However, in 1917 the company produced 134,500 tons of crude petroleum, succeeded in 1918 by the largest quantity ever produced in Egypt in any one year, 275,000 tons. Less than 200,000 tons was obtained in 1919, 138,000 tons in 1920, 156,000 tons in 1921, 171,935 tons in 1922, 152,892 tons in 1923, and 162,813 tons in 1924.

That Egypt as a whole is capable of producing larger annual totals than any of these is beyond all doubt. The earliest efforts, although amateurish and to some extent misguided, did result in obtaining oil; and the geological investigations made for the Egyptian Government and others indicate that in all probability Egypt is an oil-producing country of great potentialities. The drilling for oil in undeveloped areas being a very expensive matter, prospecting by this means was not indulged in to a great extent in Egypt during the years immediately following the Great War. Still, in 1924 it was officially reported that 18,330 feet of prospecting drilling was accomplished by commercial interests.

Yet the country has attracted, besides the Royal Dutch & Shell group, some of the largest oil interests of the world, who directly or indirectly acquired licenses to prospect. As examples may be mentioned the D'Arcy Exploration Company, Ltd., associated with the Anglo-Persian Oil Company, which obtained areas at Abu Qitifa; and the Whitehall Petroleum Corporation, Ltd.,—connected with Messrs. S. Pearson & Son, Lord Cowdray's firm, the founders of the Mexican Eagle Oil Company, Ltd.—which secured an area north of Tanka and Abu Zenima. The localities chosen by both these interests are in the Peninsula of Sinai on the eastern side of the Gulf. Apart from the Anglo-Egyptian Oilfields and their properties at Gemsah and Hurghada the chief drilling activity of late has been on the part of Oilfields of Egypt, Ltd., which was formed in February, 1920, and has been drilling at Ras Dhib, where the 28th parallel enters the Gulf of Suez on its western side, and at Ras Bahar, about 7 miles to the north-west of Gemsah headland. Although indications are stated to be favourable, no successful well has yet been completed. In September, 1923, a new
company, the Egyptian Oil Syndicate, was formed to take over from the Government the Abu Durba area where shallow drilling is being continued. The production of this area in 1924 was 528 metric tons. In 1924 a new British company was licensed to begin drilling operations on Towila Island in the Red Sea.

A policy of sympathy and encouragement has now been adopted by the Egyptian Government towards the oil industry of the country; and this, it is pleasant to think, was the direct result of British advice. Until recent years Government action was confined to authorising applicants to prospect for petroleum in specified areas licensed to them for the purpose, which licenses carried the right to proceed subsequently to the actual getting of petroleum products from a part of such areas to be leased to them under petroleum mining leases. These licences and leases are drawn in the form of agreements between the Egyptian Government and the particular companies or other applicants. They were approved by the Council of Ministers in 1910 after a careful consideration of the policy involved. and, with some modifications, continue to this day.

The principle guiding the Government, to which the term of these agreements gave affect, was that recognised the world over by those familiar with the oil industry, and was based upon the consideration that petroleum mining is an extremely speculative venture, except in well-proved fields. It is generally admitted that such risky business is not one upon which it is right for a Government to enter in normal circumstances. Previous efforts of the Egyptian Government in this direction had been by no means encouraging. Consequently, it was considered essential to attract private enterprise to undertake the mining operations required. To achieve this end the conditions offered had to be made attractive, as the risks of total loss of the capital involved were great and the reward had, therefore, to be in proportion to those risks. It was acknowledged that the share (mainly by way of royalty on oil produced) falling to the Government in the event of success would, as a consequence, be comparatively slight; but, on the other hand, the Government would incur no part of the heavy financial risks entailed upon those undertaking the search for petroleum in Egypt. At the same time the right sort of prospector had to be attracted and the wrong sort excluded; so that among the difficulties of the Government were on the one hand to prevent the man of straw from taking up a license and sitting on valuable land, and on the other hand to afford much needed encouragement to large interests to prospect for oil. While the bogus prospector is being weeded out under the present system of licensing, the responsible capitalist is in various ways being attracted. At the time this policy was initiated it will be recalled that coal was cheap
and plentiful, while the probability of finding petroleum in Egypt in quantities likely to be an appreciable economic asset to the country appeared far remoter than it does now. The outstanding fact that kerosene (lamp oil) and liquid fuel were available in Egypt throughout the war in adequate quantities and at prices considerably below those generally ruling elsewhere, was due to the policy that the Government has thus inaugurated. Anglo-Egyptian Oilfields unquestionably secured a prolific field and has made great profits; but it had previously risked the loss of large sums in searching for petroleum when the prospects of success appeared small, while the benefits of considerable local supplies of relatively cheap fuel were obtained by Egypt with no risk at all, and at a time when their value to the country was most timely.

Under the general policy of mining permits adopted by the Government, over 150 petroleum prospecting licenses had been taken out by various bodies during the fourteen years to 1920; and it is significant of the prevailing ignorance with regard to the conditions under which petroleum was most likely to be found, and demonstrative of the expense of development and small prospects of success, that out of all the areas held under these prospecting licenses only in two or three cases have leases for the actual mining of petroleum products followed.

In many cases the areas licensed for prospecting have been abandoned after surface examination, but in quite a number of places deep drilling followed and a considerable amount of money was spent without result. It is estimated that the capital expended without return by mining companies in the search for petroleum in Egypt prior to the war amounted to £750,000, which was the equivalent of some three times that sum to-day.

The strategic importance of such oilfields as are already producing in Egypt need scarcely be pointed out, and this importance was emphasised during the recent war. In addition, should Egypt, as appears quite probable, ultimately attain front rank as an oil-producing country, the domestic production of such large quantities of fuel as this implies would have a tremendous effect upon all the industries of the country.

The quality of the Hurghada oil is not of the best, this oil being relatively heavy, and deficient in the more valuable products (petrol and kerosene or lamp oil) and yielding a large percentage of liquid fuel. The Gemsah petroleum is a much lighter and therefore commercially more valuable oil. Processes now invented, however, make it probable that Hurghada crude may be made to yield considerably larger percentages of the more valuable products than is the case at present. The Anglo-Egyptian Oilfields have established a refinery at Suez, which has a capacity of 1,000 tons of crude oil per day and is connected with Port Tewfik.
by four pipe lines. In addition to Egyptian crude, the refinery is treating imported oil. Storage tanks to hold 150,000 tons of petroleum have been erected by the same company at Gemsah, Hurghada and Suez. The Egyptian Government has a holding in the company.

The Government Refinery at Suez was reopened in February, 1925, operations having been suspended since November, 1923. Its maximum daily capacity, however, is understood to be only 60 tons for certain processes, and only 40 tons for all processes, namely, the production of benzene, kerosene and mazout. The raw material available is limited to what is received as royalty from the Anglo-Egyptian Oilfields, amounting to 8,000 metric tons of Egyptian crude oil per annum.

To sum up, one may say that Egypt at present is important as an oil-producing country rather by reason of its possibilities than for that of the quantity of its present production. Scientific opinion strongly favours further prospecting on both sides of the Gulf of Suez and even in other parts of Egypt. Although it is difficult to prophesy, yet the most reliable indications point to a great expansion of the present producing industry, with a possibility of the production being many times multiplied.
Sir ERNEST OPPENHEIMER, K.B.E.
Chairman and Managing Director, The Anglo-American Corporation Ltd., and the Diamond Syndicate, 1925
MINERAL PRODUCTION in SOUTHERN AFRICA.
The World's Greatest Diamond.

Southern Africa.

DIAMONDS, GOLD AND COPPER.

The ancients were not unacquainted with the mineral wealth of northeastern Africa, for in biblical days the gold and precious stones obtained from the African Continent appear to have assumed the importance of an established trade, Solomon having seemingly organised a mercenary Hebrew Navy for the better development of the commerce between the littorals of the Red Sea.

For centuries there has existed on the north-eastern seaboard a fringe of civilisation acting as a go-between the native races bringing gold and other rare and valuable commodities for disposal and the outer world. How deeply adventurers may have penetrated into the interior of Africa is undecided, but probably streams situated as far south as Rhodesia and Mozambique—in fact, through the whole eastern valleys of the Zambesi—were washed for alluvial, and later on, as ancient mining science advanced, outcrops of gold and other metal containing ores were worked down to water level. Still further south, which has subsequently proved to be the most highly mineralised portion of Africa, mineral wealth was better concealed by nature, and although during the occupancy of the Cape by the Dutch several expeditions were despatched north to search for minerals, little of importance appears to have been discovered, with, perhaps, the exception of copper deposits in Namaqualand. It has been left for modern times to record the discovery of extensive and well nigh inexhaustible diamond deposits and the existence of pyretic gold, which have enriched South Africa and the world to the colossal amount of £1,071,893,597 (to December 31st, 1924).

The discovery of diamonds in the northern Cape Colony in 1870 was the first important mineral discovery in Southern Africa, the constancy of the mineralisation paving the way for the subsequent development of the Rand goldfield, the output from which may be said to have revolutionised the standard of value of the world, and largely brought about the great decline in commodity values which took place previous to the Great War.

The story of the early days of Kimberley and the amalgamations and absorptions which welded the field into one big combine is told elsewhere in these columns. The formation of the De Beers Company brought to an end the insensate competition resulting from small individual holdings, and by
rendering feasible a common scheme of development, brought prosperity to the industry which continued until the discovery of the Premier Diamond Mine, near Pretoria. The evils of supply exceeding demand was then again experienced until control of that mine was purchased by Messrs. Barnato Bros., an event which brought into existence a diamond selling syndicate the purpose of which was to regulate production in accordance with demand. This syndicate, with certain changes with regard to membership, remains in force to-day and has undoubtedly materially assisted in maintaining the value of diamonds and the commercial profits of producers. As at present constituted this Syndicate not only controls the output of the diamond mines in the Union, but its members dispose of the diamond outputs from South West Africa, the Congo Free State, West Africa, and Angola.

**DIAMOND PRODUCTION.**

The table below, taken from official sources, gives the annual output and value of diamonds in each Province of the Union, from the earliest date for which records are available.

### Output of Diamonds in Union, 1883 to 1924.

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<td>3,116,072</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1912</td>
<td>66,471</td>
<td>266,976</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1913</td>
<td>63,076</td>
<td>266,976</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1914</td>
<td>1,197,024</td>
<td>3,116,072</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1915</td>
<td>66,471</td>
<td>266,976</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1916</td>
<td>63,076</td>
<td>266,976</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1917</td>
<td>1,197,024</td>
<td>3,116,072</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1918</td>
<td>1,418,400</td>
<td>5,317,609</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1919</td>
<td>1,494,855</td>
<td>7,003,053</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1920</td>
<td>1,327,126</td>
<td>6,063,332</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1921</td>
<td>1,606,315</td>
<td>1,050,722</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1922</td>
<td>1,354,007</td>
<td>5,665,379</td>
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<td></td>
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<tr>
<td>1923</td>
<td>1,290,118</td>
<td>4,907,242</td>
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</table>
VALUE OF DIAMOND OUTPUT.

The following table shows the quantity and value of diamonds sold during 1924 compared with the year 1923:

**Respective Value of Outputs.**

<table>
<thead>
<tr>
<th>Province</th>
<th>Mine Stones</th>
<th>Alluvial Stones</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>per carat.</td>
<td></td>
</tr>
<tr>
<td>Transvaal</td>
<td>535,531</td>
<td>£849,161</td>
<td>145,402</td>
</tr>
<tr>
<td></td>
<td>699,818</td>
<td>1,041,827</td>
<td>115,903</td>
</tr>
<tr>
<td>Cape Colony</td>
<td>1,039,148</td>
<td>2,926,337</td>
<td>94,868</td>
</tr>
<tr>
<td></td>
<td>1,196,215</td>
<td>2,957,357</td>
<td>99,303</td>
</tr>
<tr>
<td>Orange Free State</td>
<td>233,735</td>
<td>1,150,457</td>
<td>94,868</td>
</tr>
<tr>
<td></td>
<td>295,809</td>
<td>2,957,944</td>
<td>99,303</td>
</tr>
</tbody>
</table>

**Totals:**

<table>
<thead>
<tr>
<th>Province</th>
<th>Carats Sold</th>
<th>Value</th>
<th>Carats Sold</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>£</td>
<td></td>
<td>£</td>
</tr>
<tr>
<td>Transvaal</td>
<td>992,159</td>
<td>£2,168,940</td>
<td>1,296,819</td>
<td>£4,564,750</td>
</tr>
<tr>
<td>Cape Colony</td>
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<td>£4,564,750</td>
<td>295,291</td>
<td>£999,678</td>
</tr>
<tr>
<td>Orange Free State</td>
<td>295,291</td>
<td>£999,678</td>
<td>286,234</td>
<td>£680,547</td>
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</table>

**Totals:**

<table>
<thead>
<tr>
<th>Province</th>
<th>Carats.</th>
<th>Estimated Value</th>
</tr>
</thead>
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<tr>
<td></td>
<td>per carat.</td>
<td></td>
</tr>
<tr>
<td>Transvaal</td>
<td>30/12</td>
<td>£849,161</td>
</tr>
<tr>
<td>Cape Colony</td>
<td>30/12</td>
<td>£1,041,827</td>
</tr>
<tr>
<td>Orange Free State</td>
<td>30/12</td>
<td>£1,119,589</td>
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The following table shows the fluctuations in the average prices per carat realised from 1911 to 1924 for mine stones and alluvial stones:

<table>
<thead>
<tr>
<th>Year</th>
<th>Mine Stones</th>
<th>Alluvial Stones</th>
<th>All Stones</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>per carat.</td>
<td></td>
<td>per carat.</td>
</tr>
<tr>
<td>1911</td>
<td>32/12</td>
<td>£34/2</td>
<td>104/11</td>
</tr>
<tr>
<td>1912</td>
<td>36/12</td>
<td>£34/2</td>
<td>104/11</td>
</tr>
<tr>
<td>1913</td>
<td>40/12</td>
<td>£39/2</td>
<td>78/1</td>
</tr>
<tr>
<td>1914</td>
<td>37/5</td>
<td>£39/2</td>
<td>78/1</td>
</tr>
<tr>
<td>1915</td>
<td>45/9</td>
<td>£51/5</td>
<td>131/1</td>
</tr>
<tr>
<td>1916</td>
<td>39/3</td>
<td>£44/5</td>
<td>110/11</td>
</tr>
<tr>
<td>1917</td>
<td>44/9</td>
<td>£49/9</td>
<td>110/11</td>
</tr>
<tr>
<td>1918</td>
<td>46/11</td>
<td>£53/4</td>
<td>131/1</td>
</tr>
<tr>
<td>1919</td>
<td>85/-</td>
<td>£98/5</td>
<td>254/9</td>
</tr>
<tr>
<td>1920</td>
<td>99/9</td>
<td>£113/11</td>
<td>231/3</td>
</tr>
<tr>
<td>1921</td>
<td>64/8</td>
<td>£79/5</td>
<td>137/8</td>
</tr>
<tr>
<td>1922</td>
<td>46/10</td>
<td>£61/2</td>
<td>133/4</td>
</tr>
<tr>
<td>1923</td>
<td>51/11</td>
<td>£59/10</td>
<td>135/9</td>
</tr>
<tr>
<td>1924</td>
<td>52/6</td>
<td>£66/2</td>
<td>149/7</td>
</tr>
</tbody>
</table>

PRODUCTION OF DIAMONDS OUTSIDE THE UNION.

Mine Inspector C. E. H. Langley, in a report of the State Engineer of the Union of South Africa, states that in 1913 the Union, including South West Africa, produced diamonds to the value of £14,400,000, of which total South West Africa contributed £3,000,000. At this period the production from the Congo, Angola and British Guiana was practically nil. In 1924 the output from the Union was £9,387,000, which included £1,392,000 from South West Africa, while the production from other sources was approximately, from British Guiana,
£1,350,000; Belgian Congo, £1,500,000; Angola, £500,000; and West Africa, £250,000, a total of £3,600,000. In addition the value of the uncontrolled output of alluvial stones in the Union was estimated at £2,156,000.

SIZE OF STONES.
The following table shows the average weight of diamonds obtained from the principal mines in the Union, the figures being abstracted from the official reports of the Union Mining Engineer:

<table>
<thead>
<tr>
<th>Mine</th>
<th>Claims</th>
<th>Mine</th>
<th>Claims</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premier</td>
<td>3,570</td>
<td>Bultfontein</td>
<td>1,067</td>
</tr>
<tr>
<td>Dutoitspan</td>
<td>1,441</td>
<td>De Beers</td>
<td>620</td>
</tr>
<tr>
<td>Koetjesfontein</td>
<td>1,428</td>
<td>Kimberley</td>
<td>420</td>
</tr>
<tr>
<td>Wesselton</td>
<td>1,162</td>
<td>Roberts-Victor</td>
<td>74</td>
</tr>
<tr>
<td>Jagersfontein</td>
<td>1,125</td>
<td>Blaauwbosch</td>
<td>42</td>
</tr>
</tbody>
</table>

AREA OF DIAMOND MINES IN THE UNION.

C.—Scene of the first Diamond Discovery on Colesberg Kopje, Kimberley, in 1869.
Open workings at Kimberley, 1871.
D.—The Cullinan Diamond found at the Premier Mine, Pretoria, as originally found, and the Stars of Africa cut therefrom.
E.—Alluvial Diamond Diggings on the Vaal.
Alluvial Diamond Mine in the Belgian Congo.
DIAMOND CUTTING IN THE UNION.

EXPORT TAX.

In 1917 the Union Government imposed an export duty of 5 per cent. on the value of rough diamonds exported, for the purpose of encouraging the establishment of a diamond cutting industry in the Country. In 1919, the tax was raised to 10 per cent., and in addition an Act was passed which enabled local cutters to secure from producers of rough diamonds the stones they required for cutting. In 1923 there were three diamond cutters licensed; the value of diamonds cut and polished being £26,853 as compared with £34,000 in 1922.

GEM STONES OTHER THAN DIAMONDS.

Garnets of very good quality are usually found in juxtaposition with diamond discoveries. A variety of serpentine, which has obtained the local name of Verdite, has been worked in the Barberton district, while Crocidolite has also been located.

A.—Pulsator and Steam Washing Gears at De Beers Mines, Kimberley.
B.—The open workings of the Premier Diamond Mine near Pretoria.
Gold Production on the Rand.

In 1884 Messrs. Struben Bros. started quartz mining on farm "Weltevreden," in the Western district of the Witwatersrand, and in 1885 the first gold from the conglomerate beds of the Rand was panned. The production since then has been progressively increased as will be seen from the tables of production on the next page.

The development of the Rand proceeded somewhat along the lines on which the diamondiferous ground at Kimberley was originally worked, a small number of claims being pegged out on the outcrop, and which dealing with oxidised ores and favoured with moderate capitals, usually made good. The first difficulties arose when the oxidised zone gave place to pyretic formation, which however was overcome by the discovery that cyanide would dissolve out the gold, which could then be precipitated by bringing the solution in contact with zinc shavings. This discovery with the proving of the continuity of mineralisation at depth, together with the discovery of coal at Boksburg, may be said to have firmly established the gold mining industry as a commercial proposition, the average value of the formation, taken over reasonable distances, being wonderfully uniform. This uniformity brought into existence companies mining ground in which the reef existed at depths ranging down to 7,000 feet and situated some miles from the outcrop. Such companies required large capitals for shaft sinking, equipment and development, and in order to secure success large areas were needed to minimise the risks of encountering poor zones. With deeper mining the Union Government took over the rights of public pegging, a policy which enabled the Authorities to lease large sections of ground, receiving in exchange substantial participations in the profits made by the operating companies.
### SOUTH AFRICAN GOLD OUTPUT.

#### Total Gold Output of the Witwatersrand Gold Production from May, 1887, to December, 1924.

Compiled from Government Blue Books.

<table>
<thead>
<tr>
<th>Year</th>
<th>Fine Gold.</th>
<th>Value at £4,24773 per fine ounce.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ozs.</td>
<td></td>
</tr>
<tr>
<td>1884</td>
<td>2,276</td>
<td>10,996</td>
</tr>
<tr>
<td>1885</td>
<td>1,414</td>
<td>6,010</td>
</tr>
<tr>
<td>1886</td>
<td>8,471</td>
<td>34,710</td>
</tr>
<tr>
<td>1887</td>
<td>39,880</td>
<td>169,401</td>
</tr>
<tr>
<td>1888</td>
<td>227,749</td>
<td>967,416</td>
</tr>
<tr>
<td>1889</td>
<td>350,909</td>
<td>1,490,569</td>
</tr>
<tr>
<td>1890</td>
<td>440,132</td>
<td>1,869,415</td>
</tr>
<tr>
<td>1891</td>
<td>688,439</td>
<td>2,924,305</td>
</tr>
<tr>
<td>1892</td>
<td>1,069,058</td>
<td>4,541,071</td>
</tr>
<tr>
<td>1893</td>
<td>1,290,218</td>
<td>5,489,498</td>
</tr>
<tr>
<td>1894</td>
<td>1,803,000</td>
<td>7,667,152</td>
</tr>
<tr>
<td>1895</td>
<td>2,017,443</td>
<td>8,569,555</td>
</tr>
<tr>
<td>1896</td>
<td>2,623,510</td>
<td>10,893,823</td>
</tr>
<tr>
<td>1897</td>
<td>2,743,518</td>
<td>11,653,723</td>
</tr>
<tr>
<td>1898</td>
<td>3,823,367</td>
<td>16,240,630</td>
</tr>
<tr>
<td>1899</td>
<td>3,637,714</td>
<td>15,452,952</td>
</tr>
<tr>
<td>1900</td>
<td>348,761</td>
<td>1,481,442*</td>
</tr>
<tr>
<td>1901</td>
<td>358,032</td>
<td>1,490,051*</td>
</tr>
<tr>
<td>1902</td>
<td>1,718,921</td>
<td>7,383,294*</td>
</tr>
<tr>
<td>1903</td>
<td>2,972,897</td>
<td>12,628,057</td>
</tr>
<tr>
<td>1904</td>
<td>3,773,517</td>
<td>16,288,883</td>
</tr>
<tr>
<td>1905</td>
<td>4,906,534</td>
<td>20,854,440</td>
</tr>
<tr>
<td>1906</td>
<td>5,792,823</td>
<td>24,606,336</td>
</tr>
<tr>
<td>1907</td>
<td>6,430,740</td>
<td>27,400,992</td>
</tr>
<tr>
<td>1908</td>
<td>7,086,266</td>
<td>29,973,415</td>
</tr>
<tr>
<td>1909</td>
<td>7,295,108</td>
<td>30,897,650</td>
</tr>
<tr>
<td>1910</td>
<td>7,527,198</td>
<td>31,973,123</td>
</tr>
<tr>
<td>1911</td>
<td>8,249,461</td>
<td>35,041,485</td>
</tr>
<tr>
<td>1912</td>
<td>9,107,512</td>
<td>38,868,259</td>
</tr>
<tr>
<td>1913</td>
<td>8,798,336</td>
<td>37,522,941</td>
</tr>
<tr>
<td>1914</td>
<td>8,394,332</td>
<td>35,656,814</td>
</tr>
<tr>
<td>1915</td>
<td>9,093,902</td>
<td>38,628,427</td>
</tr>
<tr>
<td>1916</td>
<td>9,296,618</td>
<td>39,489,522</td>
</tr>
<tr>
<td>1917</td>
<td>9,018,084</td>
<td>38,306,381</td>
</tr>
<tr>
<td>1918</td>
<td>8,418,292</td>
<td>35,758,630</td>
</tr>
<tr>
<td>1919</td>
<td>8,331,294</td>
<td>35,189,091</td>
</tr>
<tr>
<td>1920</td>
<td>8,158,226</td>
<td>34,653,947</td>
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<tr>
<td>1921</td>
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<td>34,328,484</td>
</tr>
<tr>
<td>1922</td>
<td>7,099,767</td>
<td>29,757,598</td>
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<tr>
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<td>9,148,771</td>
<td>38,861,311</td>
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<tr>
<td>1924</td>
<td>9,574,918</td>
<td>40,071,669</td>
</tr>
</tbody>
</table>

*Totals...189,002,815,* £382,832,948.

*South African War Period.

<table>
<thead>
<tr>
<th>Year</th>
<th>Tons Milled.</th>
<th>Fine Gold.</th>
<th>Value at £4,24773 per fine oz.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ozs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1887</td>
<td>19,080</td>
<td>£772,682,740</td>
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</tr>
<tr>
<td>1888</td>
<td>171,789</td>
<td>729,715</td>
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<tr>
<td>1889</td>
<td>306,167</td>
<td>1,390,514</td>
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</tr>
<tr>
<td>1890</td>
<td>408,569</td>
<td>1,735,491</td>
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<tr>
<td>1891</td>
<td>601,810</td>
<td>2,556,328</td>
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</tr>
<tr>
<td>1892</td>
<td>1,013,743</td>
<td>4,297,610</td>
<td></td>
</tr>
<tr>
<td>1893</td>
<td>1,221,171</td>
<td>5,187,206</td>
<td></td>
</tr>
<tr>
<td>1894</td>
<td>1,639,252</td>
<td>6,963,188</td>
<td></td>
</tr>
<tr>
<td>1895</td>
<td>1,845,875</td>
<td>7,840,779</td>
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<tr>
<td>1896</td>
<td>1,851,422</td>
<td>7,846,341</td>
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<tr>
<td>1897</td>
<td>2,491,593</td>
<td>10,583,616</td>
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<tr>
<td>1898</td>
<td>3,564,581</td>
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<tr>
<td>1899</td>
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</table>

*See Below.

<table>
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</thead>
<tbody>
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<td>1900</td>
<td>412,006</td>
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<tr>
<td>1901</td>
<td>3,416,013</td>
</tr>
<tr>
<td>1902</td>
<td>6,105,016</td>
</tr>
<tr>
<td>1903</td>
<td>8,058,295</td>
</tr>
<tr>
<td>1904</td>
<td>4,160,122</td>
</tr>
<tr>
<td>1905</td>
<td>5,539,334</td>
</tr>
<tr>
<td>1906</td>
<td>15,533,229</td>
</tr>
<tr>
<td>1907</td>
<td>18,196,589</td>
</tr>
<tr>
<td>1908</td>
<td>20,544,397</td>
</tr>
<tr>
<td>1909</td>
<td>24,142,541</td>
</tr>
<tr>
<td>1910</td>
<td>23,888,258</td>
</tr>
<tr>
<td>1911</td>
<td>25,486,361</td>
</tr>
<tr>
<td>1912</td>
<td>25,628,432</td>
</tr>
<tr>
<td>1913</td>
<td>25,701,054</td>
</tr>
<tr>
<td>1914</td>
<td>28,314,579</td>
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<tr>
<td>1915</td>
<td>33,725,422</td>
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<td>27,251,960</td>
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<tr>
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<td>24,922,763</td>
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<td>24,096,277</td>
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<tr>
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<td>24,409,695</td>
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<td>25,312,041</td>
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<td>1922</td>
<td>26,538,875</td>
</tr>
<tr>
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<td>28,209,073</td>
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*Totals...181,256,627,* 769,929,213

<table>
<thead>
<tr>
<th></th>
<th>34,607</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>£672,682,740</td>
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</table>

<table>
<thead>
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<th>Tons Milled.</th>
</tr>
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<td>584,841</td>
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<tr>
<td>1910</td>
<td>2,484,247</td>
</tr>
<tr>
<td>1911</td>
<td>4,447</td>
</tr>
<tr>
<td>1912</td>
<td>24,340</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Tons Milled.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1920</td>
<td>103,390</td>
</tr>
</tbody>
</table>

**South African War Period.**

*Estimated Unrecorded Output for years 1887, 1888 and 1889.

*Undeclared Output for period October, 1899, to May, 1900 (inclusive).

‡ Amount won in 1904, but undeclared.

§ Amount won in 1919, 1921, and 1922, but undeclared.
How the Rand was Developed and Changes in the Groups.

As already mentioned the success of the Kimberley diamond field created or attracted to that industry many powerful financial groups, who were favourably disposed by their experiences there, to the possibilities of gold mining upon the discovery of the Rand. It is very largely due to their encouragement that the huge sums needed for the development of the goldfield has been introduced. The firm of Jules Porges & Co., of Hatton Garden, who were represented in the early days of Kimberley by Mr. Alfred Beit, the financial genius who so ably supported Mr. Cecil Rhodes in the carrying out of his schemes, became on the retirement of Mr. Porges, the even better known firm of Messrs. Wernher, Beit & Co. On the death of Sir Julius Wernher, the interests of the firm were transferred to the Central Mining and Finance Corporation, while the interests of the Johannesburg partners of Messrs. Wernher, Beit & Co.—Messrs. Eckstein & Co.—were taken over by the Rand Mines. Other important changes have been as follows: viz., the Rand holdings of Mr. Cecil Rhodes, and his immediate associates at Kimberley, became the nucleus of the Consolidated Gold Fields of South Africa. The properties controlled by Mr. Barnato and his friends were transferred to the Johannesburg Consolidated Investment Company. Messrs. Albu Bros. on their migration to the Witwatersrand founded the General Mining and Finance Corporation, while the mining and other properties belonging to Messrs. Lewis and Marks, became merged into the African and European Corporation. Messrs. Adolf Goerz & Co. has become the Union Corporation, while the Anglo-American Corporation, now ranking as among the most important Houses interested in mining in South Africa, is of comparatively recent date. The holdings of the S. Neumann group were taken over on the death of Sir Sigmund Neumann, by the Central Mining and Finance Corporation, while those of Sir J. Robinson were acquired by the Johannesburg Consolidated Investment Company. There were many individual interests, but as the outcrop mines became exhausted and the necessity of deep mining required capitals amounting to sums beyond the capacity of the smaller capitalist, these interests gradually became merged into the holdings of the larger groups, and the number of operating companies grew steadily less, in spite of the undertakings now operating on the Eastern section of the Rand.
Colonel S. B. JOEL, J.P.
Africa's Diamond Magnate, Senior Partner of Messrs. Barnato Bros.
METALLURGICAL CHANGES.

Until comparatively recently the gold-containing ore was reduced to powder by means of crushing in stamp batteries, the sludge being washed through the battery boxes and passed over amalgamation tables, which absorbed a certain proportion of the gold. The residue was then treated with cyanide solution which extracted the larger proportion of the gold contents. It was discovered that the finer the ore was crushed the better the extraction, which resulted in Messrs. Denny Bros. introducing the tube mill on the Rand. This enabled the screen of the batteries being made much coarser, resulting in an increased duty per stamp. Messrs. Denny were also responsible for the logical conclusion that as cyanide had to be depended upon to extract the gold which was not absorbed by the amalgamation plates, cyanide solution should be depended upon to extract all the gold content instead of only a proportion. As the tube mills were depended upon to reduce the ore to the requisite fineness, and as the preliminary crushing could be more cheaply and efficiently carried out by rock crushers it was further suggested that the expensive stamp battery and amalgamation tables should be eliminated. This resulted in the "all sliming" process, although it was some twenty years after the advantages of the system had been demonstrated by Messrs. Denny Bros. before the process was adopted, principally through the researches of Mr. Carl Davis, the consulting engineer of the Anglo-American Corporation. The "all sliming" process is now adopted in all new plants erected on the Rand, being exclusively relied upon at the New State Areas and West Springs Mines, and has been adopted for extensions of the treatment plants at Brakpans, Springs, Geduld and Government Areas.

GOLD AND THE CURRENCY PREMIUM.

On the outbreak of war in August, 1914, an agreement was entered into between the Government and the Gold Producers, under which the output of the mines was purchased by the Bank of England, at the standard sterling price, as soon as the gold was deposited with the South African Banks to the order of the Bank of England. At first the arrangement proved satisfactory as the mines were assured of a market for their gold irrespective of the interruptions in transport. As the war continued commodity prices and cost of living advanced, increasing working costs without the companies receiving any advantage from the greater purchasing power of gold, a consequence of the depreciation in sterling. The disadvantage of the arrangement became accentuated when foreign exchanges were unpegged on
March 20th, 1919, when the dollar value of the Pound Sterling fell steadily. Previously the gold producers of South Africa, Australia, etc., had formed a Committee to urge upon the authorities that they should be allowed to sell their gold output in the open market, mainly basing their claim on the fact that the Bank of England paid for the gold not in sovereigns, as was the case before the war, but in depreciated paper currency, and that the resultant profit which accrued on shipment of the gold abroad was received not by the producers, but by the Bank, which in this case was the State. The Government appointed a committee to inquire into the grievance, which found that “no more could be properly paid for gold than its value in currency,” the inquiry consequently producing purely negative results. Negotiations then took place between Gold Producers and the Bank of England, acting for the Treasury, and in July, 1919, an agreement was reached under which the Transvaal, Rhodesian, West African and Indian Gold Producers were allowed to sell their gold in the open market, provided that if it failed to find a buyer after six weeks of its arrival it should be sold to the Bank of England at the Mint price. An experimental shipment was made in July, 1919, when according to The Times, 50,000 ounces were sold in New York, at 85/6 per standard ounce as compared with the Mint price of 77/10½. It was not until the third week in September, 1919, however, that the first shipment of South African gold was sold in London under the new arrangement. The shipment amounted to over £1,000,000, and realised an average price of nearly 99/- per fine ounce. During the year the price of gold rose to the figure of 111/3 per fine ounce, when a slight relapse ensued in sympathy with a recovery in the American exchange. On the last day of the year the price was 109/8½ per ounce. The following year saw considerable fluctuations in the currency price of the metal, which touched 127/4 per fine ounce on February 5th, and dropped to 92/7 on April 10th, the average price for the year according to the Transvaal Chamber of Mines being 93/- per ounce. On August 1st, 1923, producers became entitled to ship their gold to destinations other than the United Kingdom. In that year the maximum price realised was 96/11 and the minimum 87/3, the average being 90/3. In 1924 the maximum realised was 97/11 and the minimum price 87/5, the average being 93/5.4. On April 28th, 1925, the gold standard was restored and the market price of the metal became fixed between 84/10½ and 84/11½ per fine ounce, these limits corresponding approximately with the buying and selling prices of the Bank of England.
ESTABLISHMENT OF GOLD REFINERY AND MINT.

The establishment of a refinery and Mint was discussed for a considerable time before anything concrete took place. In 1919 the Union Government decided to establish a branch of the Royal Mint. In August of that year the Transvaal Chamber of Mines obtained the services of Mr. R. R. Kaban, who had been connected with branches of the Royal Mint at Perth, Western Australia, and Bombay, India, to advise in connection with the erection of a gold refinery. A private company, under the title of the Rand Refinery Ltd., was registered in 1920, with a share capital of £50,000, and £160,000 was borrowed on Debentures. A site near India Junction, Germiston, was selected, building operations commencing the same year and completed in December, 1921. The capacity of the Refinery is sufficient to deal with the whole of the gold produced in South Africa, the plant being the largest and most complete of its kind.

The Union Government has erected a branch of the Royal Mint at Pretoria at a cost of approximately £200,000, the first delivery of silver coins being made on June 13th, 1923, and of bronze on August 14th of that year.

LABOUR TROUBLES ON THE MINES.

Labour troubles among the white miners on the Rand have not been infrequent, and on several occasions have culminated in rioting, the principal outbreaks being in 1909, 1913, and 1922, the latter being perhaps the most serious, requiring troops to suppress what had assumed the proportions of a local revolution. The trouble began on the coal mines, the Collieries Committee of the Chamber of Mines informing the South African Industrial Committee on September 21st, 1921, that the economic circumstances of the Collieries were such that it was essential that an endeavour should be made to reduce working costs, and that as a substantial fall had taken place in the cost of living, it was considered that the time had arrived to reduce wages. Certain negotiations followed, but proving fruitless, the men went out on strike on January 2nd, 1922. In the meantime trouble has arisen on the gold mines, and also between the Victoria Falls Power Company and its employees. The fall in the currency price of gold from 130/- in February, 1920, and 95/- in December, 1921, had made the position of the low grade mines extremely precarious, and in order to avoid wholesale closing down the Chamber of Mines gave notice of certain proposed alterations in the conditions of working.
These were not acceptable by the men, and on January 10th, 1922, the white miners withdrew their labour. At this juncture, a conference between the Chamber and the Federation was arranged by the Government with the object of an amicable arrangement of the difficulty, but proved abortive. Further attempts to settle the dispute met with no better success. On February 13th, 1922, the mines reopened, and from then on a gradually increasing number of men returned to work. On March 4th, 1922, the Federation asked for a meeting with the Chamber of Mines to discuss the terms upon which the strike might be cancelled. The interview was refused, and on March 7th a general strike was called, and on the 10th, after serious disturbances, martial law was proclaimed. On the 16th the strike came to an end, and the men returned to work, after the stronghold of the agitators at Fordsburg had been bombarded and partially destroyed by the troops.

RESULTS OF THE STRIKE.

There were several consequences of the strike in 1922. Advantage was taken to reorganise underground arrangements, which allowed of a greater tonnage being obtained without increasing the number of hours spent by miners underground, while experiments were made with regard to the greater use of machines in breaking down, the better grading of steel, and the introduction of automatic appliances for regulating the temperature at which drills were hardened, and the substitution of corduroy tables for amalgamation tables. These improvements have resulted in a material decrease in working costs, as is shown in the following table:

<table>
<thead>
<tr>
<th>Year</th>
<th>Tons Milled</th>
<th>Ozs Gold</th>
<th>Dwts. per ton</th>
<th>Costs per ton</th>
<th>Profit per ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>1916</td>
<td>28,525,252</td>
<td>8,971,350</td>
<td>6.27</td>
<td>18/1</td>
<td>8/2</td>
</tr>
<tr>
<td>1917</td>
<td>27,351,960</td>
<td>8,714,686</td>
<td>6.38</td>
<td>19/2</td>
<td>7/5</td>
</tr>
<tr>
<td>1918</td>
<td>24,922,763</td>
<td>8,198,029</td>
<td>6.56</td>
<td>21/7</td>
<td>6/7</td>
</tr>
<tr>
<td>1919</td>
<td>24,043,638</td>
<td>8,111,271</td>
<td>6.72</td>
<td>22/11</td>
<td>5/8</td>
</tr>
<tr>
<td>1920</td>
<td>24,096,277</td>
<td>7,949,585</td>
<td>6.53</td>
<td>25/8</td>
<td>9/3</td>
</tr>
<tr>
<td>1921</td>
<td>23,406,605</td>
<td>7,924,534</td>
<td>6.73</td>
<td>25/8</td>
<td>9/3</td>
</tr>
<tr>
<td>1922</td>
<td>19,853,640</td>
<td>7,020,110</td>
<td>6.55</td>
<td>20/10</td>
<td>9/3</td>
</tr>
<tr>
<td>1923</td>
<td>26,538,875</td>
<td>8,896,731</td>
<td>6.65</td>
<td>20/10</td>
<td>9/3</td>
</tr>
<tr>
<td>1924</td>
<td>28,209,750</td>
<td>9,352,396</td>
<td>6.55</td>
<td>19/7</td>
<td>10/3</td>
</tr>
</tbody>
</table>

TOTAL OUTPUT OF GOLD.

The total output of gold in the Transvaal from 1884 to 1924 is estimated at £802,832,949, to which total the Witwatersrand contributed £772,682,740.

TOTAL DIVIDENDS.

The total dividends declared by the Rand gold mining companies from 1887 to 1924 totalled £178,141,528, and by mines in outside districts during the same period £5,309,875.
Base Metals South of the Equator.

By Wm. CULLEN, LL.D., M.Inst.M. M., M.I.Cham.E.

At the beginning of the present century practically no base metals or minerals were mined south of the equator. Indeed, most of the development has taken place during the last fifteen years and only three things are required to make Central Africa, south of the equator in particular, and the Union of South Africa itself two of the most important countries for the production of base metals in the whole world. These three things are Population, Capital, and Transportation facilities. Africa, to those who do not know it, is a land of "teeming millions," but this is far from being the case, and to-day development would be much more rapid if labour were more plentiful. Everywhere it is most woefully short. Capital, of course, will come if the inducements are attractive, and transportation is improving all the time, though even now it is not ahead of developments. Undoubtedly the spectacular development of the century is the copper production of the Belgian Congo under the auspices of the Union Minière. The difficulties which have been faced and overcome reflect the greatest credit on that well-managed company, and only those who have been behind the scenes realise what these are. True, Providence has been bountiful. The ore is rich and it is easily mined. It presents no very difficult metallurgical difficulties and there is enough of it in sight to keep the whole world going for the next five years. The present production is at the rate of 80-90,000 tons per annum, but in 3-4 years, if labour is available, it will be up to 200,000 tons per annum, and a large proportion will be recovered by the electrolytic process—so that it will command a premium over standard copper.

Portuguese territory to the west has also plenty of copper, but it is safe to say that it will not be touched for many a long day. South of the Congo, in Northern Rhodesia, there are also immense quantities of copper ore, and important developments are now taking place, but it is neither so rich nor so easily worked as the Congo ore so far as our present information goes. The Perkins process, however, seems to have solved the metallurgical difficulties which are met with in treating a copper silicate, and if the capital outlay per ton of copper recovered is not too high there is undoubtedly a wonderful future for this great stretch of country.
Radium is hardly classed as a base metal, but neither is it called a precious metal. It is now common knowledge that the Congo radium ore is so rich that practically every other mine in the world has had to shut up, so that our Belgian friends now enjoy, to all intents and purposes, a world’s monopoly. They have also more cobalt than they know what to do with and the tin production is no insignificant figure.

Coming south again, the Broken Hill mine and district look like being responsible for a fairly large production of zinc and lead, though it will be some little time before the new hydro-electric plant gets into its stride. What is almost as important as the zinc itself is the vanadium which is now being won on a small scale but which has immense potentialities. Our American friends control this important metal now, but it looks as if they would soon have to rely largely on the British Empire for their supplies, for there is another very hopeful prospect in South-West Africa.

Still wending our way south, there is no need at this time of day to say much about Rhodesian asbestos and chrome, for they have established themselves and fortunately there appears to be enough to keep the world supplied even if all other sources were dried up. Rhodesia now takes second place among the world’s asbestos producers, and fortunately the production costs are so low that Canada, which holds the premier position, has taken serious alarm. America, the largest consumer of asbestos, has then to come to the Empire for her supplies, but outside of Rhodesia, in the Transvaal and in the Cape, there are still many unexploited deposits. But the further south we come the more we find that base metals have been neglected, though the cause of this is not far to seek. The big mining groups have devoted all their energies to gold and diamonds, and the problems which have had to be solved and which lie in the future, have been and will be most absorbing. If there had been no gold and no diamonds the Transvaal to-day would certainly be famous for its base metals and minerals, for few realise how richly endowed it is. Leaving coal out of account altogether, and even platinum, which was almost classed as a base metal on purely technical grounds, the Transvaal is producing to-day copper and tin in fair quantities, and the prospects for both are distinctly good. Unfortunately the one producer of lead has had to close down, but should never have started. Small quantities of asbestos, corundum, chrome, talc, fluor spar, mica, iron ore, and magnesite are being mined, and it is safe to say that if one group made up its mind to go into the business of base metals thoroughly the results would astonish all. The asbestos deposits are somewhat scattered, but generally speaking the quality is excellent. Corundum
exists over a very wide area, and if grading were done satisfactorily it could easily hold its own against the synthetic article now being largely made in America. Chrome exists in unlimited quantities and though the grade is low it will fetch a remunerative price. Chrome is one of those minerals the fate of which is in the lap of the gods, but once stainless steel comes down in price there will be no limit to the demands for this metal.

Neither the talc nor the magnesite are so widely dispersed, but it is understood that of the former at least there are huge amounts only awaiting marketing. The Transvaal mica is possibly not of the best quality, but there is a ready market for all that can be produced if properly graded. This question of grading is where South Africa always seems to fall down and it applies to cotton just as much as to minerals. The fluor spar is probably of the best quality known, and America takes practically all the Transvaal production.

The foregoing does not by any means exhaust the list, but it is enough to be getting on with, and indicates what a wide scope there is for development.

Still wending our way south one may say that so far as is known neither the Free State nor Natal have been well endowed with minerals, nor has the Cape for that matter, but the Cape had for many years a well-established copper industry. True it has started up again on a reduced scale after having been closed down for some years and it is the hope of all that it has obtained a new lease of life. Tin mining, which at one time looked hopeful, has petered out, as has also the production of nitrates which was based largely on faith, but the Cape has immense asbestos deposits (the blue variety) which are far from being exploited to their fullest extent. Some day its “pyrites” may be developed, but it is not generally known that manganese of excellent quality exists in more than one place in massive form. When transportation is available the Cape will be a big producer, for manganese is becoming more and more necessary for certain qualities of steel.

When, therefore, the gold mines commence to peter out, as all mines do, Africa south of the equator will still have plenty of necessary materials to develop and exploit, so no one need feel perturbed about the future of the country. There is, however, one word of warning. To-day most Governments do all in their power to foster mineral developments, for it is perfectly well known that visible supplies of some minerals at least are becoming wonderfully short. Some Governments, however, look at mineral development from quite another point of view. They look upon them as means of raising revenue, which is quite well enough up to a point, but it can be overdone.
It has been already mentioned that besides labour and transportation facilities, capital is required to develop mining prospects. Now so far as the Union is concerned Capital is distinctly coy—not because the South African Government is hostile to mining enterprise, but simply because it does not appear to be over friendly. All Governments since 1907 have had exactly the same outlook and not one has been a bit better than the other. It is, however, very noticeable that fresh capital is not coming into the Union. One has only to look further north to note the tremendous difference. Capital is encouraged in every way both in Rhodesia and the Congo with results which are known to all. This is, however, only one aspect of the case. Another is the position of the native. In the Congo the definite policy is to make use of the natives to the utmost of their mental and physical capacity, with the result that we find them doing all sorts of jobs which are artificially made the preserve of the white man further south. The result of this is that costs are extraordinarily low. Further south in Rhodesia there is less scope, but nevertheless small propositions can be developed without onerous mining restrictions. In the Union, however, everything is changed. The native is hemmed in and cumscribed, he must not do this and he must not do that, white men alone are allowed to do certain work, and the nett result is that unless a prospect is extraordinarily attractive the initial cost of development is beyond the capacity of most small people or syndicates.

Inspectors are, it is true, given a certain amount of latitude, but it is only human to expect them to look to the Rand for guidance as to procedure. This is, of course, quite wrong, but until the regulations with regard to small properties are relaxed by common agreement, the development of the base metal propositions of the Union will be slow.

One word in conclusion. For years the technical press has done more than justice to the question of the working up of shales and torbanites. It is the writer's deliberate opinion that the present is not the time to think of this. The shales are doing no harm lying in the ground. Their time will come, but it is not yet. Moreover, with all our newly gained knowledge the question of "retorting" is still unsolved, and we certainly know precious little about the nature of the oils which will be produced. They may be only suitable for fuel, but who wants fuel to compete with coal in South Africa? On the other hand they may "crack" well or they may even give a good lubricating oil, but the point is that the distillation of a shale or a torbanite is only the first step in a series of other steps, and no none can possibly know what the other steps are yet
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE.

Coal in the Union.

It was fortunate for the success of the Rand Gold Mining Industry that coal was discovered in the immediate vicinity of the mines, the question of power being thus solved. Previously coal seams had been worked in the Cape Province and Natal. In later years coal production has assumed considerable importance both for internal consumption, bunkering and export. In the Transvaal the district of Middelburg is the principal coal area. There are also important mines to the east of the Witwatersrand, and in the Ermelo district. Coal has also been found north of Zoutpansberg, and in the Pilgrim's Rest district. Coal mining is carried on in a small way in the Cape Province in the divisions of Molteno, Wodcouse and Engcobo. In the Orange Free State coal mines are found towards the northern boundary of the Heilbron district and in the northern and north-western portion of the Kroonstad district. In Natal the largest coal producing area is the Klip River country. This field extends north-west and south-west of the town of Dundee. The Utrecht, Vryheid and Paulpietersburg district also contain important producing mines.

The following table shows the quantity of coal imported into, exported from, and consumed in the Union from 1911 to 1923:

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumption of Coal</th>
<th>Coal Imported</th>
<th>Coal Exported</th>
<th>Coal Bunkered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1911</td>
<td>6,139,481</td>
<td>1,463,256</td>
<td>2,008,433</td>
<td>68,035</td>
</tr>
<tr>
<td>1912</td>
<td>6,598,081</td>
<td>1,671,528</td>
<td>2,472,308</td>
<td>67,083</td>
</tr>
<tr>
<td>1913</td>
<td>6,546,661</td>
<td>1,895,349</td>
<td>2,585,451</td>
<td>72,266</td>
</tr>
<tr>
<td>1914</td>
<td>6,344,181</td>
<td>1,929,328</td>
<td>2,108,397</td>
<td>82,495</td>
</tr>
<tr>
<td>1915</td>
<td>6,497,716</td>
<td>1,875,377</td>
<td>2,241,131</td>
<td>13,689</td>
</tr>
<tr>
<td>1916</td>
<td>7,291,080</td>
<td>2,304,066</td>
<td>2,307,389</td>
<td>15,003</td>
</tr>
<tr>
<td>1917</td>
<td>7,510,366</td>
<td>2,381,554</td>
<td>2,537,022</td>
<td>10,070</td>
</tr>
<tr>
<td>1918</td>
<td>7,386,546</td>
<td>2,271,070</td>
<td>2,471,222</td>
<td>16,198</td>
</tr>
<tr>
<td>1919</td>
<td>7,794,918</td>
<td>2,470,104</td>
<td>2,516,104</td>
<td>13,741</td>
</tr>
<tr>
<td>1920</td>
<td>8,323,218</td>
<td>2,745,681</td>
<td>2,338,849</td>
<td>16,085</td>
</tr>
<tr>
<td>1921</td>
<td>7,974,993</td>
<td>2,432,427</td>
<td>2,098,500</td>
<td>13,592</td>
</tr>
<tr>
<td>1922</td>
<td>6,832,954</td>
<td>2,258,409</td>
<td>1,672,088</td>
<td>11,627</td>
</tr>
<tr>
<td>1923</td>
<td>8,208,971</td>
<td>2,149,986</td>
<td>2,149,986</td>
<td>1,815,975</td>
</tr>
</tbody>
</table>

* Steam coal only.  † Shipped in vessels cleared overseas only.  ‡ Not available.
PRICE OF COAL.

The price of coal varies very much in the different Provinces. The reason for this difference in prices is largely due to the situation of the collieries. Thus, the Cape Province coal, which is the most inferior in the Union, fetches the highest price, because coal from the other Provinces has to be transported by rail to the Cape Province, thus enabling the local coal to maintain its high price.

Natal coal is the best in the Union, and the up-to-date Port of Durban being now a large coaling station, the considerable bunker and export trade done at this port, and the high quality of the coal supplied, enables the Natal collieries to command comparatively high prices for their output.

There has been no great fluctuation in prices in recent years, except in Natal. The Transvaal and Orange Free State coal is mostly consumed in those Provinces, and as the demand is no greater than the supply, there has been little opportunity for prices to increase.

Average Prices of Coal (Pit's Month), Union, 1911 to 1923.

<table>
<thead>
<tr>
<th>Period</th>
<th>Cape of Good Hope</th>
<th>Natal</th>
<th>Transvaal</th>
<th>Orange Free State</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per ton*</td>
<td>Per ton*</td>
<td>Per ton*</td>
<td>Per ton*</td>
</tr>
<tr>
<td>1911</td>
<td>11s. 6.08d.</td>
<td>5s. 4.94d.</td>
<td>4s. 4.78d.</td>
<td>5s. 4.42d.</td>
</tr>
<tr>
<td>1912</td>
<td>11s. 6.59d.</td>
<td>5s. 5.96d.</td>
<td>4s. 4.80d.</td>
<td>5s. 5.37d.</td>
</tr>
<tr>
<td>1913</td>
<td>11s. 5.824d.</td>
<td>5s. 1.84d.</td>
<td>4s. 4.56d.</td>
<td>5s. 5.84d.</td>
</tr>
<tr>
<td>1914</td>
<td>11s. 7.66d.</td>
<td>6s. 1.08d.</td>
<td>4s. 5.56d.</td>
<td>5s. 2.14d.</td>
</tr>
<tr>
<td>1915</td>
<td>11s. 4.22d.</td>
<td>7s. 4.77d.</td>
<td>4s. 6.02d.</td>
<td>5s. 7.84d.</td>
</tr>
<tr>
<td>1916</td>
<td>11s. 6.19d.</td>
<td>7s. 4.77d.</td>
<td>4s. 6.02d.</td>
<td>5s. 7.84d.</td>
</tr>
<tr>
<td>1917</td>
<td>11s. 4.86d.</td>
<td>8s. 1.61d.</td>
<td>4s. 9.32d.</td>
<td>5s. 6.70d.</td>
</tr>
<tr>
<td>1918</td>
<td>11s. 3.80d.</td>
<td>8s. 1.61d.</td>
<td>4s. 9.32d.</td>
<td>5s. 6.70d.</td>
</tr>
<tr>
<td>1919</td>
<td>11s. 9.13d.</td>
<td>9s. 7.14d.</td>
<td>5s. 1.40d.</td>
<td>6s. 8.24d.</td>
</tr>
<tr>
<td>1920</td>
<td>11s. 5.22d.</td>
<td>9s. 7.14d.</td>
<td>5s. 1.40d.</td>
<td>6s. 8.24d.</td>
</tr>
<tr>
<td>1921</td>
<td>11s. 7.91d.</td>
<td>9s. 7.14d.</td>
<td>5s. 1.40d.</td>
<td>6s. 8.24d.</td>
</tr>
<tr>
<td>1922</td>
<td>11s. 2.86d.</td>
<td>10s. 7.14d.</td>
<td>6s. 1.12d.</td>
<td>6s. 1.43d.</td>
</tr>
<tr>
<td>1923</td>
<td>11s. 5.76d.</td>
<td>10s. 7.14d.</td>
<td>6s. 1.12d.</td>
<td>6s. 1.43d.</td>
</tr>
</tbody>
</table>

* 2,000 lb.

International Comparison of the Retail Price of Coal, 1918-1924.

<table>
<thead>
<tr>
<th>Year</th>
<th>South Africa</th>
<th>Canada.</th>
<th>Australia</th>
<th>New Zealand</th>
<th>United Kingdom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Anthracite</td>
<td>Bituminous</td>
<td>Anthracite</td>
<td>Bituminous</td>
<td>Anthracite</td>
</tr>
<tr>
<td></td>
<td>Per 100 lb.</td>
<td>Per 100 lb.</td>
<td>Per 100 lb.</td>
<td>Per 100 lb.</td>
<td>Per 100 lb.</td>
</tr>
<tr>
<td>1918</td>
<td>1 5.90</td>
<td>2 5.54</td>
<td>1 11.05</td>
<td>2 4.32</td>
<td>2 2.87</td>
</tr>
<tr>
<td>1919</td>
<td>1 5.31</td>
<td>2 7.67</td>
<td>2 6.51</td>
<td>1 7.15</td>
<td>2 5.60</td>
</tr>
<tr>
<td>1920</td>
<td>1 9.15</td>
<td>3 8.00</td>
<td>2 6.32</td>
<td>1 10.95</td>
<td>3 0.10</td>
</tr>
<tr>
<td>1921</td>
<td>1 11.44</td>
<td>3 8.91</td>
<td>2 7.33</td>
<td>1 10.95</td>
<td>3 4.47</td>
</tr>
<tr>
<td>1922</td>
<td>1 8.80</td>
<td>3 7.66</td>
<td>2 4.19</td>
<td>1 11.35</td>
<td>3 2.54</td>
</tr>
<tr>
<td>1923</td>
<td>1 8.86</td>
<td>3 8.31</td>
<td>2 4.48</td>
<td>1 11.11</td>
<td>2 0.18</td>
</tr>
<tr>
<td>1924</td>
<td>1 7.94</td>
<td>3 7.57</td>
<td>2 3.39</td>
<td>3 0.97</td>
<td>2 2.20</td>
</tr>
</tbody>
</table>

* 30 per cent increase over 1914 price; 2s. 6d. per ton of 2,240 lb.
‡ Average of second quarter.
§ Average of four months.
$ Average of five months.
The subjoined statement shows the markets to which South African coal has been exported through Durban, Delagoa Bay, and Capetown during the past five years.

<table>
<thead>
<tr>
<th></th>
<th>1924-25</th>
<th>1923-24</th>
<th>1922-23</th>
<th>1921-22</th>
<th>1920-21</th>
</tr>
</thead>
<tbody>
<tr>
<td>East African and Red Sea ports, including islands on East Coast—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Through Durban</td>
<td>464,153</td>
<td>376,310</td>
<td>179,678</td>
<td>196,017</td>
<td>451,992</td>
</tr>
<tr>
<td>Through Delagoa Bay</td>
<td>54,062</td>
<td>114,679</td>
<td>55,275</td>
<td>176,978</td>
<td>419,713</td>
</tr>
<tr>
<td>Through Capetown</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>518,217</td>
<td>490,989</td>
<td>235,453</td>
<td>372,995</td>
<td>871,615</td>
</tr>
<tr>
<td>West African ports and St. Helena—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Through Durban</td>
<td>16,312</td>
<td>4,769</td>
<td>50</td>
<td>—</td>
<td>17,676</td>
</tr>
<tr>
<td>Through Delagoa Bay</td>
<td>17,682</td>
<td>6,698</td>
<td>11,237</td>
<td>5,686</td>
<td>28,969</td>
</tr>
<tr>
<td>Through Capetown</td>
<td>148</td>
<td>5</td>
<td>418</td>
<td>349</td>
<td>1,277</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>34,177</td>
<td>11,472</td>
<td>11,705</td>
<td>6,035</td>
<td>47,922</td>
</tr>
<tr>
<td>India and Far East—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Through Durban</td>
<td>1,013,388</td>
<td>923,970</td>
<td>874,571</td>
<td>787,343</td>
<td>88,326</td>
</tr>
<tr>
<td>Through Delagoa Bay</td>
<td>338,228</td>
<td>399,660</td>
<td>207,849</td>
<td>567,273</td>
<td>131,028</td>
</tr>
<tr>
<td>Through Capetown</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,351,616</td>
<td>1,323,630</td>
<td>1,086,420</td>
<td>1,353,616</td>
<td>219,454</td>
</tr>
<tr>
<td>Australasia—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Through Durban</td>
<td>—</td>
<td>15,669</td>
<td>—</td>
<td>—</td>
<td>6,476</td>
</tr>
<tr>
<td>Through Delagoa Bay</td>
<td>—</td>
<td>6,145</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Through Capetown</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>—</td>
<td>21,814</td>
<td>—</td>
<td>—</td>
<td>6,476</td>
</tr>
<tr>
<td>South America—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Through Durban</td>
<td>4,664</td>
<td>—</td>
<td>69,841</td>
<td>26,586</td>
<td>68,569</td>
</tr>
<tr>
<td>Through Delagoa Bay</td>
<td>5,822</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>87,791</td>
</tr>
<tr>
<td>Through Capetown</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>10</td>
<td>10,014</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>10,326</td>
<td>—</td>
<td>69,841</td>
<td>26,596</td>
<td>166,374</td>
</tr>
<tr>
<td>South Georgia and Kerguelen Islands—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Through Durban</td>
<td>15,628</td>
<td>15,289</td>
<td>4,932</td>
<td>4,542</td>
<td>11,593</td>
</tr>
<tr>
<td>Through Delagoa Bay</td>
<td>516</td>
<td>255</td>
<td>—</td>
<td>728</td>
<td>841</td>
</tr>
<tr>
<td>Through Capetown</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>16,144</td>
<td>15,544</td>
<td>4,932</td>
<td>5,270</td>
<td>12,434</td>
</tr>
<tr>
<td>Europe—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Through Durban</td>
<td>6,423</td>
<td>117,671</td>
<td>21,129</td>
<td>105,133</td>
<td></td>
</tr>
<tr>
<td>Through Delagoa Bay</td>
<td>508</td>
<td>6,975</td>
<td>—</td>
<td>1,015</td>
<td>175,093</td>
</tr>
<tr>
<td>Through Capetown</td>
<td>—</td>
<td>563</td>
<td>64</td>
<td>21</td>
<td>1,538</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6,932</td>
<td>124,209</td>
<td>21,129</td>
<td>1,036</td>
<td>284,774</td>
</tr>
<tr>
<td><strong>Grande Total</strong></td>
<td>1,937,622</td>
<td>1,988,658</td>
<td>1,423,544</td>
<td>1,766,548</td>
<td>1,606,049</td>
</tr>
</tbody>
</table>
### BASE METALS PRODUCTION.

#### Copper.

<table>
<thead>
<tr>
<th>Province</th>
<th>Ore Dressing</th>
<th>Marketable Product</th>
<th>Shipments and Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tons Treated</td>
<td>Tons</td>
<td>Percentage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>of Pure Metal</td>
</tr>
<tr>
<td>Transvaal</td>
<td>145,021</td>
<td>7,061,007</td>
<td>86.77</td>
</tr>
<tr>
<td></td>
<td>38,765</td>
<td>3,191,290</td>
<td>97.60</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>183,786</strong></td>
<td><strong>10,252,297</strong></td>
<td><strong>90.14</strong></td>
</tr>
</tbody>
</table>

#### Tin.

<table>
<thead>
<tr>
<th>Province</th>
<th>Ore Dressing</th>
<th>Marketable Product</th>
<th>Shipments and Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tons Treated</td>
<td>Tons</td>
<td>Percentage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>of Pure Metal</td>
</tr>
<tr>
<td>Transvaal</td>
<td>107,998</td>
<td>1,969,226</td>
<td>66.06</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>107,998</strong></td>
<td><strong>1,969,226</strong></td>
<td><strong>66.06</strong></td>
</tr>
</tbody>
</table>

#### Copper Production Summary:

<table>
<thead>
<tr>
<th>Province</th>
<th>Ore Dressing</th>
<th>Marketable Product</th>
<th>Shipments and Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tons Treated</td>
<td>Tons</td>
<td>Percentage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>of Pure Metal</td>
</tr>
<tr>
<td>Transvaal</td>
<td>145,021</td>
<td>7,061,007</td>
<td>86.77</td>
</tr>
<tr>
<td></td>
<td>38,765</td>
<td>3,191,290</td>
<td>97.60</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>183,786</strong></td>
<td><strong>10,252,297</strong></td>
<td><strong>90.14</strong></td>
</tr>
</tbody>
</table>

#### Tin Production Summary:

<table>
<thead>
<tr>
<th>Province</th>
<th>Ore Dressing</th>
<th>Marketable Product</th>
<th>Shipments and Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tons Treated</td>
<td>Tons</td>
<td>Percentage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>of Pure Metal</td>
</tr>
<tr>
<td>Transvaal</td>
<td>107,998</td>
<td>1,969,226</td>
<td>66.06</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>107,998</strong></td>
<td><strong>1,969,226</strong></td>
<td><strong>66.06</strong></td>
</tr>
</tbody>
</table>
### Totals of Mineral Production.

**Value of Output of Minerals from Earliest Date of Existing Records to 31st December, 1924.**

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Transvaal (£)</th>
<th>Cape (£)</th>
<th>Orange Free State (£)</th>
<th>Natal (£)</th>
<th>Union of South Africa (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>835,546,724</td>
<td>21,947</td>
<td>86,094</td>
<td>235,654,765</td>
<td></td>
</tr>
<tr>
<td>Diamonds</td>
<td>35,124,830</td>
<td>179,465,747</td>
<td>3,449,655</td>
<td>236,238,832</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>23,009,827</td>
<td>2,008,069</td>
<td>3,780,955</td>
<td>64,877,804</td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>3,794,036</td>
<td>20,103,536</td>
<td>389</td>
<td>23,897,961</td>
<td></td>
</tr>
<tr>
<td>Tin</td>
<td>5,048,152</td>
<td>61,427</td>
<td></td>
<td>5,109,579</td>
<td></td>
</tr>
<tr>
<td>Silver</td>
<td>3,695,368</td>
<td>2</td>
<td>140</td>
<td>3,095,510</td>
<td></td>
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<tr>
<td>Asbestos</td>
<td>328,908</td>
<td>732,900</td>
<td></td>
<td>1,066,817</td>
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<tr>
<td>Lead</td>
<td>502,902</td>
<td>2,877</td>
<td></td>
<td>505,169</td>
<td></td>
</tr>
<tr>
<td>Osmiridium</td>
<td>166,280</td>
<td></td>
<td></td>
<td>166,380</td>
<td></td>
</tr>
<tr>
<td>Soda</td>
<td>111,694</td>
<td></td>
<td></td>
<td>111,694</td>
<td></td>
</tr>
<tr>
<td>Corundum</td>
<td>101,679</td>
<td>1,607</td>
<td>10</td>
<td>104,492</td>
<td></td>
</tr>
<tr>
<td>Iron Pyrite</td>
<td>52,724</td>
<td>968</td>
<td></td>
<td>53,692</td>
<td></td>
</tr>
<tr>
<td>Zine</td>
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<td></td>
<td></td>
<td>50,988</td>
<td></td>
</tr>
<tr>
<td>Magnesite</td>
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<td></td>
<td>41,258</td>
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</tr>
<tr>
<td>Antimony</td>
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<td>35,279</td>
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<td>Graphite</td>
<td>25,242</td>
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<td>25,524</td>
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<td>Talc</td>
<td>13,829</td>
<td></td>
<td>33</td>
<td>13,862</td>
<td></td>
</tr>
<tr>
<td>Mica</td>
<td>10,471</td>
<td></td>
<td></td>
<td>10,171</td>
<td></td>
</tr>
<tr>
<td>Manganese</td>
<td>7,286</td>
<td>179</td>
<td>549</td>
<td>8,014</td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>7,885</td>
<td></td>
<td></td>
<td>7,885</td>
<td></td>
</tr>
<tr>
<td>Iron Ore</td>
<td>5,705</td>
<td>229</td>
<td>496</td>
<td>6,285</td>
<td></td>
</tr>
<tr>
<td>Mineral Paints</td>
<td>1,548</td>
<td>166</td>
<td>4,571</td>
<td>6,285</td>
<td></td>
</tr>
<tr>
<td>Tungsten</td>
<td>5,539</td>
<td>620</td>
<td></td>
<td>6,149</td>
<td></td>
</tr>
<tr>
<td>Chrome Ore</td>
<td>2,054</td>
<td></td>
<td></td>
<td>2,054</td>
<td></td>
</tr>
<tr>
<td>Vanadium</td>
<td>2,716</td>
<td></td>
<td></td>
<td>2,716</td>
<td></td>
</tr>
<tr>
<td>Bismuth</td>
<td>300</td>
<td></td>
<td></td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>Kaolin</td>
<td>38</td>
<td></td>
<td>144</td>
<td>144</td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td>5</td>
<td></td>
<td></td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Mercury</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>917,291,545</strong></td>
<td><strong>202,400,274</strong></td>
<td><strong>25,230,010</strong></td>
<td><strong>26,176,338</strong></td>
<td><strong>1,171,098,167</strong></td>
</tr>
</tbody>
</table>

* Total value includes gold premium, amounting to £32,740,264, received since 24th July, 1919.

Sundry other minerals, such as clay, stone, lime, gypsum, flint, kieselguhr, verdite, and fertilizers, or salt, are not included in the above table. Figures relating to some of these are collected by the Census Office, and reliable data for others are impossible to obtain. Coal by-products are also excluded.
Platinum in the Transvaal.

Its History and Distribution.

(Reproduced from the "Mining and Industrial Magazine of Southern Africa," Johannesburg.)

The first discovery (of commercial importance) of Platinum in South Africa was made in brecciated quartz and felsite lodes in the Waterberg district of the Transvaal in 1923.

In August, 1924, Platinum was located in dunite and norite deposits in the Lydenburg district. Determination of the extent and importance of these latter discoveries led to the prospecing of Platinum in similar formation over a large portion of the sub-continent, and the existence of Platinum has been determined in the Rustenburg, Potgietersrust, Middleburg, Carolina, Pietersburg, Pretoria, and Marico Districts of the Transvaal.

The presence of Platinum has also been detected in Southern Rhodesia, in the Markwiro, Belingwe and Selukwe Districts, and also—so it is rumoured—in norite formation in the Tete District of Portuguese East Africa and in the South West African Protectorate. From the data at my disposal, I am not inclined to attach much importance to the discoveries made in Southern Africa outside of the Transvaal, although I have just been informed on fairly reliable authority that encouraging assays are being secured in the Selukwe District of Matabeleland.

With regard to the discoveries made in the Transvaal since the end of 1924, those of the Potgietersrust and Rustenburg Districts are the most important.

Principal Geological and Economic Characteristics.

The essential geological features and characteristics of these fields are as under:

(1) Waterberg District.

Brecciated quartz and Felsite Lodes and Cross Lodes. Values exceedingly erratic, and varying within restricted areas from blanks and traces up to 2,000 dwts. per ton.

(2) Lydenburg District.

(a) Hortonolite Dunite. Occurrences in pipes or lenses of limited lateral dimensions and as yet undefined vertical depth. In one only of these have high grade values been consistently obtained, namely, in the dunite occurrences on Onverwacht of the Transvaal Consolidated Land and Exploration Company. Recently, however, encouraging values have been obtained in dunite.
occurrences on the properties of Lydenburg Platinum Areas.

(b) In Norite lodes of remarkably persistent nature extending over 60 miles from South to North, exhibiting notable consistency of values ranging from 2 to 6 dwts. over moderate widths.

c) In association with chrome iron ore. Values relatively unimportant.

In Pyroxenite Bodies.

In the Potgietersrust District, extending over a belt no less than 30 miles from South to North—ore bodies of great width, i.e., up to 300 feet, values ranging from 4 dwts. to several ounces per ton with an average value in the region of 5-6 dwts. over not less than 30 feet of lode.

Rustenburg District.

(a) In Chromite. Values generally low, i.e., 2 dwts.

(b) In Norite bodies of great width but of low grade (about 2 dwts.) character.

c) In Pyroxenite. This is a recent discovery, but according to reliable information received the economic characteristics are in some sections comparable with those observed in the Potgietersrust Field.

Principal Companies.

The principal companies at work are:

(1) Potgietersrust Platinum Mines, Ltd. Owns the greater portion and pick of the Potgietersrust belt. Capital £1,250,000 in 5s. shares. Total working capital provided to date £930,000; principal firms interested are Johannesburg Consolidated Investment Co., Sir Abe Bailey-S.A. Townships, Anglo-American Corporation of South Africa, and Messrs. Becker and Ohlthaver.

(2) Transvaal Consolidated Land and Exploration Co., with which the Central Mining and Investment Corporation and the Bailey-S.A. Township interests are associated. This Company owns the Onverwacht Pilot Plant—500 tons per month capacity (since confirmed by actual output —at work and reports received at the moment of writing regarding production by this plant are favourable. The Onverwacht dunite body appears to be parsnip shaped and down to a depth of 250 feet has yielded a substantial supply of ore containing not (much) less than one ounce per ton.

(3) The S.A. Townships (Sir Abe Bailey’s Group) is largely interested, in conjunction with the Central Mining Corporation, in the Transvaal Consolidated Land, Onverwacht and Potgietersrust Companies.

(4) Onverwacht Platinum, Limited, was incorporated on April 12th, 1926, with a capital of £450,000 in 10s. shares. The Onverwacht dunite occurrence is referred to above, while the existence of stretches of norite reef up to 3,000 ft. in length has also been proved.

(5) Lydenburg Platinum Areas controlling a very large
extent of norite and (in lesser degree) dunite, capital £1,600,000. Consolidated Gold Fields of South Africa interested.

(6) Transvaal Estate and Development. Farms in the vicinity of Olifant's River (Messrs. Lewis and Marks interested.)

(7) Northern Platinum (Anglo-American control).

(8) Platinum Proprietary Company of Lydenburg (Central Mining/Rand Mines interested). (It is now rumoured that the option in respect of this property is not likely to be exercised.)

(9) Hendies Lydenburg Platinum (S.A. Townships and Hendersons Consolidated).

(10) Eerste Geluk Platinum Mines (S.A. Townships).


There are various farms and claims in the Lydenburg area in which these firms, the Transvaal and Delagoa Bay Investment Company and other firms and syndicates are interested.

In the Waterberg District the only company which is actively developing platinum bearing areas on any notable scale at the present moment is:

(12) The Transvaal Platinum, Ltd., which has a capital of £30,000. The S.A. Townships and Transvaal Consolidated Land Companies are interested. The company has erected a reduction plant capable of treating up to 1,000 tons per month and I understand that this is about to commence crushing.

Technical Question.

With the experience gained during the past 40 years on the Witwatersrand and in other mining fields of the Transvaal to guide the controllers of the Platinum Industry, it is not at all likely that the actual development and mining of the platiniferous ores of the Province will present any very difficult problems below ground. Development will probably be rapid, much more rapid than that on the Witwatersrand, particularly where the ore bodies are of great width as at Potgietersrust. Conditions differ, however, very greatly in the different fields and will, therefore, call for varying methods in the opening up of the ore bodies and in the subsequent stoping or actual removal of the platinum bearing rocks. The indications are that these ore bodies will persevere in depth and will maintain their platiniferous content. The consistency of values characterising the pyroxenite and norite deposits of Potgietersrust and Lydenburg should also make for easy mining, and development and stoping charges should be relatively low.

The Minerals Separation Company has been busily engaged on research in connection with the platinum deposits of the Transvaal for some time past, and in so far as at any rate the sulphide zone is concerned it
seems probable that no difficulties will be experienced in obtaining not only a substantial extraction of platinum, but in securing a high percentage of the nickel and copper contents of the ore by means of oil flotation from the norites. With nickel at £175 per ton and copper at £60, these should prove very valuable by-products.

The presence of platinum has been determined in about 3,000 square miles of the Transvaal, in quantities relative to tonnage which with the metal at its present price of £24 to £25 per ounce are commercially attractive.

[Editor’s Note.—Since this report was compiled the most important event that has taken place in the platinum world has been the dispatch to London of the first output of platinoid sponge or bullion won from a Transvaal mine, that recovered from the dunite occurrence at Onverwacht. The problem of obtaining a satisfactory commercial extraction from oxidised norite ores remains to be solved. The Potgietersrust Platinum Mines have embarked on a very extensive programme of development and equipment. The policy of the Government in regard to the proclamation or partial proclamation of platinum bearing farms continues to cause anxiety and criticism. Local native labour is likely to be more plentiful because of unsatisfactory agricultural conditions in the vicinity of the platinum mines. To this we may add that according to one authority it is not at all clear that the world will be able to absorb much more than 300,000 ozs. of platinum per annum unless new uses come into the picture which will probably connote a substantial decline in price.]
Rhodesia.

There is little doubt that the general belief in the mineral wealth of Rhodesia was in a great measure responsible for the penetration of that part of Central Africa now known as Rhodesia. There are many indications in the policy of Cecil Rhodes that he contemplated the opening up of the country and its consequent settlement through the means which would be provided by participating in the profits earned by mining operations. The constitution of the British South Africa Company was based on the retention of the mineral rights of the country, and the receipt of a royalty on output to be paid by producing companies, or the capitalisation of such royalty by share participations.

The first rush of prospectors into Southern Rhodesia devoted their attention mainly to the discovery of mineral deposits indicated by ancient workings, and a large number of companies and Syndicates were formed, the major part of which, however, failed to realise the expectations of the promoters. Some of this disappointment was due to incomplete knowledge of geological conditions which were in many instances totally dissimilar from those existing on the Rand, and in other instances to ores being complex and insufficiency of Working Capital. After the first disappointment more skilful management has made successes of many early failures, while new discoveries have been made, particularly in Northern Rhodesia, which promises to become one of the largest base metal producers in the world.

# Value of Rhodesian Mineral Output

## Southern Rhodesia

<table>
<thead>
<tr>
<th>Year</th>
<th>Value of Gold</th>
<th>Silver</th>
<th>Coal</th>
<th>Chrome Ore</th>
<th>Copper</th>
<th>Asbestos</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>£</td>
<td>Ounces</td>
<td>Tons</td>
<td>Tons</td>
<td>Tons</td>
<td>Tons</td>
</tr>
<tr>
<td>1890-1898</td>
<td>83,052</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1899</td>
<td>205,690</td>
<td>112</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1900</td>
<td>308,219</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1901</td>
<td>610,389</td>
<td>3,132</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1902</td>
<td>667,096</td>
<td>3,145</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1903</td>
<td>857,229</td>
<td>29,715</td>
<td></td>
<td>46,870</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1904</td>
<td>669,443</td>
<td>70,146</td>
<td></td>
<td>59,678</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1905</td>
<td>1,449,985</td>
<td>89,278</td>
<td></td>
<td>97,161</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1906</td>
<td>1,985,099</td>
<td>110,575</td>
<td></td>
<td>103,803</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1907</td>
<td>2,178,886</td>
<td>147,324</td>
<td></td>
<td>115,073</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1908</td>
<td>2,520,007</td>
<td>254,425</td>
<td></td>
<td>164,114</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1909</td>
<td>2,623,269</td>
<td>271,633</td>
<td></td>
<td>170,983</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1910</td>
<td>2,568,198</td>
<td>187,641</td>
<td></td>
<td>135,068</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1911</td>
<td>2,647,896</td>
<td>191,132</td>
<td></td>
<td>152,529</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1912</td>
<td>2,707,369</td>
<td>176,532</td>
<td></td>
<td>164,140</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1913</td>
<td>2,903,268</td>
<td>141,390</td>
<td></td>
<td>216,214</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1914</td>
<td>3,580,209</td>
<td>150,793</td>
<td></td>
<td>185,276</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1915</td>
<td>3,583,167</td>
<td>185,276</td>
<td></td>
<td>216,214</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1916</td>
<td>3,895,411</td>
<td>206,676</td>
<td></td>
<td>243,328</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1917</td>
<td>3,493,391</td>
<td>211,989</td>
<td></td>
<td>349,159</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1918</td>
<td>2,623,580</td>
<td>176,532</td>
<td></td>
<td>216,214</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1919</td>
<td>2,499,498</td>
<td>172,000</td>
<td></td>
<td>243,328</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1920</td>
<td>3,066,349</td>
<td>138,082</td>
<td></td>
<td>349,159</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1921</td>
<td>3,417,273</td>
<td>152,980</td>
<td></td>
<td>349,159</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1922</td>
<td>3,111,469</td>
<td>172,000</td>
<td></td>
<td>243,328</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1923</td>
<td>2,599,189</td>
<td>155,219</td>
<td></td>
<td>212,529</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1924</td>
<td>2,949,562</td>
<td>166,472</td>
<td></td>
<td>212,529</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1925</td>
<td>2,539,542</td>
<td>152,704</td>
<td></td>
<td>212,529</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**1925 Values**

| Value of coal sold. | £63,001,347 | £3,770,410 | £8,108,712 | £109,343 | £766,381 |

Small quantities of antimony ore, arsenic, barytes, corundum, diamonds, iron, mica, scheelite and tin have also been produced. The total value of the mineral production from Southern Rhodesia to 31st December, 1925, is £78,273,177.

## Northern Rhodesia

### In 1925.

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Amount</th>
<th>Value £</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>1,250 oz.</td>
<td>5,422</td>
</tr>
<tr>
<td>Silver</td>
<td>5,267 oz.</td>
<td>1,970</td>
</tr>
<tr>
<td>Copper</td>
<td>75 tons</td>
<td>6,086</td>
</tr>
<tr>
<td>Copper Concentrates</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>Lead</td>
<td>3,352-35 tons</td>
<td>51,435</td>
</tr>
<tr>
<td>Bauxite</td>
<td>58 tons</td>
<td>265</td>
</tr>
<tr>
<td>Mica</td>
<td>58 tons</td>
<td>677</td>
</tr>
<tr>
<td>Zinc</td>
<td>361-31 oz.</td>
<td>5,932</td>
</tr>
<tr>
<td>Zinc Ore</td>
<td>6,199-12 oz.</td>
<td>7,319</td>
</tr>
<tr>
<td>Vanadium</td>
<td>Nil</td>
<td>Nil</td>
</tr>
</tbody>
</table>

| Value £  | £78,478 |

### From commencement to 31st December, 1925.

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Amount</th>
<th>Value £</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>18,928 oz.</td>
<td>83,129</td>
</tr>
<tr>
<td>Silver</td>
<td>407,136 oz.</td>
<td>41,060</td>
</tr>
<tr>
<td>Copper</td>
<td>6,859-47 tons</td>
<td>46,858</td>
</tr>
<tr>
<td>Copper Concentrates</td>
<td>4,671-48 tons</td>
<td><strong>220,595</strong></td>
</tr>
<tr>
<td>Lead</td>
<td>100,071-93 tons</td>
<td><strong>2,325,100</strong></td>
</tr>
<tr>
<td>Bauxite</td>
<td>5,557 oz.</td>
<td>677</td>
</tr>
<tr>
<td>Mica</td>
<td>1,63 oz.</td>
<td>677</td>
</tr>
<tr>
<td>Zinc</td>
<td>246-31 oz.</td>
<td>5,932</td>
</tr>
<tr>
<td>Zinc Ore</td>
<td>18,039-05 oz.</td>
<td>94,392</td>
</tr>
<tr>
<td>Vanadium</td>
<td>109-22 oz.</td>
<td>26,928</td>
</tr>
</tbody>
</table>

| Value £  | £3,408,869 |

**Note.—** The total tonnage in respect of Northern Rhodesia shows an apparent decrease in some instances. This is due to the adoption of the standard ton of 2,240 lbs. Returns have previously been given in short tons of 2,000 lbs.

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Belgian Congo.

The principal mineral outputs are Gold, Copper, Tin, Cobalt and Uranium ores. The Union Miniere operates on a large mineralised belt in the Katanga area, which stretches for some 300 miles, and on which enormous deposits of copper and other minerals have been located. The output of copper for the last few years has been as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Kilo Mines</th>
<th>Moto Mines</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1905</td>
<td>18,912 tons</td>
<td>—</td>
<td>18,912</td>
</tr>
<tr>
<td>1906</td>
<td>26,299</td>
<td>15,791</td>
<td>42,090</td>
</tr>
<tr>
<td>1907</td>
<td>36,641</td>
<td>26,990</td>
<td>63,631</td>
</tr>
<tr>
<td>1908</td>
<td>47,546</td>
<td>38,737</td>
<td>86,283</td>
</tr>
</tbody>
</table>

The Union Miniere has become the largest individual producer of copper in the world, and when its new plants are in commission the output is expected to reach the neighbourhood of 200,000 tons per annum.

The output of gold from the Kilo-Moto mines has been as under:

<table>
<thead>
<tr>
<th>Year</th>
<th>Kilo Mines</th>
<th>Moto Mines</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1905</td>
<td>525</td>
<td>—</td>
<td>525</td>
</tr>
<tr>
<td>1906</td>
<td>3,704</td>
<td>—</td>
<td>3,704</td>
</tr>
<tr>
<td>1907</td>
<td>8,842</td>
<td>—</td>
<td>8,842</td>
</tr>
<tr>
<td>1908</td>
<td>8,405</td>
<td>—</td>
<td>8,405</td>
</tr>
<tr>
<td>1909</td>
<td>17,727</td>
<td>—</td>
<td>17,727</td>
</tr>
<tr>
<td>1910</td>
<td>23,666</td>
<td>—</td>
<td>23,666</td>
</tr>
<tr>
<td>1911</td>
<td>17,039</td>
<td>161</td>
<td>17,200</td>
</tr>
<tr>
<td>1912</td>
<td>19,998</td>
<td>6,382</td>
<td>26,380</td>
</tr>
<tr>
<td>1913</td>
<td>26,299</td>
<td>15,791</td>
<td>42,090</td>
</tr>
<tr>
<td>1914</td>
<td>36,641</td>
<td>26,990</td>
<td>63,631</td>
</tr>
<tr>
<td>1915</td>
<td>38,046</td>
<td>26,990</td>
<td>65,036</td>
</tr>
<tr>
<td>1916</td>
<td>47,546</td>
<td>38,737</td>
<td>86,283</td>
</tr>
<tr>
<td>1917</td>
<td>43,742</td>
<td>38,737</td>
<td>82,479</td>
</tr>
<tr>
<td>1918</td>
<td>43,742</td>
<td>38,737</td>
<td>82,479</td>
</tr>
<tr>
<td>1919</td>
<td>43,742</td>
<td>38,737</td>
<td>82,479</td>
</tr>
<tr>
<td>1920</td>
<td>43,742</td>
<td>38,737</td>
<td>82,479</td>
</tr>
<tr>
<td>1921</td>
<td>43,742</td>
<td>38,737</td>
<td>82,479</td>
</tr>
<tr>
<td>1922</td>
<td>43,742</td>
<td>38,737</td>
<td>82,479</td>
</tr>
<tr>
<td>1923</td>
<td>43,742</td>
<td>38,737</td>
<td>82,479</td>
</tr>
<tr>
<td>1924</td>
<td>43,742</td>
<td>38,737</td>
<td>82,479</td>
</tr>
<tr>
<td>1925</td>
<td>43,742</td>
<td>38,737</td>
<td>82,479</td>
</tr>
</tbody>
</table>

On the Forminiere Diamond Fields, Kasai, Belgian Congo.
Mineral Production to Date:
Value £27,000,000 sterling.

The value of minerals produced by the great territory flanked by the Southern Atlantic Ocean, formerly known as German South West Africa, and which since the Treaty of Versailles has been entrusted to the guardianship of the Union of South Africa, had amounted to roughly £27,000,000 up to the end of last year.

Of this total two mineral products, Diamonds and Copper had between them accounted for 95 per cent.

Copper mining on a substantial scale commenced in 1907, and the production of Diamonds from the coastal fields dates from 1909.

The country is still very young; from almost every point of view pertaining to development South West is still a mere infant.

Much of its spacious vastness is still well nigh unatlassed but it is known to be highly mineralised, and in addition to the main sources of output referred to above, various other metals and mineral substances have been located within its far flung frontiers. Some of these, notably Vanadium, Tin and Gold already have yielded substantial outputs and increased production from these sources is to be anticipated.

Aridity, difficulties of transportation and shortage of native labour plus insurrections and the incidence of the Great War have tended to keep the country back. In many districts the absence of water is a great hindrance to progress, although over a considerable portion of the territory it is to be found by boring, and the recent policy of the Government in regard to the conservation of water supplies and the location of artesian water over wide areas has much improved matters in this respect.

A main "broad gauge" railway system traverses the country from the Union border at Nakob to Walvis Bay, and there are branch lines to Luderitz and towards
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE.

South-West Africa.

MINERAL DEPOSITS

Developed ☑ Undeveloped ☐

Diamonds ☑ Copper Lead Zinc ☑ Vanadium ☑ Copper ☑ Lead & Silver ☑ Tin ☑ Iron ☑ Semi Precious Stones ☑ Fluorspar ☑ Gold ☑ Graphite ☑ Guano ☑ Kimberlite ☑ Marble ☑ Mica ☑ Salt ☑ Oil ☑

ANGOLA

BECHUANALAND

UNION OF SOUTH AFRICA

336 xxii.
Gobabis. The Protectorate contains, too, what must be regarded as perhaps the most efficient narrow gauge railway in the world, that which starting from Usakos extends for 275 miles to Tsumeb, with feeders to Outjo and Grootfontein. Motor transport is effective over a very large portion of the territory, indeed it may be said that the automobile has revolutionised not only general travel but in particular the inspection of remote mining propositions and their subsequent exploitation.

In Walvis and Luderitz Bays, South-West Africa possesses two magnificent land-locked harbours, and it has been the recent policy of the Government to improve the first named port so that it may adequately and effectively serve the growing needs of the country.

The European population is approximately 20,000, and of natives and other coloured persons about 208,000. The Administration is doing its utmost to augment the labour supply by organising recruiting in Ovamboland. As yet no coal of commercial value has been found and worked in the country, but great hopes are centred in the possible location of oil wells in the Gibeon, Keetmanshoop and Berseba districts where the Petroleum Corporation of S.W.A. has now commenced boring.

It is perhaps hardly necessary to point out that the discovery of oil gushers in South-West Africa would put an entirely new and favourable complexion upon commerce and transportation, not only in that territory but throughout the whole of the sub-continent.

Whilst South-West Africa cannot deny the presence of considerable difficulties in the way of mineral development, it must be emphasized that the territory can also lay claim to certain very decided "bull" points. Nowhere else in the world, perhaps, are there such presumably extensive and relatively high grade base mineral deposits awaiting development through the medium of the financiers' cheque book and the pick and jackhammer of the miner. Immense cupriferous areas await exploitation. It is indeed the considered opinion of some experts that the latent copper deposits like those at Doros and cassiterite properties such as Paukwab give promise of one day becoming mines of the very first magnitude.

The mining laws of the country are very liberal and the scale of taxation is low. The climate of the greater part of the territory, although sometimes rigorous, is proverbially healthy.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE.
2. Hinterland of Walfish Bay.
South-West Africa's Minerals.

By His Honour G. R. HOFMEYR, C.M.G.

"As in other parts of South Africa, mining in South-West Africa is as yet in its infancy, but the Territory is pregnant with considerable possibilities and offers a very large field to prospectors. In the near future it will play a big rôle not only in its pastoral production, in which direction rapid strides have been made during recent years, but will make a very substantial contribution towards the mineral supplies of the world.

"The magnificent harbour at Walvis Bay, which will be completed long before the end of the current year, the up-to-date cold storage works there, and railway extension to Rhodesia, which it is essential should materialise in the immediate future, should materially assist the development of the Territory in general and of the mining industry in particular. Thus we may look hopefully to the future.

"Ores of the following metals, in addition to the various minerals named, occur in different parts of the Territory in such quantities as to have warranted in every case some exploration and in some cases exploitation:

<table>
<thead>
<tr>
<th>Gold</th>
<th>Topaz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>Tourmalines</td>
</tr>
<tr>
<td>Iron</td>
<td>Lazulite</td>
</tr>
<tr>
<td>Lead</td>
<td>Zinc</td>
</tr>
<tr>
<td>Silver</td>
<td>Fluorspar</td>
</tr>
<tr>
<td>Tin</td>
<td>Graphite</td>
</tr>
<tr>
<td>Tungsten</td>
<td>Limestone</td>
</tr>
<tr>
<td>Vanadium</td>
<td>Marble</td>
</tr>
<tr>
<td>Amazonite</td>
<td>Mica</td>
</tr>
<tr>
<td>Beryl</td>
<td>Phosphates</td>
</tr>
<tr>
<td>Diamonds</td>
<td>Rock Salt</td>
</tr>
<tr>
<td>Rose Quartz</td>
<td>Salt</td>
</tr>
</tbody>
</table>

"In addition, those mentioned below have been discovered either alone in small quantities or in association with other minerals and have not, up to the present, received sufficient attention to warrant their inclusion in the above list:

<table>
<thead>
<tr>
<th>Cadmium</th>
<th>Nickel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cobalt</td>
<td>Uranium</td>
</tr>
<tr>
<td>Apatite</td>
<td>Asbestos</td>
</tr>
<tr>
<td>Cobalt</td>
<td>Corundum</td>
</tr>
<tr>
<td>Gallium</td>
<td>Gypsum</td>
</tr>
<tr>
<td>Germanium</td>
<td>Monazite</td>
</tr>
<tr>
<td>Molybdenite</td>
<td>Sulphur</td>
</tr>
<tr>
<td>Tantalite and Columbite</td>
<td></td>
</tr>
</tbody>
</table>

"Experts have for some time been engaged upon researches over a large tract of country in the Keetmanshoop and Gibeon districts, their object being to examine strata with a view to the possible finding of petroleum wells.
South-West Africa.

GEOLOGY

Sand

Kalahari Limestone and Calcareous Sandstone

Karoo Volcanics

Dwyka and Ecca Series

Volcanic Rocks of Acid & Intermediate composition

Newer Granite of Post-Lower Nama age

Pretoria Series 2

Dolomite Series

Gneiss, Gneiss-Granite

Older Granites

Schists, Quartzites and Marble of the Schists-Formation. Phyllites and Quartzites of the Phylite-formation

Kilometres

336 xxvi.
The South-West Africa Company.

The South-West Africa Company was formed in England in August, 1922, with an authorised capital of £2,000,000, and issued capital £1,700,000, with Mr. Edmund Davis as its Chairman and Managing Director.

The Company was formed for the purpose, inter alia, of acquiring the so-called Damaraland Concession, an area of 22,000 sq. miles, under which the Government granted certain rights in the then Protectorate of German S.W. Africa. In September, 1892, the grant of the concession was made absolute and transfer to the company sanctioned.

The object of the Government in making the grant was to open up the territory granted and in particular the copper mines known to exist in the Otavi area.

For this purpose this company was given the sole right to construct railways from the coast to their mines on any point North of a parallel drawn through the most Southern point of the Kuiseb River, and was laid under the obligation of commencing mining within a certain period and to continue and show an aggregate output of 5,000 tons per annum within eight years.

The outbreak of Rinderpest in 1896 destroyed all means of communication between the coast and the interior, and the Government accordingly decided that the building of a railway between Swakopmund and Windhoek was essential. The company had the sole right to do this under an agreement of October, 1898, so that to compensate them for the surrender of this monopoly the exclusive rights of searching for and winning minerals in a portion of Ovamboland was granted them by the Government.

EXPLORATION WORK.

Immediately after its formation the company set about the exploration of its territories. Several expeditions were sent out to investigate the area from a mining point of view and also to study the question of railways. These adventures during the period 1892-1902 are said to have cost the company £160,000. The expeditions were under the following gentlemen:—

Captain Mathew Rogers, 1892: Mining.
Mr. Angus, 1892: Railways.
Dr. Hindorf, 1894: Agricultural possibilities.
Mr. Pearson, 1896: Mining.
Mr. S. J. Speak, 1899: Mining.
Mr. C. James, 1899: Mining, with special reference to Tsumeb.
Mr. T. Toennesen, 1899: Railways and Harbours on Kaoko Coast.
Mr. T. Toennesen, 1902: Railways and Harbours north of Kunene.

During the period when the work was done the country was in a continual state of unrest, rebellions, native wars, etc., interfering with the work.
TSUMEB DISCOVERED.

During the 1892 expedition the Tsumeb Mine was discovered, and on this and other copper propositions in the Otavi Valley work was started. In order to develop the Tsumeb Mine and the other copper propositions in the vicinity the company floated, in 1900, a subsidiary known as the Otavi Minen and Eisenbahn Gesellschaft.

Between 1904 and 1906 the Herero war almost stopped operations in the company's territory, but with the completion of the railway from Swakop to Tsumeb in 1906, the development of this portion of the territory was facilitated. In 1907 a branch from the main narrow gauge line from Otavi to Grootfontein was started and finished the following year at a cost of £116,000. This line was for a long time non-paying and was a considerable source of expenditure to the company, but things improved as settlement along and beyond the Otavi Valley progressed. In 1906 the company started an experimental farm on which a considerable sum has been spent.

During the war period 1914-1919 prospecting operations were practically suspended, but in 1920 prospecting was resumed and the further opening up of the Vanadium deposits, discovered first in 1912, was undertaken. During the past four years, in addition to prospecting work, development has been done on the now promising Vanadium deposits at Abenab, Uris, Berg Aukas and Uitsab, on some of which properties deposits of great value have been opened up.

Production and sales during this period have been:

<table>
<thead>
<tr>
<th>Year</th>
<th>Produced (Tons)</th>
<th>Produced (Concentrates)</th>
<th>Sales (Tons)</th>
<th>Sales (Concentrates)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1922</td>
<td>1,270</td>
<td>63,500</td>
<td>1,15</td>
<td>46,358</td>
</tr>
<tr>
<td>1923</td>
<td>987</td>
<td>51,300</td>
<td>891.5</td>
<td>70,472</td>
</tr>
<tr>
<td>1924</td>
<td>1,022</td>
<td>52,100</td>
<td>1,355.2</td>
<td>81,358</td>
</tr>
<tr>
<td>1925</td>
<td>995</td>
<td>51,200</td>
<td>1,269.0</td>
<td>81,358</td>
</tr>
</tbody>
</table>

Prior to 1908 the company's territory was closed to prospecting, but as from the end of that year with the acceptance of the Imperial Mining Ordinance of 1905 it was thrown open to the public on the Company's terms as regards size of claim, licence, etc. Very little prospecting was done.

As the result of the findings of the S.W.A. Concessions Commission of 1920 the whole of the company's rights were cancelled except certain land rights under the original grant of 1892, but at the same time the company was granted the exclusive right to prospect for and win minerals in the area of the Damaraland concession for a period of one year. This period has been extended on three occasions and now runs to November of this year.

DIVIDENDS PAID.

The company paid its first dividend in 1908 and continued to pay up to 1913, these six years yielding:—1908, 5 per cent.; 1909, 5 per cent.; 1910, 7½ per cent.; 1911, 5 per cent.; 1912, 7½ per cent.; 1913, 5 per cent.

There was no further dividend until 1923, when 7½ per cent. was paid, followed in 1924 and 1925 by 10 per cent. each year.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE.

South-West Africa.

THE OTAVI MINEN AND EISENBAHN GESELLSCHAFT AND OTAVI EXPLORING SYNDICATE.

Offshoots of the South-West Africa Company that have greatly helped in the Development of the Territory—Geology of the Deposits—Technical Practice at Tsumeb.

In September, 1899, an Agreement was entered into between the Disconto Gesellschaft of Berlin and the Exploration Co., Ltd., of London, to form a company to acquire and handle certain rights then held by the S.W.A. Co., Ltd., these including both land rights, railway rights, and mining rights. The newly-formed company was to undertake the examination and exploration of the mines in the Otavi area as well as the work in connection with the construction of the railway which would connect the Otavi area with a port on the West Coast. Land rights acquired extended over 500 English square miles and the mining rights over various sections along the proposed railway and over an area of 1,000 square miles.

FLOTATION ON MILLION POUNDS BASIS.

Owing to the unrest prevailing, delays occurred in the formation of the company, but this was ultimately formed in 1903. It was a German flotation, the capital being 20 million marks (£1,000,000) in 200,000 shares of 100 marks (£5), and 200,000 deferred shares of no face value, of which the S.W.A. Co. received 100,000; they in addition subscribed £80,000 towards the capital.

A start was made with the railway construction in 1903, and in spite of the interference due to native wars, labour troubles, etc., the 354 miles from Swakopmund to Tsumeb was completed in 1906 at a cost of about 19,000,000 marks (£950,000), and the line opened to traffic over its entire length. For a start the railway was operated by the Company, but early in 1910 the company sold the line with rolling stock, etc., to the Government for 22,000,000 marks (£1,100,000). Later in the same year (July) the company leased the line again from the Government for a period of 10 years, with the option of renewal in 5-year periods. In 1910, after the sale of the railway to the Government, the company repaid to its shareholders 16,000,000 marks (£800,000), thus reducing the capital of the company to 4,000,000 M. (£200,000). In 1921 the 4,000,000 marks were
altered into £200,000. The 200,000 deferred shares mentioned above were given a value of £1 each—£200,000—and the capital was increased by £400,000, so that it stands to-day at a figure of £800,000.

In accordance with the first agreements (1899) the further examination of the copper deposits in the Otavi area was undertaken and work was carried on from then until 1905 at Tsumeb, Asis, Guchab, etc. At this date the further development of the Tsumeb mine, which showed great prospects, was undertaken and shaft sinking commenced.

**FIRST EXPORT OF ORE.**

With the completion of the railway (1906) the company was enabled to increase its operations and the first export of ore took place.

From the start of operations to the outbreak of war in 1914, 253,820 tons of copper and copper-lead ore were shipped or dumped at the mine pending the construction of reduction plant; and in addition, 12,115 tons of copper matte (47-50 per cent. cu.), and 9,785 tons of pig lead were produced and exported.

The average number of persons employed by the company during 1925 was 1,977, comprising 216 whites and 1,761 natives.

The following dividends have been paid by the O.M.E.G.:

<table>
<thead>
<tr>
<th>Year</th>
<th>Ordinary Shares</th>
</tr>
</thead>
<tbody>
<tr>
<td>1907/8</td>
<td>9 per cent.</td>
</tr>
<tr>
<td>1908/9</td>
<td>11</td>
</tr>
<tr>
<td>1909/10</td>
<td>10</td>
</tr>
<tr>
<td>1910/11</td>
<td>21+</td>
</tr>
<tr>
<td>1911/12</td>
<td>30</td>
</tr>
<tr>
<td>1912/13</td>
<td>40</td>
</tr>
<tr>
<td>1913/14</td>
<td>45</td>
</tr>
<tr>
<td>1914/21</td>
<td>5</td>
</tr>
<tr>
<td>1921/22</td>
<td>72*</td>
</tr>
<tr>
<td>1922/23</td>
<td>72</td>
</tr>
<tr>
<td>1923/24</td>
<td>72</td>
</tr>
<tr>
<td>1924/25</td>
<td>11</td>
</tr>
</tbody>
</table>

**OUTPUTS TO DATE.**

During the whole of the war period, even at that progress, operations were continued, whilst from 1916 onwards, there has been a steady increase in production and export of ore, etc., from the Tsumeb, Asis, and Guchab mines. The production and export for the past 10 years have been:

<table>
<thead>
<tr>
<th>Year</th>
<th>Production.</th>
<th>Export.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1915-16</td>
<td>40,000</td>
<td>—</td>
</tr>
<tr>
<td>1917</td>
<td>47,013</td>
<td>—</td>
</tr>
<tr>
<td>1918</td>
<td>42,083</td>
<td>—</td>
</tr>
<tr>
<td>1919</td>
<td>26,570</td>
<td>—</td>
</tr>
<tr>
<td>1920</td>
<td>36,921</td>
<td>30</td>
</tr>
<tr>
<td>1921</td>
<td>72,642</td>
<td>242</td>
</tr>
<tr>
<td>1922</td>
<td>113,342</td>
<td>106</td>
</tr>
<tr>
<td>1923</td>
<td>114,994</td>
<td>—</td>
</tr>
<tr>
<td>1924</td>
<td>122,823</td>
<td>965</td>
</tr>
<tr>
<td>1925</td>
<td>132,698</td>
<td>2,386</td>
</tr>
</tbody>
</table>

*During August, 1925, a strike took place among Europeans, the work in the mine being entirely stopped except for pumping. But for this, output would have been bigger.
SOUTH-WEST AFRICA'S MINERAL OUTPUT YEAR BY YEAR, AND TO DATE.

Specially compiled for the "Mining and Industrial Magazine."

In the following statistical tables are stated the outputs of the various mineral products of the Protectorate. Figures are given not only for last year and for 1924, but we have been enabled to obtain data as to outputs since the commencement of mining and producing operations. The tables reproduced hereunder should prove of very considerable value. We give also a tabulation which exhibits the numbers of European and coloured persons employed in mining during the past two years.

We may first of all give a summary of outputs during 1925 and 1924. These have been as under:

**PRECIOUS MINERALS.**

**SALES.**

<table>
<thead>
<tr>
<th>Mineral</th>
<th>1924</th>
<th>1925</th>
<th>Actual Production, 1925</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quantity</td>
<td>Value</td>
<td>Quantity</td>
</tr>
<tr>
<td>Diamonds, ct.</td>
<td>449,846</td>
<td>£1,224,441</td>
<td>693,174</td>
</tr>
<tr>
<td>Gold, oz.</td>
<td>147,166</td>
<td>£373</td>
<td>1,780,08</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>597,012</td>
<td>£1,225,814</td>
<td>873,254</td>
</tr>
</tbody>
</table>

**BASE MINERALS.**

**EXPORTED (Shipments Sea and Rail).**

<table>
<thead>
<tr>
<th>Mineral</th>
<th>1924</th>
<th>1925</th>
<th>Actual Production, 1925</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tons</td>
<td>Value</td>
<td>Tons</td>
</tr>
<tr>
<td>Copper as Matte</td>
<td>(2,240 lbs.)</td>
<td>£5,784</td>
<td>(2,240 lbs.)</td>
</tr>
<tr>
<td>Copper-Lead-Zinc Ore</td>
<td>443,798</td>
<td>£416,746</td>
<td>48,114</td>
</tr>
<tr>
<td>Vanadium</td>
<td>1,605</td>
<td>£83,933</td>
<td>2,235</td>
</tr>
<tr>
<td>Tin</td>
<td>209</td>
<td>£34,599</td>
<td>190</td>
</tr>
<tr>
<td>Lead (Pig)</td>
<td>762</td>
<td>£19,864</td>
<td>1,532</td>
</tr>
<tr>
<td>Lead Ore</td>
<td>16</td>
<td>£108</td>
<td>219</td>
</tr>
<tr>
<td>Zinc Ore</td>
<td>152</td>
<td>£1,519</td>
<td>---</td>
</tr>
<tr>
<td>Iron</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Fluor Spar</td>
<td>---</td>
<td>---</td>
<td>269</td>
</tr>
<tr>
<td>Phosphates</td>
<td>50</td>
<td>£362</td>
<td>845</td>
</tr>
</tbody>
</table>
| **Totals**     | 686,646 | £1,914,660 | 828,222 | £2,724,831 | 336 xxix.


The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE.

In the following tables are stated the productions (output in tons, ounces or carats, and the value in sterling) of the various mineral products of the Protecorate year by year since production commenced. The table should prove of very considerable value for purposes of reference:

1.—Production and Value of DIAMONDS, 1909 to 1925.

<table>
<thead>
<tr>
<th>Year</th>
<th>Diamonds won</th>
<th>No. of Diamonds sold</th>
<th>Diamonds Price per Carat</th>
<th>Total Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1909/10</td>
<td>560,977</td>
<td>5.0</td>
<td>560,977</td>
<td>836,000</td>
</tr>
<tr>
<td>1910/11</td>
<td>708,865</td>
<td>29.83</td>
<td>20,675</td>
<td>1,069,000</td>
</tr>
<tr>
<td>1911/12</td>
<td>598,865</td>
<td>29.83</td>
<td>560,977</td>
<td>1,045,000</td>
</tr>
<tr>
<td>1912/13</td>
<td>659,965</td>
<td>6.09</td>
<td>902,157</td>
<td>1,324,500</td>
</tr>
<tr>
<td>1913/14</td>
<td>1,570,000</td>
<td>4.97</td>
<td>2,715,277</td>
<td>2,698,500</td>
</tr>
<tr>
<td>1914, Apr. to end July</td>
<td>438,980</td>
<td></td>
<td>438,980</td>
<td></td>
</tr>
<tr>
<td>1914, Aug to British Occupation</td>
<td>1,994</td>
<td></td>
<td>1,994</td>
<td></td>
</tr>
<tr>
<td>1915</td>
<td>37,802</td>
<td>40.0</td>
<td>415,074</td>
<td></td>
</tr>
<tr>
<td>1916</td>
<td>113,342</td>
<td>66.8</td>
<td>1,224,441</td>
<td></td>
</tr>
<tr>
<td>1917</td>
<td>222,224</td>
<td>34.03</td>
<td>34,033</td>
<td></td>
</tr>
<tr>
<td>1918</td>
<td>828,714</td>
<td>32.82</td>
<td>268,714</td>
<td></td>
</tr>
<tr>
<td>1919</td>
<td>428,180</td>
<td>29.83</td>
<td>29,830</td>
<td></td>
</tr>
<tr>
<td>1920</td>
<td>230,751</td>
<td>19.75</td>
<td>570</td>
<td></td>
</tr>
<tr>
<td>1921</td>
<td>121,537</td>
<td>19.75</td>
<td>2,204,326</td>
<td></td>
</tr>
<tr>
<td>1922</td>
<td>297,600</td>
<td>36.8</td>
<td>1,599,349</td>
<td></td>
</tr>
<tr>
<td>1923</td>
<td>495,675</td>
<td>45.9</td>
<td>492,513</td>
<td></td>
</tr>
<tr>
<td>1924</td>
<td>693,174</td>
<td>54.7</td>
<td>1,656,700</td>
<td></td>
</tr>
<tr>
<td>1925</td>
<td>495,675</td>
<td>66.8</td>
<td>1,224,441</td>
<td></td>
</tr>
</tbody>
</table>

2.—Production of Ore from Mine, and Exports of Matte Copper, Pig Lead and Crude Copper-Lead-Zinc Ore: 1907 to 1925.

<table>
<thead>
<tr>
<th>Year</th>
<th>Production of Ore from Mine</th>
<th>Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quantity</td>
<td>Value</td>
</tr>
<tr>
<td>1907/8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1908/9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1909/10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1910/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1911/12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1912/13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1913/14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1914/15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1915/16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1916/17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1917/18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1918/19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1919/20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1920/21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1921/22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1922/23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1923/24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1924/25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Section III.

Tropical Products on the Route.

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Cotton Growing in Uganda - - 361
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Cotton Culture in the Nile Valley - - 375

Animal Diseases in South Africa - - 393
An East African Tropical Product.

A Specimen of Kenya Sisal at Full Maturity.
Tropical Products on the Cape to Cairo Route.

AFRICA'S AGRICULTURAL WEALTH.
By C. W. Hobley, C.M.G.

That Africa is capable of producing a vast quantity of tropical products may be described as a truism, and yet, with the exception of West Africa the results have up to now been disappointing and it is evident that the path to success is somewhat difficult to traverse.

This is mainly due to ignorance—ignorance both on the part of planters and on the part of the native labourers employed, but these are not the only reasons. In view of past failures it is a matter of interest to review the situation.

There is a tendency to assume that given low latitude and consequently a hot sun, tropical products will naturally flourish. It must be realised, however, that the African Continent, generally speaking, rises from both coasts in a series of steps and that a great extent of the interior consists of an elevated plateau on which the sun is fierce by day but during the night a great fall of temperature occurs.

Moreover, except during the season of heavy rains the climate is on the whole a dry one, and omitting the Congo basin there are but few places where the steamy atmosphere of the West coast and the Amazon Valley exists.

Then, again, over large expanses of country the rainfall is intermittent from year to year and spells of partial drought are not uncommon. In other areas some hailstorms may be periodically expected. Insects pests are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rife throughout Africa from the locust down to others and are, moreover, rive througho
ments, and from the results obtained thereat have been able to advise their people what to plant and how to plant it. With the exception of sugar and tobacco, however, their experiments are mostly with tropical products.

The governments of the countries farther north have all done a certain amount of valuable work in this direction, their efforts only being restricted by paucity of funds, but for all that a vast amount of information is now available which was unobtainable 15 years ago, and to take one important point alone—meteorological data extending over a considerable number of years, is now obtainable for a great number of places in Central Africa.

Owing to the general increase of altitude as one proceeds from the coast to the interior, products of temperate climes are now being grown on elevated tracts within the tropical belt, and on the other hand tropical products, or at any rate subtropical products, are being grown with success outside what is theoretically the tropical zone.

To commence with the Union of South Africa, we find oranges and also high class tobacco grown in Cape Province. In Natal a great sugar industry has been founded and is flourishing all along the Zululand Coast; the output in 1922-23 was no less than 159,362 tons, thus leaving a quantity for export, the consumption of the Union being about 120,000 tons per annum; the industry is protected by a duty of 6s. per ton on high grade sugar, and 4½ per ton on the lower grades. On April 30, 1923, the area under sugar was 210,996 acres.

A valuable by-product of the sugar industry is a motor spirit called "Natalite," of which about a million gallons is produced. Molassine meal is also a valuable by-product for stock feeding purposes. The cane which is most in vogue, is what is called the "Uba" variety, it has a good internodal length, it contains a good percentage of saccharine juice and grows freely. About 8.5-10.0 tons of cane are required for the manufacture of a ton of sugar, which result compares very favourably with the old established but efficient sugar mills of Mauritius.

As one goes North into Zululand, the conditions for sugar apparently improve considerably, which is only to be expected.

In the northern part of the Transvaal, large quantities of tobacco are grown, particularly in the Magaliesberg range; it is not a high grade product, nor is it well cured, but it has a great popularity throughout South Africa being generally known as Boer tobacco. The total production of tobacco in the Union in 1923 was nearly 10 million pounds.

Owing to the world shortage of cotton, efforts are now being made to promote the growth of this product in the warmer areas in the North and N.E. Transvaal, and in other parts of the
Union; as far as can be judged there is no reason why success should not be achieved. Many hundred tons have annually been produced for some years past in Natal and Zululand, but it is now proposed to embark on operations on a large scale and covering a wider area.

Tea is grown with considerable success in Natal at an altitude of about 1,000 feet and about 600 tons of the manufactured product is the annual output. The industry is protected by an import duty of 4d. per lb. South African tea will, however, never seriously compete with that of Ceylon and other parts of the East Indies, and the present tendency is to abandon its cultivation in favour of sugar. The production of manufactured tea in 1922-3 was 799,419 lbs.

In Portuguese East Africa, through the initiative of the Mocambique Co. and private enterprise such as that of Messrs. Hornung and Raposo, sugar culture is being successfully carried out, and the annual production now amounts to about 35,000 tons. Mr. Hornung’s continuous efforts in this direction are dealt with in a separate article.

The Mocambique Co. has also introduced sisal culture and has large plantations in the Zambezi valley. About 1,800 tons of cotton is annually produced in this colony and this amount will probably be greatly increased in the near future.

On the railway from Beira to Rhodesia large tracts are planted with maize; the Colony appears to be particularly suited to this cereal for in good years the yield per acre is remarkably heavy—the production of maize from this territory has now reached considerable dimensions and in 1923 it reached the record figure of 517,114 bags.

As we proceed north along the coast of Portuguese East Africa we enter the coconut belt. It may roughly be said to commence North of the Zambezi mouth; the cultivation of the palm is mostly in native hands, so the export of the copra does not loom very large, but the potentiality of this belt of coast for coconut culture is beyond doubt.

Oil seeds such as sesamum, the oil bearing groundnut (Arachis) and the castor oil plant all flourish in this territory but their cultivation is only erratically carried on by natives.

Rhodesia

Proceeding North from the Union into S. Rhodesia, we find an energetic farming community, part engaged in stock farming and part in agriculture. Maize is the staple agricultural product and in 1923 some 80,000 tons were exported, in addition to a large quantity supplied to the mines and other local industries for rationing native labour.

Some 2,000 tons of Kaffir corn were also exported. Those who do not grow maize generally favour tobacco and the Rhodesian tobacco is a high grade product and well cured; some is prepared
Cotton Growing in Southern Rhodesia.

Cotton Field on the Romsley Estate, Southern Rhodesia.
and sold locally. In 1923 the export was worth £196,839.

Cotton is receiving some attention, but the crop has not yet attained any great volume; the quantity will, however, steadily increase.

Northern Rhodesia is as yet too thinly settled to produce a great volume of agricultural products, but it is a potential area of great richness, particularly the Eastern portion. Cotton cultivation is being energetically supported by the B.S.A. Co., and the country will eventually produce large quantities of maize, tobacco and oil seeds, as well as cotton. It is unfortunately, however, situated far from the seaboard; a handicap which will always be with it.

**Nyasaland**

The planting prospects in Nyasaland are bright even though that Colony has like all others suffered severely from the world depression.

Some years ago after great disappointment and loss had been experienced owing to the failure of coffee planting, it was discovered that Virginia tobacco of a high grade could be grown in the country. Since then tobacco cultivation has proceeded apace. The British American Tobacco Co. has greatly supported the planters' efforts, and absorbs practically the whole of the crop, the annual output being some 750 tons.

The cultivation of cotton by the natives is being actively supported by the local government, and marked results should soon be apparent; the Nyasaland Upland Cotton commands a higher price than any other cotton in the market. The European settlers were formerly attracted by this product but the lure of tobacco culture has proved too strong for most of them and cotton is now mainly left in native hands. Oil seeds, ground nuts, and other products also flourish in this fertile patch of Africa.

**Belgian Congo**

In the Belgian Congo great developments are in progress on the lower and middle river, principally due to the initiative and enterprise of the Huileries du Congo Belge, the great company of which Lord Leverhulme is the head. In order to obtain oil for his associated companies Lord Leverhulme is developing the oil palm resources of the Congo basin on a gigantic scale, and apart from dependence upon the wild palm, is planting large areas in the vicinity of his factories. This matter has been dealt with in a special article.

Rice cultivation is also being encouraged on the river by the Belgian authorities, and as time goes on other products such as sugar and cotton will doubtless be developed.

Para Rubber promises well, but the low price of the product during the last two years has retarded development.

In the vicinity of the great copper belt and around the Kilo Moto gold fields there is a great demand for food stuffs with which to feed the native labour and efforts are being made by
settlers to grow maize and other cereals to supply this market.

**Tanganyika Territory**

Tanganyika territory before the war exported a large amount of sisal, coffee, copra and other products, but the country was ravaged by 4 years of war and every industry was consequently reduced to chaos. After the war change of ownership and the establishment of a new administration hampered progress; the universal depression has also proved yet another blow to the speedy rehabilitation of the planting industry. In spite of all this, however, the territory exported in 1923 some 4,300 tons of coffee, 4,800 tons of copra, 4,200 tons of oil producing products, 11,000 tons of sisal and about 1,700 tons of cotton. Apart from sisal and coffee it is a country where most of the products are of native production and it has vast potentialities in this respect. The local government is making strenuous efforts to push cotton production among the natives, and success is likely.

Before the war about 1,300 tons of rubber was produced every year, mostly from the Ceara bush, but the introduction of that species of rubber bearing plant is now realised to have been a grave mistake and the cause of the loss of a large amount of capital; during the last two years the low price of rubber has finally sealed the fate of all the Ceara rubber plantations and they have either reverted to the bush or have been replanted with other products. The coconut palm is a plant of great promise in the coastal regions in Tanganyika for those who are prepared to wait the requisite number of years.

**Kenya and Uganda**

These countries, like many others, have passed through various vicissitudes in their planting history. At one time the Uganda planters were convinced that Ceara rubber, coffee and cocoa were destined to become the staple crops. Ceara was soon demonstrated to be a failure, the coffee bush proved to be subject to many pests but its cultivation is still being proceeded with by some planters, cocoa promised well at first, but fungoid pests defeated the efforts of most and it fell into disfavour. The Fumtumia rubber tree promised well in many places but the slump in prices and the distance of Uganda from the sea prevented its profitable culture. Cotton grown by natives proved a success from the start, in a great measure owing to the detailed attention its culture received from both the Agricultural Dept. and the Administrative staff, and the anticipated output for 1923-4 is placed at over 100,000 bales.

Even the planters are turning their attention to cotton and others are convinced that the time has now come to grow sugar with profit.

It is certain that this fertile land cannot fail to produce at a profit some crop which the civilised world needs.
Similarly in Kenya in the early days of this century, large sums were invested in Ceara rubber and in due time all was lost; the collection and milling of the wild Sansevera fibre also absorbed considerable capital and for a time the industry paid; experience, however, demonstrated that it was not a sound business venture. The planting of sisal however, became a success from the beginning; it superseded the schemes for the utilization of the wild fibre and large profits were made up to and during the war. In 1920, however, the slump in prices began and continued throughout 1921 and every sisal estate in the country was then losing money. Prices are still low compared with the cost of production, but the manufacturing costs have been cut down and the better organised estates are now, it is said, winning a small profit, but it can hardly be said to be on a safe footing as yet. The great hope for this industry lies in some improvement in the process of decortication which will result in the yield of a greater percentage of cleaned fibre, and there is no doubt that this will be achieved ere long.

The planting of black wattle was much recommended at one time, the bark being a valuable tanning material; difficulties however, occurred and large forests of wattle remain with most of the bark unstripped. Factories to express the "tannic" essence will, however, undoubtedly be erected as the cost of machinery decreases.

Coffee has held its own in Kenya from the commencement and in spite of depressed prices the estates which are not too far from a railway still return something to their owners. The long dry season in Kenya appears to keep the dreaded pest Hemileia vastatrix in check, providing the planter cares well for his trees. Thrips at times strips all the foliage from the trees, but they recover in a marvellous manner and incidentally the latter pest may possibly check the spread of the Hemileia fungus. The coffee export from Kenya and Uganda in 1922 was 129,261 cwt.

Sugar is now receiving some attention, and a well organised company operating near Lake Victoria bids fair to make a success of this crop.

Although the number of colonists in Kenya is not large, they constitute an energetic community and a steady increase of development may be anticipated as the colony recovers from the financial troubles by the world wide depression.

A considerable amount of copra is produced at the coast mostly by natives, whose plantations are ill cared for and full of the Oryctes beetle.

A model plantation formed by the East African Estates Co. has, however, demonstrated that this pest has few terrors for a European planter who systematically looks after his coconut palms.
The thieving of nuts which goes on is a much greater source of loss, and until this matter is drastically dealt with it is a great drawback to the planter.

A considerable quantity of oil producing products is produced by native growers, and might be greatly increased.

The up country colonists are also now producing annually an increasing quantity of maize and the railway rates have been adjusted so as to render its export a payable proposition.

The Sudan

In the Sudan the only crop worth consideration is cotton and the possibilities are great, but they depend entirely upon facilities for irrigation. This has been tackled with imagination in the Gezireh Province, which is dealt with in a special article.

From the foregoing it will be seen that planting in Africa in spite of all the drawbacks is steadily progressing, mainly by a process of trial and error. It is, however, to be hoped that the worst mistakes have been made and that the margin of error has thereby been greatly reduced.

Planting in Africa can be separated into two compartments—production by natives working on their own land for themselves and production by European planters on land purchased from Government and through the medium of native labour.

Both of these forms of efforts have their place in Africa; some products such as cotton and probably ground nuts and oil bearing seeds can best be grown by natives on their own land and in their own time, providing that in the case of cotton, the local government controls the supply of seed.

Sisal is solely a product for a European planter or a company, on account of the cost of the machinery and the organisation required: it is said that a sisal estate of sufficient size to pay requires a capital outlay of not less than £30,000.

Coffee is best grown under European control, for the continuous watch which has to be maintained to prevent the spread of pests is not such as would be carried out by native cultivators.

Coconut plantation too is, generally speaking, best carried out by European planters for the casual native will as a rule soon allow the beetle to over-run his plantation, and further can rarely resist the temptation to tap the palms for toddy, a procedure which immediately reduces the yield of nuts.

Sugar is, of course, a European venture, for the cost of the machinery and the technical supervision required in its manufacture place it beyond native capacity. In some places, however, it may be possible to arrange with native cultivators in the vicinity of the factory to grow cane for sale at an arranged price, and such a form of co-operation is to be recommended.

Tobacco curing too must be carried out on systematic lines,
and is therefore what may be termed a European’s crop.

The next few decades will undoubtedly see great expansion in the planting industry in Africa. Knowledge is increasing, communications are improving year by year, and when the world recovers from the effects of the past struggle the demand for tropical produce will become colossal.

In addition to capital the main needs at present are:

1. Further researches into insect and fungoid pests.
2. Experimental stations at varying altitudes where a multitude of products can be tried under different conditions and the results made widely known.
3. An organisation by which the experiments in one part of Africa can be made known to other parts.
4. More extensive meteorological data.
5. Native agricultural education, combined with executive support to induce natives to grow a greater volume of exportable products as apart from their own food needs.
6. A general policy of low railway freights for exported agricultural products.

One very pertinent question is this: If Africa continues to turn out a steadily increasing volume of exportable products, is there a reasonable hope of a market for them? The best way to answer this will be to consider the main products separately.

SUGAR.—According to well-informed authorities the world’s consumption of this important article of diet should be about 22 million tons per annum and the present production is 17 million tons. The under-consumption is mainly due to the present economic position and the consequent restricted buying capacity of European people. At the same time the sugar beet industry has been greatly crippled by the war and therefore the fierce competition from that direction has been greatly reduced. It will revive in due time and has to be reckoned with by all manufacturers of cane sugar, in which the African sugar planters are included.

At the same time the fact must not be overlooked that the local consumption of sugar in Africa in normal times annually increases and will greatly increase in the future. Weighing all factors it would therefore appear that there is a profitable field for very considerable expansion of African sugar production, providing the planter is favourably situated as regards communications and can command an ample supply of labour at a reasonable rate.

COTTON.—The prospects ahead of this product appear to be extremely bright. The normal world consumption is about 15½ million bales and the present
total output is said to be under 12 million bales. It is true that under consumption rules at present but the dominant producer viz., America, owing to the ravages of the bollworm and an increasing local consumption appears to have less and less available for export. The conditions therefore favour Africa and if the great native population of that Continent can be induced to produce cotton of a suitable quality with the same success as in Uganda, there is little doubt that it will find a sale at a fair price. Efforts are already in train in our various colonies and dependencies and it will be of interest to watch the result. There is little doubt that the world will absorb with avidity under present conditions at least 13 million bales of good cotton and far more as prosperity is generally regained. Most authorities are agreed that efforts should be concentrated on cotton of the Egyptian type instead of the lower American grades.

Fibres.—Sisal fibre is the main product of this class in tropical Africa and the Eastern side of the Continent appears to be particularly suited to its culture.

The great rival of Africa in this field is Yucatan which has the advantage of being nearer the market; Yucatan, however, does not possess such great resources of labour as Africa and it would therefore appear that any great expansion of the industry in the former country is unlikely.

Flax, although not a tropical product flourishes on some of the inland plateaux of Africa and it was grown to a considerable extent when the prices were higher than they are to-day. As consumption increases African flax will probably be again seen on the home markets.

Cocoa.—Africa is, as is well known, the largest producer of cocoa and this product mainly comes from the Gold Coast Colony and certain islands off the West Coast. These are outside the scope of this work, but cocoa is grown in the Congo basin and the quantity will undoubtedly increase; its culture is, however, not likely to attract great attention on the part of the European planter.

Tobacco is grown and will continue to be grown with success in many parts of Africa, but its culture is not a form of enterprise which can be indefinitely expanded, as good flavoured tobacco is produced in so many parts of the world.

Oil Bearing Plants. The market for vegetable oils is vast, their uses are manifold, and the field for their employment increases yearly.

The oil palm of West Africa stands first and although the greater part of the oil palm area is outside the scope of this work, the industry has been extensively developed in the Congo basin.

Even now nearly all the oil produced from this source comes from wild palms and vast areas are said still to exist in which the produce falls ungathered.
GROUNDNUTS

For all that, however, the amount of oil from planted palms is certain to increase, for it is obvious that a plantation can be worked cheaper than wild palms scattered about in thick forest, the plantation can be made near the line of transport, be it rail or river, the haul to the factory can be reduced to a minimum, and so forth.

Oil palm planting has been extensively undertaken in Sumatra and some are inclined to look upon this new source of supply as a serious competitor to West Africa. Such fears are, however, probably premature for West Africa is so much nearer the markets of Europe and America.

GROUNDNUTS AND SESAMUM as sources of oil are not to be despised; their growth is at present almost entirely in native hands, but European planters would do well not to dismiss all consideration of these products which are fully tested as to their ability to survive in Africa.

The coconut flourishes along the East coast of Africa and is worth careful consideration by planters who can obtain cheap land in a suitable area and can afford to wait until the palms come to bearing. It is a form of planting which after the initial stages requires comparatively little labour and the palms may be reckoned to bear for 60 years or more.

COMMERCIAL ALCOHOL.—The growth of crops for the production of commercial alcohol is a field which is as yet but little tested. It is however, one which deserves every consideration if the necessary capital for the extraction plant can be commanded. Many plants which give a supply of starch have been experimented on with success and the authorities state that the market is very large and is steadily increasing.

The main point to be considered is that only extraction units of considerable size are likely to pay and these entail the planting and working of a big area on economical lines and the consequent availability of a considerable labour supply. In this respect the undertaking resembles the sugar industry.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

Mr. W. H. SCHERFFIUS, M.Sc.,
Chief of the Tobacco and Cotton Division, Union of South Africa.
Cotton in South Africa.

By W. H. SCHERFFIUS, M.Sc.,

(Tobacco and Cotton Division, Pretoria.)

EARLY STAGES.—

Cotton was introduced into South Africa about seventy years ago, since when, until recently, attempts to establish cotton growing were spasmodic only. There are instances of good crops produced and of favourable reports on samples sent overseas, but the lack of transport facilities and ginning establishments, combined with a limited knowledge of the subject, deterred farmers from continuing with the cultivation of the crop.

In 1909 the present Tobacco and Cotton Division of the Department of Agriculture was formed for the purpose of encouraging the development of the industry. Experiments were planned and plots established in a number of likely areas to ascertain, by actual field trials, how cotton would thrive under the various climatic conditions, also to determine which varieties would do best under such conditions. Valuable data began to accumulate and gradually the industry grew. The Government purchased further ginning machines and established them in Rustenburg and Durban, the two principal centres within reach of most of the trial fields.

The industry did not develop only on account of the inflated prices during and since the war, as reference to the table on the following page will show.

Thus, the industry was making steady progress before the war, when prices were more or less stable and normal. Doubtless the substantial prices since ruling have enhanced the profit of cotton growing, and so induced farmers to increase their acreage.

The production of cotton in South Africa is still small, but the industry was started on a sound basis and is permanently established.

In the original varietal experiments many varieties are tested to ascertain which gave the best results, both in quality of staple and in yield per acre. As these experiments continued the least desirable varieties were gradually eliminated until now
only about a half-dozen different varieties are grown, mostly of the Upland type, all being very similar in quality and the lint more or less of the same value. Variations are principally due to the lint being grown in areas with slightly differing soil and climatic conditions. The aim is to establish a medium, long staple product of about 1 in. The table on the following page shows the progress made in that direction.

Experiments continue, the object being constantly to improve. Other varieties, such as "Sea Island" and "Pima," are being tested to ascertain whether one of these long-stapled varieties may not be grown profitably under irrigation.

Expansion of the Industry.—The expansion of the cotton industry in the Union is claiming wide attention. The available lands for future development where the soil and climatic conditions are favourable, comprise, generally speaking, the whole of the middle and low veld areas of South Africa. These areas include large stretches of country in the northern and eastern Transvaal, northern and eastern Natal and Zululand, and numerous river-valleys in Natal and the Cape Province. Small tracts, under irrigation, have already been placed under cotton in the Griqualand West districts of the latter Province (near Kimberley and Douglas). Notwithstanding the fact that these are really the first experiments of a considerable magnitude in these parts of South Africa, reports indicate that splendid results have crowned the efforts of those concerned in the ventures. Various estimates have been made of the area of suitable land for cotton culture in the Union. There may be up to 4,000,000 acres. But the available acreage is not the limiting factor, which lies rather

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<th>Year</th>
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<th>Number of Bales of 500 lb. each</th>
<th>Percentage of Increase over Previous Year</th>
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<td>13,623</td>
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<td>32,471</td>
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<td>1918-19</td>
<td>1,094,763</td>
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<tr>
<td>1920-21</td>
<td>1,096,182</td>
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<tr>
<td>1921-22</td>
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<td>1922-23</td>
<td>(approximate)</td>
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in the white population to supervise, and the native population to supply the necessary labour. The position is correctly reviewed as follows by a well-known local authority:

"The first and greatest essential in the development of the cotton belt is a European population—in other words, settlers or farmers. Both to secure it, the many facilities of civilization, so indispensable to the life of the white man, are required. Foremost among these are transport facilities—railways and their tributaries, and the public roads. A survey of these unsettled parts show an absence of railways and roads, with perhaps one exception, and in that district little attempt has been made to secure European settlers for the lands adjoining the railway; the area between Kaapmuiden and Komatipoort, Barberton, Transvaal, is referred to where a railway exists. Practically all of the other Crown lands available for cotton growing lie at great distances from the railway."

"Land in the Transvaal.—
From the comparatively small quantity of cotton produced at present, one might think the area available, or some other necessary factor, was lacking, but this is not so. In the Barberton District there are 4,600 square miles of territory with approximately 400,000 to

<table>
<thead>
<tr>
<th>Comparison of Grading</th>
<th>1922-23</th>
<th>1921-22</th>
<th>1920-21</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Staple.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 in. and above</td>
<td>213</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>14 in.</td>
<td>1,270</td>
<td>43½</td>
<td>447</td>
</tr>
<tr>
<td>1½ in.</td>
<td>742</td>
<td>14</td>
<td>228</td>
</tr>
<tr>
<td>1 in.</td>
<td>916</td>
<td>17½</td>
<td>1,014</td>
</tr>
<tr>
<td>1½ in. and below</td>
<td>26</td>
<td></td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>5,259</td>
<td>100</td>
<td>1,719</td>
</tr>
<tr>
<td><strong>Grades.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barely Middling Fair, g. c.-</td>
<td>702</td>
<td>13½</td>
<td>52</td>
</tr>
<tr>
<td>Fully Good Middling, &quot; &quot;</td>
<td>1,381</td>
<td>26½</td>
<td>555</td>
</tr>
<tr>
<td>Good Middling, &quot; &quot;</td>
<td>1,357</td>
<td>25½</td>
<td>732</td>
</tr>
<tr>
<td>Fully Middling, &quot; &quot;</td>
<td>359</td>
<td>48</td>
<td>184</td>
</tr>
<tr>
<td>Middling, &quot; &quot;</td>
<td>217</td>
<td>4</td>
<td>38</td>
</tr>
<tr>
<td>Fully Low Middling and below</td>
<td>184</td>
<td>3½</td>
<td>2</td>
</tr>
<tr>
<td>Good colour</td>
<td>4,190</td>
<td>79½</td>
<td>1,563</td>
</tr>
<tr>
<td>Off colour</td>
<td>1,069</td>
<td>20½</td>
<td>156</td>
</tr>
<tr>
<td></td>
<td>5,259</td>
<td>100</td>
<td>1,719</td>
</tr>
</tbody>
</table>
Mr. R. A. ROULLARD, A.R.S.M., A.R.C.Sc.,
Chairman and Managing Director of Candover Estates, Ltd., Zululand.
COTTON IN SWAZILAND & ZULULAND

500,000 acres that could be ploughed for cotton; the population consists of 33,367 natives and only 3,246 Europeans, of which a large proportion are concerned solely with gold-mining or Government administration.

"In the Zoutpansberg District the area is 10,000 square miles, with a native population of 133,000 and less than 2,000 Europeans, and probably more than 500,000 acres are suitable for cotton. The Waterberg area is a larger one still, having 15,000 square miles, but with a smaller native population of 68,376, and 7,152 Europeans. Here probably more than 500,000 acres would be arable, and suitable for cotton planting. Rustenburg, which is smaller, with 9,000 square miles, has considerably developed in cotton growing, although the native population is 46,589 and the European population 15,564; the probable area suitable for cotton is between one and one and a quarter million acres. Marico, a comparatively small district, with only 3,051 square miles and a native population of 18,000 and a European population of 7,520, produces very little cotton but contains between 50,000 and 100,000 acres of suitable land; there is as much or more available in each of the other two districts, Lydenburg and Middelburg.

"In Swaziland and Zululand. — Swaziland, a territory adjacent to the Union, and in the present Customs Union, has a very large proportion of land suitable for cotton cultivation, practically untouched. There are, at a very low estimate, probably 400,000 acres in this territory that could be used for cotton growing.

"In Zululand there is an area of 10,000 square miles, with a native and mixed population of nearly 220,000. Much of Zululand is high or middle veld, or native reserve, yet about 350,000 to 400,000 acres in this area would be suitable for cotton growing. Much of this is unsurveyed Government land, and locked up. Immediately adjoining is the Ngotshe District, with an area of 1,400 square miles and a native population of 23,962, the European population being less than 500. In this small district there are some 200,000 acres of suitable cotton land. It is surveyed land, mostly privately owned, but not yet developed through lack of transport facilities.

"The Great Cotton Belt. — These figures show that there is an enormous area that, from the point of view of soil and climate, is believed to be suitable for cotton growing, and indeed at many points within these areas, the growing of cotton has been proved; but only by pushing development work and eliminating barren spots from the fertile ones can the real possibilities of these areas be determined.

"In some localities there may be a shortage of rainfall, particularly in Marico and parts of
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE
the Rustenberg District. It will be necessary, as development proceeds, probably to find for certain areas types of cotton that are more especially adapted to droughty conditions, while in other areas the most important factor will be that of early maturity on account of frosts. In very few of the parts mentioned above as suitable for cotton will it be found that there is sufficient frost to hamper production.

"Labour.—To many South Africans the labour question is the problem of cotton growing; the shortage of labour—its unsuitability and inefficiency—is stated to be such as to prevent the development of the cotton industry. There is, however, an adequate labour supply if gradually trained and educated to work in the cotton fields, and sufficient to enable the country to build up to a production of 500,000 bales of cotton annually within a comparatively few years, and to reach a larger output as population and efficiency increase. For instance, in a certain area in Natal, experiments with cotton were undertaken in 1915. The farmers openly stated that it was useless to try to establish cotton on account of the labour position. The initial experiment proved the suitability of the soil, and an area on a commercial scale was planted. The first year about 20 acres were planted, the second year approximately 50 acres, and the third year about 75 acres. When the people in the community saw this, they wondered where the labour would be obtained to reap so much cotton. During this time the managers of the enterprise made known the fact that labour would be required and be well rewarded. The result is that to-day approximately 900 acres are being grown within a radius of one mile of the land on which the first 20 acres were grown, and more labour is offering in proportion to the work to be done than was offered when only 20 acres were planted.

In the Ngotshe District approximately 5,000 acres were reaped in 1922, and this work was done with from 3,000 to 4,000 labourers, including women and children; the labour was not employed to the full extent, as there are 23,000 natives in the district. Under the control of one man there were more than 3,000 acres of cotton, and ample labour was offering.

"There are great possibilities for the development of cotton growing as far as labour is concerned. In Natal and Zululand in particular, the work is done mostly by women and children, thus enabling development without interfering with any other established enterprise."

Taking the industry generally, native labour will be found fairly plentiful at prices ranging between £1 and £2 per month for each male adult. Women and children are useful for hand cultivating and harvesting.
Land Valuations and Production Costs.—This is an important question to every prospective cotton planter. Land may be purchased at prices ranging from about 10s. or 15s. per acre upwards, depending on the distances from the railway and the principal town. An average price to pay for a farm with good, non-irrigable lands would be about £1 to 30s. per acre. The cost of clearing lands varies according to the amount of bush contained, but generally, it will cost about £1 per acre to clear and stump the land.

The cost of producing a crop of cotton is roughly estimated on a basis of £1 per acre, this amount being required to prepare the lands, cultivate, and harvest the crop. With cotton at the present price, and an average crop of 600 lb. of seed cotton per acre, a net profit of about £8 per acre may be reckoned on.

Ginning Facilities.—Ginning facilities have been greatly improved within the past few years. There are ginning plants at all of the important centres where cotton is grown to any appreciable extent.

Insect Pests.—Cotton insects are present, as in other cotton growing countries, but neither the Mexican boll-weevil nor the pink boll-worm, the two worst known cotton insect pests, has been introduced, which is very fortunate.

The Demand for Cotton.—The strong demand for cotton continues and there is every indication of its increasing. At the end of July, 1923, the world's production that season was estimated at 18,300,000 bales, while the estimated consumption was 2,000,000 bales in excess thereof. There was a carry-over from the previous season that will be used to make up the deficit, but the carry-over shows a steady diminution every year. When European conditions become more settled, more cotton will be required. The world's demand calls for more cotton lands, and South Africa possesses abundantly the essentials of suitable cheap land, of climate, and of labour.
Cotton Growing in Rhodesia.

Encouraged by better prices, farmers in Rhodesia are increasing their acreage under cotton, and there are now several thousand acres devoted to this crop in Southern Rhodesia. Until a few years ago cotton had only been grown experimentally, but it is now being grown on a commercial scale. There is an up-to-date ginnery at Salisbury, where farmers can have their crops ginned, pressed and marketed, and other plants are being erected.

As cotton cannot be grown with certainty as a commercial crop above an altitude of 3,800 feet, except in very sheltered and isolated spots, it is not suitable for all parts of Southern Rhodesia. It has been shown, however, that certain areas in the Hartley, Mazoe, Lomagundi, Urewa, Mtoko, Makoni, Umtali and Victoria districts are suitable for cotton cultivation, and it is also being tried in parts of Bubi, Bulawayo, Nyamandlovu, Gwelo and Selukwe districts.

The type grown is Upland cotton, and both buyers and spinners state that the lint is of correct staple and colour, besides being well graded and packed. Cotton is planted during November or early December, so that it gets the benefit during the growing season, and the rains, which begin in November, increase in December, and are heaviest in January and February. During April and May the bolls are maturing when there is plenty of sunshine and little rain. The crop is harvested during May, June and July when the rains have practically ceased. As normal rainfall is ample, irrigation is not necessary.

An abundance of cheap native labour is available if the natives are paid regularly and treated justly.

The yields vary. As much as 1,600 lbs. of seed cotton, equal to more than 500 lbs. of lint, have been obtained, and other yields of 1,500 and 1,200 lbs. of seed cotton per acre have been produced. A yield of 600 lbs. of seed cotton returns a handsome profit.

The principal insects which attack cotton in Rhodesia are cutworms, boll worms, and the cotton stainer. None of these does serious damage. The only diseases of cotton noted in the Colony are angular leaf spot, anthracnose, and boll rot, and these are serious only in seasons of abnormal rainfall.
Uganda's Cotton Wealth.

The history of the development of cotton cultivation in the Uganda Protectorate affords a striking example of the benefit which such a country can derive from the systematic establishment of an economic crop. What this development has been is shown by the following facts.

Twenty years ago the output of cotton in Uganda was less than 1 bale of 400 lbs. For the 1924-25 season the crop was 128,000 bales.

When the fact is borne in mind that cotton growing in Uganda is almost entirely a native industry, the few European settlers in the country being concerned mainly with coffee and with other crops, the remarkable increase in cotton production is a tribute to the energy and perseverance shown by the Government in its continued efforts to foster the industry, the success of which is now perhaps one of the chief factors in the prosperity of the Protectorate itself.

A little cotton, which was either indigenous or produced from seed secured from the coast, was grown by the natives prior to 1902, and spun and woven into cloth by those who were more progressive than their fellows who were content, for the most part, to wear skins and bark-cloth. In 1904, however, the Government decided to carry out experiments with a view to establishing a cotton-growing industry. Some Egyptian seed was accordingly imported, and the Uganda Company, a missionary pioneer company, introduced American Upland, Peruvian and Sea Island strains. There was little or no organisation, however, the different varieties being grown in close proximity and the seed mixed. The inevitable result was that hybrids were produced, and by 1907 Uganda was producing a cotton which was a mixture of most of the varieties introduced with American characteristics predominating. In order to try and put an end to this chaotic state of affairs Ordinances were passed forbidding the growing of cotton except from seed distributed by the Government, and attempts were made during 1908 and 1909 to eradicate plants which displayed Egyptian characteristics. In 1909 the Agricultural Department decided to carry out experiments in order to ascertain the variety most suitable for the country. Ex-
Experimental stations were established, and fresh seed of the American Upland type was imported, it being obvious by this time that this type would grow well. In addition, experiments were undertaken to ascertain the optimum planting seasons for various districts and the relative merits of different methods of cultivation. Of the varieties tested, "Sunflower" and "Allen's Improved" were found to give the most satisfactory results, the best sowing seasons were found to vary with different districts, but to lie between the middle of May and the middle of August, whilst it was also proved that land that had been ploughed with a light ox-plough gave just as good a yield as that cultivated in the laborious native manner with a hoe. The natives were persuaded to break in some of their oxen, and ploughs gradually became more and more popular.

The industry was now well on the way to becoming established, and it was clear that its extension must be accompanied by the provision of adequate facilities for ginning the crop and the improvement of transport. Up to 1912 most of the cotton produced was grown in the Buganda Province and ginned at Kampala, Entebbe or Jinja, which were the only places at which power ginneries had been established. With the opening of the Busoga railway from Jinja to Namasagali on Lake Kioga, attention was directed to the possibilities offered for cotton cultivation by the rich soil of the country surrounding Lake Kioga, and, indeed, of large areas of the whole Eastern Province. The Government Agricultural Department took the matter in hand with energy. To maintain and improve the quality of the crop, Government seed farms were established, and the seed distributed, while after the harvest the best cotton from each district was collected and ginned separately, and the seed reserved for next year's planting. The deterioration in quality, which must have inevitably set in had the natives been allowed to plant indiscriminately whatever seed they could most easily obtain, was thus prevented.

In order to stop indiscriminate buying and mixing, and to ensure that a fair price was paid to the growers, an Ordinance was passed making it illegal to buy cotton except at recognised markets. These markets were supervised as far as possible by the Agricultural Staff, who were thus able to do a certain amount of grading and to see that good cotton was not mixed with inferior qualities.

By the time the war broke out the industry was thus both firmly established and well controlled. The precautions for maintaining the quality were being thoroughly carried out; the remaining hand gins were being abolished even in the most outlying districts, and communications were being improved.
Towards the end of 1914 there was reason to fear that the industry would experience a severe set-back owing to the war. A serious slump occurred in cotton prices at home, and it was feared that no buyers would be forthcoming for the Uganda crop. But the British Cotton Growing Association, which had throughout done so much to foster the industry, stepped into the breach and other purchasers gradually followed their lead. As the war went on large numbers of natives were recruited as carriers for the troops operating on the borders of German East Africa, and the European staff of the Agricultural Department was sadly depleted. Nevertheless, it is striking evidence of the firm hold which the industry had by that time established, that notwithstanding the decrease in the crop from 42,000 bales in 1914 to 25,000 in 1915, it never fell much below this figure during the war, and recovered after its close to 40,000 bales, the figure for the last pre-war year.

The following table gives approximate figures for the Uganda cotton crops every five years from 1904 to 1920, and annually from then onwards.

<table>
<thead>
<tr>
<th>Year</th>
<th>Bales of 400 lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1904</td>
<td>... 54</td>
</tr>
<tr>
<td>1909</td>
<td>5,000</td>
</tr>
<tr>
<td>1914</td>
<td>42,000</td>
</tr>
<tr>
<td>1920</td>
<td>51,000</td>
</tr>
<tr>
<td>1921</td>
<td>81,000</td>
</tr>
<tr>
<td>1922</td>
<td>30,000</td>
</tr>
<tr>
<td>1923</td>
<td>100,000</td>
</tr>
<tr>
<td>1924</td>
<td>128,000</td>
</tr>
</tbody>
</table>

In 1919 the "Cotton Tax," an export duty of 4 cents of a rupee per pound of ginned cotton (a little more than 3d. per lb.) was imposed. The sum collected in this manner was £47,000 and it was hoped that a considerable sum would be raised each year, which should be devoted to the extension of the cotton-growing industry by providing funds for increased transport facilities, the expansion of the staff and work of the Agricultural Department, and other services more or less directly concerned with the industry. The sum collected in 1920 was £57,000 in spite of a reduction in the tax to 3 cents. The Government did not find it possible, however, to adhere to their original intention of devoting the whole of the proceeds of the tax to services intimately connected with cotton growing, and during the last few years the money has been absorbed into general revenue. Still this tax has enabled Uganda to show a balance on the credit side of her accounts; the tax falls on that section of the native community best able to bear taxation, and a considerable proportion of the revenue so collected, benefits, more or less directly, the industries upon which it is levied. The present tax is at the rate of 6 cents. per lb. Within the next few years the crop should reach 250,000 bales per annum, and it should be possible to extend the output up to one million bales.
The New Barakat Ginning Factories

No. 1 Factory

Nos. 2 and 3 Factories. Each Factory has 80 Gins.
Cotton Growing in the Sudan.

In setting the Anglo-Egyptian Sudan upon the path leading to material as well as to moral progress, no wiser plan could have been adopted than that of encouraging agricultural productivity. In undertaking this necessary task both governmental and private enterprise has been employed and played its important part. Recognising the vast possibilities of cotton-growing in the Sudan, as in Egypt the Government has made every legitimate effort to encourage this form of native industry. The result has been that, to-day, Sudan and Egyptian cotton not only realises the highest price on the chief markets at home and abroad, but gives promise of forming the main future source of economic wealth of the two countries.

The Government, supporting private capital when needed for the establishment of experimental farms where cotton-cultivation is the chief enterprise, such, for example, as those situated at Tayiba, in the Blue Nile province, and at Zeidab, in the Berber province, has aided by carrying out plans destined ultimately to provide a sufficiency of water-supply for all practical purposes, and has given the closest attention to the education of the not-unreceptive native, both in the Sudan and Egypt, in the art of protecting his crops from parasitic diseases as well as in the adoption of all other protective measures consonant with the fruition of his interests as a cultivator.

Enlightenment in these directions is continually spreading, and with confidence it may be said that to-day both the Egyptian and Sudan fellah is at last commencing to realise that the Department of Agriculture is working solely for his advantage.

As an instance of the assistance afforded, between 250,000 and 300,000 acres of the crop, as far back as 1913, were planted out with seed supplied on credit by the Department of Agriculture, which purchases the seed in large quantities from the ginners. No less enterprising has been the attention devoted to the improvement of the grade of cotton grown in both these countries. For the purpose of watching and promoting progress in this direction, a cotton-breeding station has been established at Giza, Egypt, while similar benefits have been established in the Sudan upon the estates of the Sudan Plantations Syndicate, Limited, an enterprise
Sudan Cotton Production.

Inside View of a Ginning Factory at Barakat.

Another Inside View of a Ginning Factory.
now in the fourteenth year of its existence. The chief property of the Sudan Plantations Syndicate, Limited, is located at Zeidab in the Province of Berber, other plantations being at Tayiba, Barakât, Hag-Abdulla, and Tokar, the latter worked on joint account with the Sudan Government. Agriculture is and always has been, the main industry of the Province of Berber, and, since the pre-eminently successful establishment of the plantations of the Zeidab Syndicate, it has become known as a valuable cotton-producer.

Besides rendering undoubted economic benefits to the country at large by increasing its productivity, exports, and employment of native labour, the Syndicate has done exceedingly well for its own shareholders, as may be gleaned from the fact that, besides distributing dividends amounting, in its financial year, ending June, 1925, to 5/- per share (or 25 per cent. less income tax) a bonus for the staff of £10,000 was paid: for the preceding twelve months the dividend was at the rate of 20 per cent. less tax. The net profit for the past year was £162,884, as compared with £112,934 for the previous year and there was a balance carried forward of £189,450.

The present authorised capital of the Sudan Plantations Syndicate, Limited, is £750,000 in £1 shares, but in October, 1925, this was raised to £2,500,000 in £1 shares. A sum of £400,000 has been loaned to the Syndicate by the Sudan Government, under a favourable agreement, dated October, 1919, and secured by a debenture creating a floating charge upon the assets and undertaking of the Syndicate. Vast sums of money had been expended upon development work, and an area of 300,000 acres has now been developed and canalised. The sound financial condition of the Syndicate may be appreciated from the fact that besides having more than £613,000 invested in British Government securities, cash at bankers and in hand amounts to over £90,000.

During the financial year, 1925, the cotton crop dealt with at the company’s ginning factories amounted to 13,684 bales. This is nearly 4,000 bales less than the previous year, nearly all caused by a decrease in the Gezira crop owing to unusually severe damage caused by insect pests. Measures have been taken to reduce damage from this source. On account of higher prices realised, however, the financial results are as satisfactory as in the previous year.

The following table shows the cotton crops dealt with from the various plantations in the seasons 1924-25:

<table>
<thead>
<tr>
<th>Plantation</th>
<th>1924</th>
<th>1925</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zeidab</td>
<td>3,088 bales</td>
<td>2,814 bales</td>
</tr>
<tr>
<td>Gezira</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tayiba</td>
<td>1,025</td>
<td>913</td>
</tr>
<tr>
<td>Barakat</td>
<td>1,887</td>
<td>1,425</td>
</tr>
<tr>
<td>Hosh</td>
<td>4,507</td>
<td>3,920</td>
</tr>
<tr>
<td>Wad el Nau</td>
<td>7,172</td>
<td>4,612</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>17,679 bales</strong></td>
<td><strong>13,684 bales</strong></td>
</tr>
</tbody>
</table>
The progress made may be regarded as record work, reflecting great credit upon the resident staff. All stations worked by the company are showing up very well, and there would seem to be no doubt of the permanent success of the Syndicate, for the foundations have been well laid. The company may also be congratulated upon the completion of an even larger scheme to which it is wedded through an agreement with the Sudan Government. This is the construction of the Sennar Dam on the Blue Nile, an enterprise which is destined to bring water to the arid Gezira Plain; it has been carried out by the Sudan Government at an estimated cost of about £13,000,000. Details of this great work are given in a separate article. With the completion of this dam, gravitation water is now available for the large area to be cultivated this season, about 80,000 acres having been planted and a crop of 800,000 bales is expected, of which 65,000 bales will be high-class Egyptian cotton. It is hoped that next season there will be 100,000 acres under cotton in the Gezira.

Four new ginning factories, of 80 gins each, were completed at Barakat in 1924-25.

Business relations between the Syndicate and the Government in Khartoum and with its officials in the provinces are all that can be desired. No less satisfactory are its relations with the native tenants. The writer can personally testify, from visits paid to the Syndicate’s estates at Tayiba, Zeidab and Tokar, that these associations are amiable. The tenants know, and freely admit, that they get absolutely fair, straightforward and sympathetic treatment; consequently they implicitly trust the management. This fact can be best illustrated by citing the circumstance that when the Syndicate want tenants for new areas, applications from double the number that could be accommodated are generally received.

Those who may have visited the territory of the Syndicate, feel confident of the immense potentialities of the Gezira Plain and hopeful of the first 300,000 acres which have been irrigated. Here is a plain 80 miles long by about 20 miles broad, composed almost wholly of black and reddish-black earth, yards in depth, practically flat, and, for the most part of the year, absolutely bare of vegetation. This area is bounded by the Blue Nile, while a railway runs through its whole length.

Tayiba is the first of the plantations to be reached. At a distance of a further 15 miles south is located Barakat, while 30 to 40 miles further south is Hag-Abdulla, or, as it is now called, Hosh. Remarkable, indeed is the sight presented by this once-arid plain, now sparkling in the glorious African sunlight, fresh and green as a result of the operations of the industrious Syndicate, veritably “a desert blooming like the rose.” Each of the plantations, spaced out
Mr. F. ECKSTEIN
Chairman of the Sudan Plantations, Ltd.
over the area to be worked from the dam, when completed, forms a nucleus around which native families have grown, or are growing up, with at least an elementary knowledge of cotton, and how to grow it. A wholly British staff inspect, superintend and help them. Without these nuclei to train the cultivators or the competent British staff, it would be impossible to keep pace with the great strides made in the extension of areas under cotton, which will follow the putting into service of the precious waters of the dam.

The Syndicate is also substantially interested in the Kassala Cotton Company, Ltd., which is making steady progress. This company was formed in 1923, and has 15,000 feddans under cotton.

One of the happiest features of the work of the Sudan Plantations Syndicate is that, whilst planning the great scheme, its board of directors, always in close touch with the Government at Khartoum, were able, long before the big work was put in hand, to lay the foundations of a solid business paying very acceptable dividends. Starting in a relatively small way on a purely experimental scale in various parts of the country, they made these experiments pay, thus proving that cotton-growing in the Sudan could be made exceedingly profitable, and that, if any one syndicate or group could, by private enterprise, daring, and ability help the Government to exploit such potential territories as the Gezira, that group was the Sudan Plantations Syndicate itself. Having proved which, they ipso facto reaped the natural reward. To-day they are still on the threshold of their career; ten years hence they will be amongst the most powerful and influential organisations in Africa, and certainly the largest cotton-growing and marketing organisation in the world. The men at the head of the Plantations Syndicate, who nursed it from its infancy sixteen years ago, and are now looking ahead into a land of waving cotton fields, are deserving of the greatest admiration. They are assisting to carry out, thereat, the dreams of Cromer, who, according to Mr. Eckstein, dreamed that one day railways would be constructed from Sua-kim to Atbara, from Khartoum to El Obeid, from Atbara to Kassala; that one or two dams would be built on the Blue Nile; and that the Gezira Plain would be developed. So it is, and, if we except the keen interest always displayed by the Governors-General and "that very efficient Government in Khartoum," no man has taken a more persistent, though modest, part in making these dreams come true than Mr. Frederick Eckstein, who was, with his lamented distinguished brother, Herman, amongst the chief constructive pioneers of the Rand and chairman, amongst his other vast undertakings, of the Sudan Plantations Syndicate, which, in the words of Lord Lovat, is his "pet child."
Makwar Dam Construction Scenes.

1. A view of the temporary dam thrown across the main stream. The foundations laid by Alexandrini can be seen on the immediate left of these derricks.

2. A sectional view of the dam, showing some of the spillways, at top. One of the sluice gates can be seen below.

3. The main canal, showing the size of the cutting to carry water for irrigating the initial area of 100,000 feddans.
History of the Sudan Plantations Syndicate.

The conception of growing cotton in the Sudan on a large scale is due to Mr. Leigh Hunt, an American gentleman of vision and great ability.

At the beginning of this century Mr. Leigh Hunt visited the Sudan on a shooting trip and whilst so engaged got thoroughly imbued with the belief that the Sudan, only just freed from the bondage of the Mahdi rule, could be made a great cotton growing country. With characteristic energy he set to work and obtained through the late Lord Cromer a concession for a tract of land consisting of 10,000 acres at Zeidab about 150 miles north of Khartoum. With this concession Mr. Hunt came to London in 1904 to enlist the co-operation of the firm of Wernher Beit and Co. The late Mr. Alfred Beit, always ready to do pioneer work, received Mr. Hunt's ideas enthusiastically and there and then formed a private company called The Sudan Experimental Plantations Syndicate.

Work was commenced forthwith at Zeidab, levelling the land, building houses, engaging native labour, etc., and cotton was produced at varying results for some years.

In 1908 the name "Experimental" was dropped and the present title adopted.

Up to 1910 operations were confined chiefly to the development of this northern (Zeidab) area and good cotton of the American class was regularly obtained.

The managers of the Syndicate, however, felt that the real and ideal cotton belt in the Sudan was south of Khartoum and experiments in this direction had further taught the Syndicate that there could be grown with great advantage fine long staple Egyptian cotton. That being so, attention was therefore directed to a tract of land known as the Gezara and situated about 100 miles south of Khartoum, between the Blue and White Nile and bearing southward to Sennar. This stretch of country consists of a flat plain of about 5,000,000 acres of which
3,000,000 acres must be classed as first class cotton soil.

The difficulty of the Syndicate was to find out whether this fine long staple Egyptian cotton could be grown commercially at a time when Egypt did not require the water from the Blue Nile; in other words whether the period of the Blue Nile flood was seasonable for this purpose. With this in view, negotiations were commenced in 1911 between the Syndicate and the Sudan Government, and a pumping station was erected at Tayiba (Blue Nile) capable of irrigating about 3,000 acres—of which one third was to be under cotton. This experiment—after two years cultivation—proved so successful that both Lord Kitchener, then British Agent in Egypt, and Sir Reginald Wingate, Governor-General of the Sudan, firmly resolved to push the development of the Gezira as rapidly as possible. Incidentally it must be remarked here that Lord Kitchener repeatedly visited the plantations of the Syndicate and took an intense interest in its work which lasted up to the time of his death.

The decision finally arrived at was to build a dam at Makwar, near Sennar, for the purpose of utilising the flood water and to bring it by gravitation to the 3,000,000 acres area and provide in the first instance enough storage for about half a million acres in an average year. It was further decided to make canals sufficient to irrigate 300,000 acres to start with, but eventually by widening the canals to enlarge this area.

It was further agreed that the Sudan Government was to undertake the construction of the dam and the main canalisation, and the Sudan Plantations Syndicate to construct the minor canalisation, the necessary buildings, ginning factories, agricultural machinery, and finance and market the crop, in other words act as managers for the Sudan Government. The planting of the cotton was to be done by the local natives, under the Syndicate's supervision.

This agreement constituted therefore a three-cornered partnership of which the native tenant was to participate to the extent of 40 per cent. for the work done by him, the Sudan Government to receive 35 per cent. to pay for interest on their outlay and upkeep, and the Syndicate to receive the remaining 25 per cent. for their part of the work.

As a further training ground, both for natives and Europeans, another pumping station was erected in 1914 at Barakat, and which is capable of irrigating 6,000 acres of which 2,000 are under cotton. This station also provides water for the Gezira Research Farm, which is run jointly by the Sudan Government and the Syndicate for the purpose of conducting scientific experiments and research work.

The War naturally interfered greatly with development of every kind and description, but on resumption, after peace, of
more natural conditions the Syndicate erected in 1919 a third pumping station at Hag Abdulla to supply water for the development of the southern portion of the 300,000 acres area, and 7,000 acres were under cotton in 1921.

The Syndicate decided to erect a fourth pumping station at Wad el Nau capable of irrigating 30,000 acres. The reason for erecting the last pumping stations was that owing to certain financial difficulties the completion of the Sennar Dam suffered some delay. At the same time this station served as a further training ground and facilitated the rapid development of the whole area of 300,000 acres. There can be no doubt that after the cultivation of the 300,000 acres is complete, further expansion must take place, first by utilising the full capacity of the dam, this to be followed by increased storage of the upper reaches of the Blue Nile so that the whole Gezira area of 3,000,000 acres can become productive.

This would mean a crop of four million kantars or one million bales of 400 lbs. each and lasting prosperity to the Sudan.

Some of the workers engaged on the construction of the Makwar Dam.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE
Cotton Culture in the Nile Delta.

By ADOLPHE BOGDADLEY. (Alexandria.)

COTTON has been grown in Egypt from the earliest ages and was most probably first cultivated in the Upper Nile Valley. It is stated in the Bible that Pharaoh, as a mark of his Royal gratitude, had Joseph clothed in a mantle of fine cotton (byssus). Indeed cotton materials were exclusively reserved for the Royal family and the priesthood. The reason was that being of vegetable origin, they were preferred to woollens, which being of animal origin were therefore considered to be impure.

We have not much information regarding cotton since the Christian era, throughout the Middle Ages or even during more recent times until the French invasion. We know, however, that the European ports, especially Marseilles and Trieste, received their cotton either raw or spun from Alexandria. The savants who accompanied the French expedition relate that at that time cotton cultivation had so declined in Egypt, that only trivial quantities were being exported. On the other hand the textile industries there were more highly developed and more prosperous than in recent times.

Until 1820 Egyptian cotton was in no way superior to American or Indian cotton and was frequently of worse quality. It was only during the reign of Mehemet Ali that the first step was taken to improve this textile fibre, which was the starting point of Egypt's prosperity.

The following is related on this subject: A certain Jumel, a native of Geneva, accidentally discovered in the garden of one Mohamed Bey Orfali a variety of cotton, the fibre of which was distinguished by its length and fineness, as well as by its silken lustre. It is alleged that it was a Turkish dervish who had brought back the seed of it from a voyage to India, without suspecting its commercial value.

Jumel, not without much difficulty, induced the Viceroy to make some experiments with the new variety. When Mehemet Ali had before him the wonderful results of the first plantings, he recognised with his practical acumen, the great advantages which his country, and in particular his finances might derive from this shrub. His formidable power as an oriental autocrat and his personal energy soon succeeded in forcing this new plant upon the indolent fellahin, who were slow to accept any innovations.

At the end of three years, exports, which had been nil at the outset, reached 228,000 cantars of cotton (including seed). The quality of the
fibre immediately met with great success among spinners, who had no hesitation in paying prices ranging from 15 to 17 dollars per cantar. *

Shortly afterwards, production began to diminish and prices began to drop, without our being able to assign the reason. However, the annual output until 1840 kept up to an average of 210,000 cantars. From that year forward a constant increase in the production may be observed and at the time of the American War of Secession, Egypt had an export of 569,000 cantars of 100 lbs. each.

From this time forward cotton cultivation increased by leaps and bounds and reached its maximum in 1865, the date of the conclusion of peace, with an export of 2½ million cantars, amounting to a sum of £15,500,000. The cause of this unexpected and tremendous increase was the shortage of American cotton in Europe, which compelled the demands of Egyptian sellers to be submitted to. For three years prices kept above 30 dollars and even reached 52 dollars. It was only in 1910 that the price of 30 dollars was exceeded for the second time.

Immediately after the conclusion of peace, a fairly slow reduction in price took place. In consequence of this reduction, a diminution in exports may be noticed. Prices, however, remained fairly satisfactory and exports resumed their upward movement, which in 1881 attained an average of 2½ million cantars. Meanwhile complaints began to be made that Egyptian cotton was degenerating and losing its quality, which was immediately translated into an appreciable and continuous drop in prices. This deterioration had, indeed, long since been anticipated; especially as in Egypt all plants tend to deteriorate in quality when selection, which is the only remedy, is neglected.

On the other hand, the farmer was at that time subject to all manner of vexatious measures. Heavy taxation on the one hand and usurers on the other, swallowed up the fruit of his labour; it is natural that the fellah should have neglected cultivation and no longer have sought to obtain a superior quality.

It frequently happened that spinners requiring from Egypt cotton of a certain quality received an inferior quality instead. If this state of things had continued, cotton cultivation would have been affected thereby.

Happily, this position came to an end when the British occupied the country. Cotton cultivation immediately resumed its upward course, especially as the irrigation system was improved, extended to new lands, and completed by numerous drainage canals.

Subsequently new varieties of cotton were successfully introduced and they now make the reputation of Egypt. In good years the annual exportation has reached 7½ million cantars of ginned cotton.

It should, however, be mentioned that the quantity of cotton produced by a unit of land tends to diminish. If, however, the export figures increased until 1913, the fact may be attributed to new plantings

[*One cantar, or quantar=99.05 lbs. One cantar of unginned cotton is 315 lbs. For trade purposes, however, a cantar of ginned cotton is reckoned at 100 lbs.—Ed.]
introduced in lands previously left fallow, which was made possible by the raising of the Assuan dam. Although there is no lack of such lands in Egypt, their cultivation will become more and more difficult and costly, either on account of the shortage of water or because saline soils will have to be utilised, and they require careful, artificial drainage. The salvation of cotton cultivation thus depends both on the employment of new methods, permitting of an increase of the yield per unit of land and on the improvement of the qualities of the plant.

It is well known that agricultural Egypt is confined to the Nile valley and more especially to the Delta. If a cross section of the Nile valley is examined, it will be noticed that in prehistoric times the Nile must have totally filled this valley, which it hollowed out in the rock. When at a later geological period the amount of water diminished, it only filled the valley during the flood, and the silt then carried along by the water would naturally be deposited all over the valley. But during low water it would be carried away in the actual river bed where the water always flows. The alternating floods and low water thus eroded the bed of the river, while at the same time raising the level of the banks, either because the water reached there later or because the banks were at more distant places. This explains why the lands close to the bed of the Nile are higher near the banks than at a distance, which phenomenon facilitates the distribution of irrigation water.

From these deposits of silt there would first arise a small island dividing the river into two branches, which would later on be subdivided by other islands. The more branches there were, the slower the speed of the current would be, so that the channels themselves would become obstructed and with the assistance of swamp vegetation, the banks of the islands would gradually coalesce. This hypothesis as to the formation of the Delta is confirmed by what may still be observed to-day.

The Egyptian Delta was formed by the deposit of the silt contained in the water of the Nile when the river, on reaching the sea, slowed down and allowed the material it transported to fall to the bottom, just as happens at the mouths of some rivers in America and in Europe.

In consequence of the foregoing it will be understood that the Delta soil is composed of a layer of clay, varying in depth from 25 to 80 feet, resting upon the rock in which the river has cut its bed. Sands and gravels alternate with beds of black clay, which itself frequently contains fairly large quantities of fine and quartz-like sand. Almost everywhere, however, the top layer is composed of black clay.

Owing to its origin, this arable stratum contains large quantities of nutritive material for vegetation, so that it is very suitable for the cultivation of so exhausting a plant as cotton.

It is, however, impossible to plant cotton in the same spot several years in succession. It is necessary in cultivating this plant to employ
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

Top: Gathered up in small quantities the cotton is placed in sacks and stored in the cultivator's depot.
Centre: Transport of the cotton to the factory by camel.
Bottom: Plucking the cotton in the fields, under the supervision of an Egyptian foreman.
IRRIGATION

a two-years', or better still, a three years' rotation to prevent exhaustion of the soil.

Formerly, cotton was cultivated for two or three years on the same land, as is still the practice to-day in America. Not only did the crops suffer greatly from this, but it produced an alarming increase of the cotton pests. To-day, this system is prohibited by a special law.

The best method of cultivation is always a three years' rotation. During the period when cotton is not cultivated, maize, barley, wheat, beans, rice and other plants are sown, the most important of which for us is "bersim" (Trifolium alexandrinum), a clover. which, while yielding for six months a nourishing fodder for the cattle is, like all leguminous plants, a good accumulator of nitrogen. Frequently after early wheat crops the land is left fallow.

Greed of gain often induces the farmers to sow cotton every second year, but this very debatable method of cultivation, owing to the quality and quantity of the crop suffering greatly, is now prohibited.

It has often been repeated that Egypt is a gift of the Nile and nothing is more true. Not only is the soil of Egypt formed by the silt deposits of the Nile, but no agriculture would be possible without its beneficial waters, rain being a rare event in Egypt.

The Nile, which is about 3,500 miles in length, is formed by two groups of tributaries, the first group arising in the Equatorial lakes and the second coming from the mountains of Abyssinia. During the tropical rainy season the tributaries very quickly rise and convey reddish water loaded with fertilising material. But the flood does not reach the part of Egypt which interests us, comprised between Assiut and the Mediterranean until several months later, on account of the considerable distance it has to travel; the maximum level only reaches Lower Egypt in the month of September. The first indications of the rise of the water are already noticeable at the end of July. When the maximum is attained, the water slowly and continuously goes down, the lowest level being reached in May. Rains, which in Upper Egypt are insignificant in winter, are quite rare in the parts of Lower Egypt near the sea. They are absent altogether during summer, i.e., during the cotton-growing period. In order to grow cotton in Egypt, artificial irrigation is therefore necessary.

The plant requires water from March to October. The quantity of water brought down by the Nile from spring time to the beginning of summer would be quite insufficient, if there were not means of retaining the flood water so as to be able to distribute it during the dry season. There is first of all the Assuan dam, the most important hydraulic work in Egypt, which, although recently constructed, has rendered inestimable services to Egypt. Its length is about a mile and a quarter. Its 180 iron sluices are wide open during the rise of the water in order to allow the masses of muddy water to pass through. A beginning is made of
closing them when the water becomes clearer. By this means the water stored in the reservoir only deposits insignificant quantities of mud there. The reservoir contains no less than 2,500 million cubic metres.

The other hydraulic works of less length, but also of great importance, are those of Assiut and Esne. Below Cairo a barrage is constructed, which regulates the water distribution for the Delta. Besides the two great branches of the Nile, three canals as wide as rivers emerge from its numerous arches:

1. The Behera Canal, supplying water to the Behera province, lying to the west of the Rosetta branch of the Nile;
2. The Menufia Canal, supplying water to the Gharbia and Menufia provinces, lying between the two branches of the river;
3. The Tewfikia Canal, supplying water to the Sharkia and Dakahlia provinces, lying to the eastward of the Damietta branch.

At Rifta another barrage is established across the Eastern branch of the Nile, which is, however, rather of local interest. The two branches of the Nile are during the low water period entirely barred by dykes of earth, so that not a drop of water is lost during the period of shortage.

The regulating barrages and sluices of minor importance are legion and we do not deem it necessary to enumerate them. Irrigation is performed in various ways, according to the level of the land to be irrigated. The improvements made in irrigation by the establishment of the numerous barrages has raised the lever of the water in the canals, which level to-day frequently reaches above the lands to be irrigated, thus permitting them to be watered by natural flow. But in the majority of cases the level of the water is lower than that of the land, so that it is necessary to raise the water artificially. In Upper Egypt the "shadoof" is used for this purpose, composed of a level with a counterpoise to which a vessel is attached, which is alternately filled in the canal and emptied upon the land. The working of it is laborious and inefficient. A very useful appliance, which is fairly efficient in its way, is the "sakia." This is a water-wheel with compartments, which are filled in the canal and empty themselves on the land. The wheel is turned by a couple of wooden-toothed wheels, which are worked by one or two oxen. Although this appliance is built of wood, it supplies from 2,000 to 6,000 gallons per hour, according to the height to which the water is raised, and its degree of perfection. For very slight differences in level, Archimedean screws are used, built entirely of wood, which turned by a handle by one or two labourers, supply up to 10,000 gallons per hour.

These screws are also sometimes built of iron and are used for differences of level of about 40 inches. Being worked by oxen they cannot be transported like the wooden ones.

On large estates, irrigation is effected by means of centrifugal pumps worked by steam engines or oil engines. In some places the transmission of power by electricity has been successfully employed.
Although the Egyptian cultivator has nothing to pay for the supply of water apart from the agricultural taxes, he is only allowed to take irrigation water at fixed places and periods. The landowners alongside the canals at their beginning would make an abuse of them and others, whose land was further off, would never be able to irrigate at all. In order to remedy this state of things, the Government established rotations each year during the low period, i.e. between March and September. For this purpose the lands adjoining the canal are divided into two, three or four sections, only one of which is entitled to water at a time, whereas the others must await their turns. These rotation periods last from nine to twenty-one days, according to the level of the Nile and local requirements; infringements of the regulations are severely punished. It should be mentioned that the irrigation of fallow land is entirely prohibited during the dry season.

Within the last few years the underground water is frequently utilised for irrigation by boring from two to ten wells to a depth of 50 to 300 feet and these wells together supply a centrifugal pump worked by some kind of motor. The water thus obtained is very clear, sometimes slightly brackish, but without any nutritious matter as compared with the Nile water, which conveys to the land its valuable silt.

However, these wells render signal service because, not being liable to rotation, they are always available for irrigation purposes.

With regard to the quantity of water used for irrigation, it varies for one single irrigation from 150 to 200 cubic metres of water, whereas a first irrigation after a fallow period may consume up to 1,000 cubic metres per feddan of 4,200 square metres or 1.038 acres.

It has already been explained that the space now occupied by the Delta was formerly covered by the sea. It is not surprising, therefore, that the soil of the Delta should contain a large quantity of salt, although in many places the salt has disappeared. The Northern Provinces of the Delta are always seriously contaminated by salt, which in small quantities is detrimental to the crops and when found in large quantities prevents agriculture altogether.

The only means of removing the salt from the land is by washing it out of the soil and removing the water by drainage. The Northern provinces are intersected in every direction by numberless drainage canals, into which the drains of private owners open. Drainage is effected in such a way that the properties requiring the same are intersected by numerous ditches, on the average 40 inches in depth and at a distance of 100 to 300 feet from each other, which open into the public drains. The irrigation water spread over the land dissolves a certain quantity of salt in passing through the soil, and filters into the drains whence it runs off. Removal of salt is also effected by leaving the irrigation water for a certain time on the ground and then letting it flow directly into the drains. This system is less efficient than the one previously described, because although
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

Top: Interior of a ginning factory. The ginning is done by girls and children. The fibre is taken on small trucks to the hydraulic press. Centre: Weighing the sacks at the ginning factory. Bottom: The ginned cotton is made up into bales, pressed and made ready for transport to Alexandria.
FERTILISERS

... involving a large consumption of water, it only permits of a slow and superficial removal of salt.

Frequently, and especially when the level in the public drains is too high, drainage is effected by “sakias,” Archimedean screws or centrifugal pumps, which raise the drainage water that could not flow away by gravitation. This system is at present made use of even where the natural outflow is sufficient in order to effect a deep and durable removal of salt more rapidly. This applies most frequently to new land which it is desired to bring into cultivation in a short time. The drainage of the major portion of the province of Behera, the drains of which flow into the Lake Mariut, may be classified as artificial drainage. The level of this lake is 7½ feet below that of the sea and powerful works are established at Meks, near Alexandria, in order constantly to maintain this difference in level. As this station is at the same time the one having the greatest output in the whole world, it is deserving of attention. It utilises six Farcot steam engines, driving a vertical shaft which is directly coupled to the shaft of the centrifugal pumps. Each centrifugal pump has an output of 7 cubic metres per second or 3,600,000 cub. m. every twenty-four hours for the whole group. In addition to this, two Gwynne pumps are at work. The schemes initiated by Lord Kitchener provided for several installations of this character, but war interrupted the work and the attention of the Government appears at present to be directed towards the creation of reservoirs in the Upper Nile, destined for the purpose of increasing the quantity of water available for Egypt and the Sudan.

The passionate disputes aroused by the Willcocks proceedings have placed the parties interested au courant of the advantages and drawbacks of the works projected and in course of execution.

Having taken a survey of the soil, the means of irrigation and of drainage, there remains a word to be said as to the fertilisers applied to cotton.

In spite of its advantages it is not a very general practice to apply manure to the cotton plant; in the majority of cases the fellah reserves his fertiliser for good crops, such as maize and wheat. When he can, however, he applies a certain quantity of farm manure or chemical fertiliser to the cotton plant.

There is nothing special to be said about farm manure in Egypt excepting that the bedding of the cattle is composed not of straw, but of mud, so that the manure is simply enriched Nile mud. This manure is applied either by being spread prior to ploughing or else it is put into holes at the foot of the plant prior to the third hoeing.

Sometimes also a special manure formed by the accumulated detritus of centuries on the sites of ancient towns is made use of. This manure, called “sebakh el kufri” does not contain much organic and fertilising material, but in order to obtain the same the cultivator has only to pay
his share of the salary of the keeper of the antiquities, and the transport expenses by ass or camel.

Anyway, this kind of manure is tending to disappear by the progressive exploitation of the tumuli.

The Cairo Sewage Company supplies several kinds of very rich manure, which is manufactured from the town sewage by mixing it with the soil of ancient Cairo.

Some farmers apply chemical fertiliser to the cotton plant. In such a case an endeavour is made to give predominance in the fertiliser to phosphate and potash, the addition of a large quantity of nitrogen to the soil would tend to favour leaf development and the boll would tend to suffer.

Chemical fertilisers, which at first were little used, are to-day widely employed, as in 1901 the imports amounted to £6,000, whereas in 1913 they amounted to £600,000. Chemical fertilisers have not as efficacious an effect on cotton as might be supposed. They are almost always used for the previous crops, where they have a very good effect, while leaving the soil richer for cultivation. A combination of organic and chemical fertilisers gives good results, especially if sulphate of ammonia is applied at sowing time and nitrate of soda during growth. The latter is very quickly assimilated, but its solubility causes it to dissipate rapidly into the sub-soil, where the irrigation water then dissolves it. Sulphate of ammonia has a slower, but more durable effect and also tends to remain on the surface of the ground. Of the phosphate group, super-phosphates, slags and precipitated phosphates are most frequently used, the two former for lean and the latter for lighter soils. In the majority of cases an addition of potash is not necessary, as the soil contains a sufficiency of potash. The best manner of combined fertilising is to apply organic manure before or during ploughing and chemical manure in small quantity to each cotton plant when of sufficient size.

Organic manure is applied at the rate of about 33 tons per feddan, although some farmers use as much as 40 tons.

Cotton having roots that penetrate the soil to a fairly considerable depth, the land should be well ploughed. In the majority of cases the native plough is used for the purpose. It is composed of two pieces of wood, one of which is 4 m. in length and provided with a yoke, which serves for attaching the cattle, whereas the other, about 1 m in length carries a plough-share in the shape of a spade. The native plough does not turn over the soil like the European plough, but stirs it up to a depth of only 5 inches. In order, therefore, to prepare the land well, several ploughings are necessary. Generally three or four ploughings are given, while negligent cultivators content themselves with only two, but that is to the detriment of the crop. European ploughs would suit very well, but the fellah, who is very conservative, is loth to adopt them; anyway, these ploughs that overturn the soil would only be of use where the sub-soil does not contain salt.
CULTIVATION

On the large estates ploughs are frequently used worked by two steam tractors; but the overturning plough is nearly always replaced by cultivators with multiple plough-shares; while increasing the rapidity of ploughing this permits of performing the same service as the native plough. Motor ploughs have made rapid progress in the country and are very advantageous for estates of medium size, for which a plough with two stationary engines would not suit. However, there is still great room for progress, especially as regards the weight of these ploughs, which at present are still too heavy.

The last ploughing is nearly always performed with the native plough, which for this purpose is provided with a piece of wood for the purpose of heaping up the soil on each side of the furrow. This ploughing divides the land into furrows about a foot in depth and at a distance of 2 to 3 feet from each other. The fellah thereupon makes further deeper and wider furrows at right angles to the former set and at a distance of 22 to 50 feet from each other, which varies according to the district; these will later on serve for conducting the irrigation water. The small furrows are connected with each other and with the irrigation furrows so that the water passes through them in zig-zag fashion. The fellahin often take a pride in the arrangement of these furrows and one is bound to admire the straight manner in which they trace them without any guide to assist the eye.

This work being completed, the land is ready to receive the seed, which is frequently sown a fortnight later. The only tool employed for sowing is a pointed piece of wood, with which the women and children drill holes if possible in the Southern sides of the small furrows. The distance between these holes varies from 16 to 22 inches according to the climate, the composition and the peculiarities of the soil. The maximum distance is found in the districts where cotton develops very rapidly. The middle of February is the best time for sowing; in the Northern provinces it is delayed until the middle of April on account of the cold winds of early spring, which are very detrimental to the young plants. In any case sowing is completed in May.

As a rule about 10 seeds are poured into each hole, but sometimes and especially when the quality of the seed is suspected, some twenty are poured in. The number is also increased in the case of early sowing, because the risks are greater in that case. But it must not be supposed that an economy in seed is obtained by sowing early, because in that case a bad crop may frequently result.

Immediately after completion of the sowing, plentiful irrigation is applied, so that only a third of the small dykes emerge from the water. If the temperature is favourable, the plants appear after 8 or 10 days. The method of sowing described above is what is most common in Egypt and is known under the name of "misquawi." Another method
Top: Arrival of the cotton at the factory, where it is placed in front of the ginning rooms and divided up into lots.
Centre: Transport to the factory by barge on the navigation canals.
Bottom: Packed in large sacks in the courtyard of the factory, the cotton is classified and weighed.
called "dimsawi" consists of sowing in soil, which having been previously irrigated, is already commencing to dry up. In this case the advantage is secured of the worker being able to place all the seeds at the same height which is marked by the water that has retired. In any event it is customary to soak the seed in water before use.

It frequently happens that the seeds do not come up uniformly, either because they are of bad quality or in consequence of improper levelling or because of too much salt being contained in the soil.

The quantity of seed necessary for one feddan may be taken as from 50 to 90 pints. The number of groups of plants, taking into account the distances given above, works out at 10,000 to 11,500. Assuming only groups of two plants, the number of same would be 20,000 to 23,000 per feddan. Three weeks after the appearance of the plants, a first superficial hoeing is effected by removing the earth from the side of the furrow opposite the plant and placing it round them.

A fortnight later a second hoeing is carried out which goes deeper. Shortly after this work, when the plants have already produced four leaves they are thinned out, each group being left only with the two most vigorous ones. The third and last hoeing is carried out some three or four weeks later, leaving the dykes intact as far as possible and deepening the furrows only. From this time forward the plants grow so vigorously that no weeds are tolerated between the lines, and weeding not only becomes unnecessary but even impossible.

According to the district, the land is irrigated from 7 to 10 times during the cotton growing period. There is no general rule and the number of irrigations only depends on the rotations already referred to and on the industry of the cultivator. The native farmer is often inclined to give too much water, which is very harmful to the yield, and the rotations may be considered not as a hindrance, but as a benefit to cultivation. Cotton can consume an average of 2,000 cub. m. of water per feddan each season, but on some sandy soils this figure may amount to 5,000 cub. m.

The height attained by the plant varies according to the variety, climate and the composition of the soil and is by no means a measure of the yield. A plantation of medium height is frequently found to give the maximum yield, whereas another plantation, the cotton plants of which attain a height of 10 feet is unsatisfactory in its production.

The flowers appear in June and the fields soon take on a yellowish white or reddish appearance. Towards the 10th of September a beginning is already made in picking the first pods.

This picking is the most abundant one and the fibre resulting from the same is most sought after. Picking is made by sending a child into each furrow, who takes up the edge of his skirt to form a bag around his body, which he gradually fills with cotton taken out of the capsules. Cotton containing pieces of the capsules is deprecated. The cotton collected is placed in heaps at the corners of the field, where it is im-
The parasites of the leaf and pod of the cottonplant. (The English translation is written alongside the Arabic.)
mediately filled into sacks to be transported to the farm. A keen watch
is necessary in order to prevent theft.

Picking is repeated twice more, but as already explained, the quality
and the quantity of these two pickings are not equal to the first one.
The last picking in the Northern part of the Delta lasts until the beginning
of December. The temperature has already appreciably gone down and
frequently the fields are left dry, in order to hurry the ripening of the
last capsules.

After the last picking the plant is removed in the case of careful
cultivation and is conveyed to the farm in order to serve as roofing thatch
or fuel. In order to avoid the multiplication of a cotton pest which
hibernates in the wood, the Government has issued an order compelling
the wood to be removed in December.

Frequently clover is sown between the lines of cotton, between the
second and third collections. Under these conditions the clover is well
protected against winds and fogs and grows well, and is useful for fodder
when the cotton cultivation is completed. The cotton is packed in sacks
and kept in well-ventilated warehouses in order that the quality may not
deteriorate through moisture, which would turn the cotton yellow and
impart a bad smell to it.

In common with all plants, cotton also has its enemies. The most
dangerous among them is a moth Prodenia littoralis, the caterpillar of
which hardly spares any cultivated plant in Egypt. This butterfly, which
reappears each year in successive broods, lays several hundred eggs on
the underside of the leaves, near the foot of the cotton plant. A few days
after being laid, the eggs hatch out and the young caterpillars begin their
devastating work. During their larval condition the caterpillars shed
their skin five times and reach their full size in about a fortnight. The
caterpillar is then about an inch and a half in length and is of a greenish,
almost brown colour. Darker lines run along its cylindrical body. The
young caterpillar only attacks the softer parts of the leaves, but on increas-
ing in size it becomes voracious and only leaves the large nerves of the
leaves. It retires into the earth to pupate and surrounds itself by an oval
capsule of agglutinated silk. The pupa stage occupies a fortnight at
least, but may extend to a much longer period in winter. The moth
emerges during the night. Its colours and form make it indistinguishable
from the plant on which it is resting. The result is that it is seldom visible,
which explains why the Arab does not suspect its connection with the
caterpillar.

Another enemy of cotton is Agrotis ypsilon, but contrary to the
Prodenia, it only attacks the young plant and passes on to other plantations
when the cotton plant becomes too large. The life history of this butterfly
is very similar to that of Prodenia.

A third enemy is Earias insulana, called in Arabic “doud el loz,”
which in America is known under the name of boll worm. This attacks
the capsules. The butterfly deposits its eggs one by one either in the
flowers or in the young capsules. The caterpillar feeds on the young fibres and causes the capsules to fall, when it forms its chrysalis. The fellahin often attribute the falling of the capsules to the red waters of the Nile, which they consider too strong, as the falling of capsules often takes place just at this period.

In this category of parasites it is necessary to mention Gelechia gossypiiella or pink boll worm, the ravages of which are of course most greatly feared.

In order to combat these pests, which according to modest estimates, cost some £30,000,000 to Egyptian agriculture, various systems have been proposed. It must first of all be acknowledged that no chemical substance affects the caterpillars themselves and sprinkling with poisonous materials has not produced any effect. At the present time the method is to pick off the leaves of the cotton shrub with eggs on them. As the eggs are usually laid on the lowest leaves at the foot of the plant, the search is fairly easy. Government inspectors continually go about the districts that are threatened or infested and children are sent into the fields to pick off the leaves, even against the will of the farmer, to whom the expenses are charged together with the tax.

In order to combat the weevils in the seed, the Government has no other means but to stave the seed intended for sowing. By means of special apparatus, the organism can be killed without the germinating power of the seed being affected.

The results hitherto attained by the various Government measures are insufficient and research is in progress with a view to attaining better results.

The last 50 years have seen a number of varieties of cotton created by private initiative appear and disappear. Unfortunately degeneration rapidly overtakes new varieties and it is fortunate that the Government should at last have seriously taken in hand, although still inadequately, the question of continuous selection of certain varieties. It may be hoped that by this means the qualities of the good varieties may be maintained. Anyway, at the present time, the principal varieties of cultivated cotton are:

In Lower Egypt:

1. The "Sakellarides" according to Dudgeon selected from the Afii in 1906—1907. This is an excellent variety and is at the present time the most widely disseminated.

2. The "Mitafi" and the "Assili" created respectively in 1882 and 1906. These varieties are less valued and are in full course of degeneration.

3. The "Pilion," a variety of recent creation, of coarser fibre, but maturing more rapidly and of a large yield. The fear of hybrid formation between the "Sakellarides" and "Pilion" has caused it to be avoided by the majority of farmers.
In Upper Egypt:

1. The "Ashmouni," a variety which is largely disseminated, of a fibre not so fine as the "Sakel" but of good yield.

2. The "Zagora," a recently created variety, which surpasses the "Ashmouni."

The other varieties: "Gallini," "Abassi," "Yannovitch," "Nubari," have at the present time only a historical interest.

Until 1913 cotton production followed the improvements in the irrigation system and especially the increase in the supply of water. However, as the development of irrigation has not been followed by as regular a development of the means of drainage, and as on the other hand, the high price of fibre induced the cultivator to extend the cultivation of cotton too greatly, which multiplies the parasites, an appreciable diminution in the yield per feddan has been observed. It is to be hoped that a more rational distribution of water, an energetic fight against parasites and finally a system of cultivation less intensely fixed upon cotton would bring up the yield per feddan to what it was formerly.

This would be the crowning of the admirable work that the British nation has carried on in Egypt during the last 40 years.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

Sir ARNOLD THEILER, K.C.M.G., D.Sc.
Director of Veterinary Education and Research, Union of South Africa.
The Study and Control of Animal Diseases in South Africa.

By Sir ARNOLD THEILER, K.C.M.G., D.Sc. (Cape.)

(Veterinary Education and Research, Union of South Africa.)

VETERINARY science is, if not the last, at least one of the last branches of applied biology to find its way to South Africa. The panzootics of the Old World known since time immemorial which appear at intervals, destroy large numbers of stock and interfere with agricultural progress in general, appear also in South Africa where they have repeatedly and for long periods jeopardised stock-farming. In addition to these old plagues, new ones appear unknown before and not occurring elsewhere. They seemed to come as the country became more populated with livestock. Thus South Africa was faced by problems, which still occupied the attention of the veterinarians of the Old World, as well as by those of which science had as yet no cognisance. Such was the state of affairs, when the government of the late colony of the Cape of Good Hope applied first for assistance from the old country, where the most devastating plagues, such as rinderpest and pleuro-pneumonia had been successfully dealt with by the beginning of the second half of the last century.

The conception of Veterinary Science, as put forth in this article, is the science which has for its object the prevention and cure of disease of animals, as it is applied by trained men according to principles taught in the established colleges of the old world and accepted as the result of observation. Wherever there are animals under the care of man, assistance will be given to those showing signs of disease, no matter what stage of civilisation the stock-breeding race may have attained to. This assistance may be rational and based on painstaking and good observation, or, as is more often the case, may be wholly irrational. It may be identified with the crude empirical state of Veterinary Science, since it is not the result of critical observation and deduction by specially trained men. It existed in South Africa among the nomadic natives long before the advent of the white man and is still to be found in all its original forms. It certainly influenced the white stock-breders when he came into contact with the
natives and traces of it bordering sometimes on crude superstition are occasionally still to be found. Undoubtedly in South Africa empiricism, where rational, has been of great assistance to the veterinarian and has paved the way for successful research. I am bold enough to assert that without the observations made by farmers, scientific research could not have made such rapid strides as it has done. This applies more particularly to diseases indigenous to South Africa.

The Cape Colony was the first to appoint an official veterinarian and was later followed by Natal. One at least of these men deserves special mention. He is the late D. Hutchison, who can be considered as the pioneer.

A new period of veterinary activity commenced with the advent of that formidable cattle plague known as rinderpest, which had traversed the whole of Central Africa, crossed the Zambezi, invaded Matabeleland, swept through Bechuanaland, and approached the Cape Colony and the late South African Republic in the most threatening manner, leaving practically no cattle in its trail. Even the game, particularly that most closely related to the bovines, suffered terribly and whole herds of buffalo were exterminated. The governments of the two republics, in which as yet hardly any legislation concerning stock diseases existed, found it advisable to ask for veterinary advice and appointed experts. The method of stamping out by slaughter was considered to be the only one with any prospect of success and was therefore recommended. It was rigorously carried out at first with some measure of success, but failed in the course of time and was abandoned. Meanwhile the need for more knowledge concerning the nature of rinderpest was realised by the veterinary experts. The problem of combating the disease had to be approached from the point of view of immunity; the aim being to find a practical method of immunising and thus saving the cattle. Accordingly scientists such as Professor Koch and later Bordet, who subsequently became one of the leading, if not the leading investigator in immunity. The names of Dr. George Turner, Professor Kolbe, Watkins-Pitchford and the writer may be remembered in this connection. Through the efforts of these men methods of immunisation were devised, which proved decisive in preventing further ravages and made possible the successful eradication of the pest. Scientific research had thus secured a great and lasting success.

Such diseases as pleuro-pneumonia, glanders, anthrax, quarter-evil, scab, etc., are still known in South Africa and outbreaks have at times assumed huge dimensions, but in general
veterinarians have not found themselves helpless in dealing with them.

The geographical, orographical and climatic conditions of the country are factors that give us the clue to the distribution of several diseases, their periodical reappearance and also their spontaneous disappearance. The animals coming into consideration are horses, asses, mules, cattle, sheep, goats and the ostrich. Not all parts of the country are equally suited for the breeding of these animals. Thus the high-lying grasslands are best suited for horses and merino sheep, whilst the karroo with its scerophytic vegetation is the main home for the fat-tailed sheep and the ostrich. Cattle generally thrive everywhere and particularly where none of the other classes of stock can exist, viz.: in the bush and low countries. Within these areas the climatic factors determine to a great extent the health of the stock. The conditions under which stock generally live are very favourable for the development and existence of ectoparasites, ticks and winged insects, which act as hosts for endo-parasites. An intimate adaptation of the latter to the former has taken place. A cycle in the evolution of the parasites has been formed, which for its fulfilment often requires two hosts. The domesticated animal is frequently the second host and being non-resistant, becomes the sufferer.

The South African stock diseases may be grouped into three main classes:—one caused by organisms of the animal kingdom, including the ultravisible viruses, one by plants and the third by deficient pastures. The principal diseases are caused by protozoa, or by ultravisible viruses that find access to the blood of the animals. These are also called tropical or sub-tropical diseases, which terms indicate their geographical distribution and the climatic conditions under which they are generally found. The primary cause is an endoparasite and the secondary cause or transmitting agent an ectoparasite. It is evident that the climatic influences that bear on the life of the ectoparasites are directly responsible for the presence or absence of the diseases, which these transmit. Hence we find in the course of a year, a period in which diseases are absent or dormant and one in which they are rife. Finally there are diseases known to travel in certain years from low to higher altitudes and across large tracts of country, simply because the climatic conditions, particularly the incidence of rains is spread over large areas and renders them suitable for the development of the ectoparasite. This applies particularly to tick and insect life.

In our researches into parasitic diseases we are guided by the following considerations:—

1. What is the cause of the disease?
2. If caused by any known virus, how is it transmitted?
3. Where is the reservoir of the virus?
4. Are animals that have made a natural recovery immune from further attacks?

These four points when settled give us a clear conception of the nature of the disease and indicate where it is possible to interfere with a view to combating it. The study of the aetiology of a disease is of the greatest importance, taking into consideration the ultimate object in view, i.e., the prevention of the disease. The first three points of our research schedule deal with this object. It is evident that the eradication of all Zoonooses must be possible through the removal of the cause. The destruction of the virus reservoir, which maintains the source of infection, should lead to the same solution. Although for some diseases one or other or all the circumstances leading to the appearance of the disease are well known, the breaking of the chain of events is as yet impossible, owing to the impracticability of applying quite simple measures over large tracts of country. Under such conditions the only course that can be adopted is to treat the individual animal by making use of the immunity which results from recovery from the disease, provided artificial immunisation is practicable. This is possible in a number of diseases and the results obtained have largely contributed to the popularity of the method among the farming community.

The class of diseases caused by parasites of the animal kingdom may be dealt with in two groups: one by protozoa, including the ultravisible viruses and the other in which metazoa, such as helminths and mites are the primary causes. Diseases caused by protozoa and ultravisible viruses can further be subdivided into two sub-groups—one in which the transmitting agent is a winged insect and the other in which it is a tick. To the former belong the trypanosomeiases of which, in South Africa the so-called Nagana of Zululand forms the classical example. Applying our schedule of inquiry to the study of Nagana we find that the trypanosome is the primary cause; the fly is the transmitting host and the game the virus reservoir. By removing any of the three links in this chain the disease would disappear. Removing the trypanosome is, as yet, out of the question, although curative attempts recently taken are most promising. Eradication of the fly is possible by destroying its natural haunts, which are the rank vegetation and undergrowth of the Zululand bush-country. This has been attempted, but its application on a large scale is impracticable. Better results were obtained by excluding game from the pastures occupied by the cattle. This is indeed the only way by which
in the past the disease was naturally kept at bay. It disappeared before the advancing civilisation, simply because the game disappeared.

To the group of insect-transmitted diseases belong horse-sickness in equines and Blue-tongue in sheep. Their causes are not identical, although they have many points in common in their epizootiology. They are caused by ultravisible viruses, which are filterable and inoculable and are present in the blood as soon as the fever reactions begin. Recovery, in both instances, confers a relative immunity. Both are intimately connected with the orographical conditions and the climate. The third point to be considered is the virus reservoir. In analogy with trypanosomiasis we believe in the existence of a reservoir which may be found not to be an equine or ovine animal. So far, experiments to ascertain whether recovered animals can act as virus carriers have not yet given decisive results. The interpretation appears to be, that they are not, although in horse sickness the transfusion of large quantities of blood, a considerable period after recovery, has shown the presence of virus in some of the recovered animals. Without the existence of a virus reservoir we cannot explain the sudden appearance of horse sickness in countries where there have never been any equines. The virus is probably present in some wild animal, not necessarily game, whence mosquitoes obtain it and accidentally carry it to the highly susceptible horse. The diseases will thus appear as soon as climatic conditions make mosquito-life possible. The same applies to Bluetongue. Experience and experiment have proved that in these diseases recovery is succeeded by an immunity. We have been able to utilise this both for the protection of equines against horse sickness and of sheep against Bluetongue. A method of sero-vaccination to protect mules against horse sickness was introduced in 1905 and since then annually applied to mules exposed in horse sickness districts. More recently a similar method has been introduced to protect horses against the same disease.

The second sub-group of diseases comprises those transmitted by ticks. Some of these were introduced within more recent times, as was Redwater caused by Babesia bigemina which was introduced with oxen from Madagascar. The most formidable is East Coast fever, caused by Theileria parva, which, although well under control, still causes much anxiety, and was introduced from East Africa. Biliary fever in horses caused by Nuttallia equi and Babesia caballi, also belong to this group. Piroplasma mutans should also be mentioned here.

The visible blood parasites transmitted by ticks are of two different classes, either endoglobal or extracellular as are the
Spirochaetes. A third subgroup comprises ultravisible viruses e.g. the cause of Heartwater in ruminants.

In this connection must also be considered Anaplasmosis of cattle. Although South African scientists were not the first in the field to discover tick-borne diseases, they can claim to have contributed a good deal towards the knowledge of the subject and to have established a sound base for their eradication. In the life cycle of a tick four different stages occur, viz.:—egg, larva, nymph and imago. Observation has established the periods the eggs require to hatch, the larvae and nymphae to moult and the female imago to engorge and to lay her eggs. Known also is the length of time they can live in the various stages and how often they can change their host. These are all points of the greatest importance from a practical point of view. It was observed that some ticks require only one host for their development, i.e. the larva once attached only leaves the host as a mature imago. A second group of ticks requires two hosts while a third requires three. The classification indicates the possibilities of transmission of diseases by ticks, and the knowledge was of the utmost practical importance when it came to devising ways and means of preventing the spread of these diseases, more particularly in the application of adequate dipping methods. The third point of interest is the virus reservoir. Two classes can be distinguished, one in which the recovered and immune animal acts such and the other in which this is not the case. To the former belong diseases caused by the Babesidæ, to the latter those caused by Theileridæ. We are thus confronted by the remarkable fact that an immune animal, apparently healthy in all respects, growing and developing normally is constantly infected and acts as a virus reservoir. This holds good also for diseases caused by spirochaetes and anaplasms. It is evident that the veld, where the ticks are not destroyed is a constant source of danger. Indeed we may call all diseases, in which the immune animal is a virus reservoir, acclimatisation diseases, through which all animals whether born on the veld or imported have to pass. The eradication of ticks is attempted on a large scale by means of dipping in an arslenical solution. Experience has shown that the control of tick-borne diseases and even their eradication has become possible by dipping.

Whilst the diseases caused by protozoa are most prevalent amongst cattle, a different class of parasites belonging to the metazoa viz.: helminths, particularly nematodes, the so-called wire-worms (Haemanchus contortus) have been the greatest source of losses among sheep. The biology of this worm was studied in a systematic manner, again from the point of view laid down in our
schedule of research. Of course not all questions enter equally for consideration and the main ones are: How and when does an animal become infected and where is the reservoir to be found? It was found that the larval worm after its second ecdysis is the infecting agent. Infection can only take place under certain definite climatic conditions. The sheep acts as the reservoir inasmuch as the egg-laying female is lodged in its stomach and consequently for a considerable time it casts eggs over the pasture. The mature larvae can live a year and so constantly reinfect the grazing sheep. It was thought that if the worms in the sheep could be destroyed at intervals to prevent the reinfection of the farm, it would be possible to clean both the sheep and the farm at the same time if carried out over a period of at least one year, i.e. the time the mature larvae can live on the veld. This theoretical consideration led to practical results. It was known that in arsenite of soda and copper sulphate we had very powerful parasiticides. A combination of the two drugs in powder form was prepared in definite relations and quantities and proved that a thorough disinfection of the stomach of the sheep was possible. A monthly repetition of the dosing during the summer months, when the pasture is infected is sufficient to clean both sheep and farm if regularly and systematically carried out.

Another disease caused by metazoan parasites is sheep-scab, which also formed the subject of extensive investigations. The life history of Psoroptes communis, the cause of sheep-scab brought new ideas as to an effective line of treatment of the disease. Based on investigations dating back to the first half of the last century, which were never challenged, it was recommended to dip sheep at intervals of 14 days. Our researches show that this interval was too long and had to be shortened to not more than nine days, this being the interval required for the evolution of the mite from hatching to egg-laying.

There remain to be discussed diseases of vegetable origin. These may be divided into two groups, one including the infectious and the other the intoxicating. To the former belong those caused by bacteria and fungi or their toxins. It is an interesting fact, that in South Africa there are but few indigenous diseases caused by these agencies and probably none which are not known in Europe. There is, however, one that deserves to be mentioned on account of its economical importance, viz.: Aspergillosis of ostrich-chicks, the so-called chick-fever caused by the common fungus Aspergillus fumigatus. At times it has interfered seriously with ostrich breeding, killing off the chicks hatched in incubators. The cause of the mortality was the common mould mentioned, which was found to
infest the air chambers of the egg, the incubators and the receptacles in which the chicks were kept after being hatched. The young birds thus breathed an atmosphere of spores, either before hatching or immediately after, which were inhaled into byphae penetrating the lungs and killing the birds. Once the cause was recognised, prevention was comparatively simple.

South Africa possesses a number of interesting diseases due to vegetable intoxications. I shall mention in the first instance the so-called Lamzielte of cattle caused by bacterial toxins. It must, however, be well understood that these bacteria do not live in the system of the living animal but grow only in cadavers where they produce a very toxic substance. In certain parts of South Africa cattle frequently eat bones, which leads to the disease when the bones contain this toxin. Thus the presence of one disorder, the Osteophagia not fatal of itself, which may be called a deficiency disease leads to another, Lamzielte, which is fatal and would not be contracted in the absence of the former.

Intoxications caused by the consumption of higher plants (Angiosperms) at times assume the dimensions of true plagues as is the case in Geeldikkip of sheep, caused by Trilurus terrestris, a plant which suddenly appears over large tracts of the Karroo after a drought followed by rains. The consumption of these plants is, however, not always toxic and the circumstances under which this is the case are not fully known.

We also know of some diseases that appear only weeks or even months after the plants are eaten. Such are:—Gaauwziekte in sheep caused by Vang- neria pygmea, Pushing-disease in cattle caused by Matricaria nigellifolia and Jaggielke in horses caused by Cratolaria dura. In the latter disease we have even the extraordinary fact that feeding of the autoclaved plant gives rises to an inflammation of the lungs, accompanied by a typical fever and preceded by an incubation period, both of which phenomena have so far only been known in true infections.

The resume of the work done and the results obtained show the great field for research Veterinary Science has in our sub-Continent. We are justified in concluding that with the general advance in agriculture many of the diseases referred to will disappear. The improvement in stock-breeding during the last decade is to a great extent the outcome of the disappearance of the devastating plagues and a consequence of the better knowledge of the cause of disease generally. With the advent of better breeds, better care will be taken of stock. It follows that experts in Veterinary Science will be required, and these are being trained in the Faculty of Veterinary Science of the University of South Africa.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

TYPES OF ROLLING STOCK AND EQUIPMENT ON THE SOUTH AFRICAN RAILWAYS.

1. The Kimberley Mail.  2. A Main Line Corridor Restaurant Saloon.  3. A Suburban Ten-Compartment First-Class Coach.
4. One of the Modern Locomotives now employed on the System.  5. Another snapshot of the Kimberley Mail.
9. A Mail Train leaving Pretoria Station.  10. A Red Cross Saloon as used in South-West Africa during the War.

Photographs by Courtesy of the South African Railways Publicity Department.
Rolling Stock and Equipment of the Railways on the Route
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE.

South African Railway Locomotives.

The "Garratt" Articulated Locomotive. It weighs over 145 tons, and has a tractive power of over 46,000 lb.

Class M.H. Locomotive
Locomotives and Rolling Stock on the Route.

Now that even the tourist can travel those 7,000 miles from the Cape to Cairo without any pretence at privation and hardship, a description of the accommodation which enables him to do this is of great interest and importance. The railways, as such, have been dealt with very fully by other writers in this book and so my mission is to confine myself solely to the vehicular traffic on which the journey is accomplished, i.e., the locomotives and other tractors and the carriages and trucks of the railways.

Of the motor cars by which it is still necessary to bridge the comparatively short gap of some 500 miles between Stanleyville in the Northern Congo and the White Nile, on the Sudan border, I have nothing to say as their types are ephemeral and can be changed and will be changed as occasion requires until the day when the section which is now traversed by motors is converted into a further extension of the railway system.

It is only as a passenger line that the Cape to Cairo route can be looked at as a whole at the present day because the breaks of gauge and other interruptions to the railway journey by the lake and river sections prohibit its use as a through route for ordinary merchandise traffic.

It is only natural in a continent like Africa, where all developments are effected by penetration from the coast towards the interior, whatever may be the point along the coast line at which the attack may be made, that the degree of comfort and convenience in travelling should be at its maximum at the two ends of the journey and at its minimum as it approaches Central Africa from those two points northwards and southwards respectively.

There are few people, however, outside South Africa who realise that so far back as twenty-five years ago a passenger could travel from Cape Town northwards into the heart of Rhodesia in trains which even then compared not unfavourably except for speed with some of the trains-de-luxe in Europe at that time, and from the point of view of comfort, were far ahead of anything of the kind in North or South America.

Still less do they realise that at the present day it is possible to travel from Cape Town right into the heart of the Belgian
Congo to Bukama, a distance of 2,600 miles without a break of gauge and in still more luxurious trains.

There is a popular fallacy among people whose experience of travelling is limited, to the effect that a narrower gauge necessitates narrower rolling stock, and that consequently the South African standard gauge, being 3 ft. 6 ins. as against the standard gauge in Britain of 4 ft. 8½ ins., the South African rolling stock must be proportionately narrower. In practice such is not the case, as the difference in width of the carriages and trucks of South Africa and England is insignificant and in some cases nil. Thus on the narrower gauge of the South African rolling stock there is virtually the same accommodation as on that of the wider gauge railways elsewhere. This of course necessitates a greater overhang of the rolling stock beyond the rails.

The disadvantage of excessive overhang is that it militates against the speed of the traffic more particularly in negotiating curves. On the other hand the advantage of the narrower gauge is that it permits of more abrupt curves than the wider gauge, a highly desirable feature in a continent like Africa.

The 3 ft. 6 in. gauge may be considered as already the standard gauge of the African continent and must eventually be the minimum gauge adopted all through the systems when the railways of that continent are linked up. At the present day the whole of the railways on the Cape to Cairo route are of that section, with the exception of the Egyptian track, which is 4 ft. 8½ ins., and certain short isolated lines in the Belgian Congo which are built of one metre gauge. These last will unquestionably have to be widened to the 3 ft. 6 in. gauge when the projected extensions northwards from the present railhead at Bukama in the Southern Congo link them with the South African system.

Apart from the main Cape to Cairo artery, all the existing feeder railways, viz., those already linking up with it from the other ports in the Union and also those in South West Africa and Portuguese East Africa, are of 3 ft. 6 in. gauge as are also those projected feeders which may be classed as well within sight of accomplishment.

The first of these to be completed will be the 3 ft. 6 in. Sinoia-Kafue cut-off which requires the construction of only about 200 miles to tap the main line northwards at Kafue, in Northern Rhodesia. The other important feeder now in progress is the line from the west coast at Lobito Bay in Portuguese territory which will traverse the whole of Angola and tap the main line at Tshilongo in the Southern Congo. The completion of the Benguella-Tshilongo and the Beira-Kafue feeders will have the effect of completing a trans-African direct line without
any break of gauge from the east to the west coast.

I have touched upon the question of gauges here because they have a direct bearing upon the design and capacity of the locomotives and rolling stock used on them and it is difficult to account for the features of the latter without a knowledge of the former.

In dealing with the southern section of the route it is difficult to separate the Rhodesian from the South African Union Railways from the rolling stock point of view, for although the latter only carry the main line traffic on the Cape to Cairo route a distance of 774 miles, from Cape Town to Vryburg, their through trains run over the Rhodesian system, first from Vryburg to Kalomo (over the Rhodesian Railways), 960 miles, thence to Broken Hill (on the Mashonaland Railway) 281 miles and finally from Broken Hill to the Congo frontier at Sakania (on the Rhodesia, Katanga Junction Railway and Mineral Co.'s line) 141 miles making a total of 2,156 miles from Cape Town.

There is no reason, save international arrangements, why these same trains should not run further on from the frontier over the Belgian Katanga line to the most northerly point of the unbroken system to Bukama, a further distance of 442 miles.

The South African Railways, with the railways of the South West African Protectorate, now incorporated with this system, are by far the most elaborate and extensive of all African railways and are dealt with in a separate article.

In general appearance most of the locomotives in use on railways in British Africa (with the exception of a few supplied by American and Canadian firms of characteristic-ally American appearance) re- present a compromise between British and American practice. In most cases cowcatchers are fitted, though in a few cases, such as the locomotives in use on the Shire Highlands Railway, the cowcatcher is omitted. Outside cylinders are invariably employed, often with Walschaert valve gear. Sandboxes on the top of the boiler and large lantern headlights are other distinctive features.

In Northern and Southern Rhodesia the locomotives and rolling stock though, as stated above, owned by three separate companies and running on a system aggregating 2,217 miles are generally speaking uniform in types and styles with those of the South African Union. They possess 164 engines of various types, 199 coaches (three classes), 1st and 2nd class saloons, sleeping and private saloons, service coaches, dining and sleeping and post-office cars, and native carriages.

The merchandise stock consists of 2,235 vehicles, including open and covered goods wagons, box platform, sheep, cattle and tank trucks, refrigerating cars, brake
and breakdown vans and ballast and explosives wagons.

With the exception of 36 American, all the locomotives are of British make and the same is the case with all the coaching stock. Canada, the United States and Germany have each contributed a small amount of the merchandise stock.

The coaching and merchandise and mineral stock is generally speaking of bogie type, each carriage and wagon running on two four-wheeled pressed steel bogies and having steel underframes of the built up or pressed type.

The rolling stock employed on the Portuguese railways from Lourenco Marques and Beira, for the purpose of tapping the railway systems of the South African Union and Rhodesia respectively are based entirely on that of these last two territories and require no particular comment.

Such is the case also as far as the locomotives and to some extent the passenger vehicles are concerned with the Belgian line (Katanga Railway) from the Northern Rhodesian border, which carries the Cape to Cairo route a further step northwards to Bukama where the first break in the railway system from the south occurs.

The original object of this line being to exploit the enormous mineral resources of the surrounding country the locomotives and rolling stock have followed primarily the principles laid down for mining traffic and it is the goods rather than the passenger traffic which has developed the more rapidly. These developments during the last decade are best shown in table form.

<table>
<thead>
<tr>
<th></th>
<th>1910</th>
<th>1924</th>
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<tbody>
<tr>
<td>Engines (various types)</td>
<td>22</td>
<td>70</td>
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<tr>
<td>Coaches (1st &amp; 2nd)</td>
<td>5</td>
<td>7</td>
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<tr>
<td>&quot; (3rd class)</td>
<td>6</td>
<td>18</td>
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<tr>
<td>Dining cars</td>
<td>—</td>
<td>2</td>
</tr>
<tr>
<td>Inspection carriage</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Wagons (various)</td>
<td>290</td>
<td>986</td>
</tr>
</tbody>
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Practically the whole of the merchandise stock is of the bogie type.

From here the journey is taken up by steamers on the River Lualaba, which eventually becomes the mighty Congo itself.

It is doubtless the existence of a network of more or less navigable rivers, which are dealt with elsewhere, that has retarded railway construction so greatly in the Belgian Congo. Suffice it to say that in spite of all other progress that has been made in other directions the Belgian Congo considering its known resources and trade is far behind all other territories on the continent of Africa as far as railway facilities are concerned.

Of the locomotives and rolling stock on the short isolated metre gauge lines from Kongolo to Kindu and from Ponthierville to Stanleyville, as also the railway connecting Lake Tanganyika with the river system at Kabalo there is nothing of interest to say. The locomotives and stock are all light and of simple types and must be merely regarded as a
makeshift until such times as these lines are brought up to the standard of the other railways on the main route.

It is at a point on the Katanga Railway, viz. at Tshilongo, about 70 miles from the present rail-head, that a junction with the Benguela 3 ft. 6 in. railway is to be effected. But while arrangements have now been made for the completion of the Benguela Railway, the Belgian section is making but little head-way in spite of the extraordinary advantages which will accrue to the Katanga district when it is completed. The Portuguese section of the Benguela Railway will, when finished, be 764 miles; of this some 520 miles are completed up to the present time.

This section which, until completed, is only of academical interest as far as the Cape to Cairo route is concerned, is destined when that takes place to be the most important of all the feeders to that main artery.

On the Benguela Railway at the present day there are 29 locomotives of various types, including four of the rack type, with an aggregate tractive power of 512,400 lb. Those of the most powerful non-rack type (of which there are four) are capable of drawing a load, exclusive of the engine and tender, of 350 tons up a gradient of 1 in 50 and the rack locomotives are capable of drawing 160 tons up a gradient of 1 in 16\(\frac{2}{3}\). All, except the rack locomotives, which are German, are of British manufacture.

As is natural with a railway which is under construction and cannot attain anything like its proper passenger traffic until it has linked up with its objective, the passenger accommodation is small but of a higher order. All passenger coaches are on the bogie principle and of British make. There are 20 coaches, including 2 petrol and 7 other service coaches. All the six 1st class coaches are saloons, two of them having sleeping accommodation. There are but four 2nd class coaches and four coaches for natives.

The goods stock comparatively speaking is rather considerable which to a great extent is due to the wagons and trucks required for the construction work. Altogether there are 233 on the line, all of the bogie type with the exception of 30 small four-wheeled wagons, most of which have been constructed locally.

The total load capacity of the goods stock is 10,960,000 lb., of which the bogie type are responsible for 10,390,000 lb. As stated earlier, the Benguela Railway, being of the 3 ft. 6 in. gauge, will link up naturally with the ever growing railway systems of the southern half of Africa. When completed, quite apart from its tapping the Cape to Cairo route, and its value as a factor in the first through line from the east to west coast of Africa, its effect will be to shorten the journey from Europe to the Southern Congo and Northern Rhodesia by about ten days.
Apart from the Benguella Railway, the only feeder to the main artery from the west coast which can be said to be “within sight” is the extension of the Katanga Railway from Bukama to Ilebo, on the Kasai River, some 625 miles. This has been begun and the line will eventually be carried on to Kinshasa, where it will link up with the 2ft. 6in. gauge line (shortly to be widened to 3ft. 6in.) between Leopoldville and Matadi. This will, of course, involve the provision of larger rolling stock. There is no prospect at present of there being a feeder from any of the French West African possessions and consequently their rolling stock does not enter into the question.

There is, of course, an existing feeder from the south-west coast as both Walvis Bay and Luderitz, in the South West African Protectorate, connect with it at De Aar in the Cape Province but the route is so circuitous that it can hardly be classed as a feeder from the point of view of utility and, in any case, the rolling stock has been dealt with in connection with the South African Railways of which this system is now an integral part.

In like manner the rolling stock of the existing south-eastern feeders from Port Elizabeth, East London and Durban is a part of the same system, and those from Lourenco Marques and Beira, in Portuguese East Africa, as already stated, have rolling stock which is based on the more ordinary types of the South African and Rhodesian railways as far as the through traffic is concerned.

Going northwards along the East Coast, the first feeder line we come to is the Central Tanganyika Railway from Dar es Salaam to Lake Tanganyika at Kigoma, constructed by the Germans. This and the short Usambara line, near the Kenya border, being modelled on the Uganda system, are of metre gauge. Their locomotives and rolling stock, with the exception of a few vehicles borrowed from Kenya, is all German and inferior at that, as it has suffered badly from the effects of the war. Much has already been scrapped and a good deal more is merely being used until it can be replaced. Practically the whole of it is pre-war stuff and certain of the locomotives still in use date from last century.

Of the 86 locomotives recently listed as belonging to these railways between 20 and 30 have recently been scrapped, leaving a total of about 60 in use on the two lines. With the engines in their present state it is impossible to give an accurate figure to represent their tractive efficiency. The most powerful type, of which there are still 14 in operation, are of the 2-8-0 tender type and weigh 71 tons, 4 cwt. These were designed to exert a tractive force of 24,400 lbs. Probably the aggregate tractive power of all the engines on this system to-day does not exceed 700,000 lb., though collectively the 86
engines were designed for well over 1,000,000 lb.

As with the locomotives, so it is with the rolling stock. Practically the whole of it is German and very much the worse for wear. Out of a total of 95 coaches, nine have recently been scrapped. Many of those still in use have been re-built or patched up and some converted from wagon stock, only 9 are of the bogie type and, with the exception of the Governor's coach which has been re-built, there is nothing in the passenger stock to suggest luxury of any sort or even comfort. This of course will be remedied with time, for in other respects this railway has its definite uses either as an independent unit or as a feeder to the Cape to Cairo route. Though built primarily by the Germans for strategical reasons its existence is justified for the opening up of the country's resources.

But the Germans at all events designed their coaches to accommodate as great a quantity of people as possible, though they sacrificed the quality of the accommodation and the speed of their traffic in the process. Most of the more important passenger coaches have a width of 9 ft. 6 in. and over, many of them being 9 ft. 8 in. and some 9 ft. 10 in. This last occasions an overhang of the carriage on each side of the rails amounting to rather more than the width of the gauge. Thus two thirds of the width of the rolling stock is actually outside the rails.

Turning to the merchandise stock we find a curiously mixed collection of vehicles and most of them of primitive types. Here again, out of a total of nearly 800 miles on these two lines, less than 50 are of the bogie pattern and, although some of them are almost as wide as the widest of the passenger coaches, and a few are 39 ft. long, two-thirds of them are under 18 ft. and many are less than 15 feet.

The Central Tanganyika Railway, such as it is, with the lake service from Kigoma to Albertville in the Congo, and the Belgian railway thence to Kabalo, may claim to be an existing feeder to the Cape to Cairo route. Of the steamers which traverse Lake Tanganyika on this route, one only, a small 20 ton boat is British. The other three, viz., one of 350 tons and two tugs of 35 tons are Belgian. There are, however, two more under construction, viz., a British of 100 tons and a Belgian of 600 tons.

In strong contrast with the Tanganyika line but, alas, of the same metre gauge, is its elder sister, the so-called Uganda Railway in the adjoining Kenya Colony, immediately north of Tanganyika and connecting the east coast at Mombasa—Kilindini, with Lake Victoria Nyanza at Kisumu. This railway, exclusive of the two short sections in Uganda possesses 118 locomotives. Eight different types are used. Of these the most powerful are the G. Class-4-8-0, super-heated. The success of
these engines, of which up to the present there are only two on this railway, seems to point to their extended employment. Hitherto, however, the most popular engines on this railway have been of the same class but less powerful and without superheating. Of these there are 41. The coaching stock comprises 252 vehicles and in these generally speaking luxury may be said to have given place to utility. There are 53 bogie vehicles out of the 136 devoted to passenger accommodation and there is nothing special in the design of any of them which calls for comment. Naturally the destructive effects of the war have been felt here as in Tanganyika, and these effects have left their mark on the locomotives and rolling stock but are gradually being eliminated, much of the body work being constructed on the spot.

There is plenty of scope for improving the quality of the passenger accommodation when times are better but very rightly in the meantime money and attention are concentrated more on facilitating and increasing the goods traffic, much of which is of a very high order.

The merchandise stock consists of 1,445 vehicles with an aggregate load capacity of 22,460 tons. Of these no fewer than 616 are bogie vehicles. All of these have a load capacity of over 25 tons.

Before dealing with the Kenya line as a potential feeder to the Cape to Cairo route it must be mentioned that this important railway with its gradually extending branches, one of which already extends into the Tanganyika territory, should be considered in conjunction with the two lines existing in the latter country as forming the nucleus of a future network of railways which as they extend should be as important in their way in opening up the East Coast as have been those of South Africa elsewhere. Further it is quite probable that the Uganda Railway system may in the future link up with lines of similar gauge in the Eastern portion of the Belgian Congo, and also be extended northward to meet the open water of the White Nile opposite Rejaf.

The 61 mile metre gauge railway in Uganda from Jinja to Namasagali possesses four locomotives, viz., three “B” Class 2-6-0 and one “N” Class. The coaching stock, which is modelled on the larger Kenya section of this railway, consists of ten vehicles, viz., three composite passenger coaches, four third class coaches, one inspector’s coach and two brake vans. The merchandise stock comprises 80 vehicles, viz., 44 covered goods vans, six covered bogie vans, 26 low-sided trucks and four water tanks. The truck capacity is shortly being increased. In the Uganda Protectorate there is also a 6-mile line from Port Bell (on Lake Victoria) to Kampala, with two locomotives and coaches and 24 goods vehicles. This, however, has no bearing on the Cape
to Cairo route but is purely a local line for handling the rapidly extending cotton trade.

Before leaving the question of the east coast railway system mention must be made of the modest but admirable flotilla on Lake Victoria Nyanza, which comprises nine steamers of varying cargo capacity from 40 to 750 tons and of horse powers from 50 to 530 I.H.P. The total cargo capacity of the fleet is 2,893 tons and the total I.H.P., including a tenth vessel, a tug which carries no cargo, is 3,410. Between them these steamers have accommodation for 63 first class and 46 second class passengers. Four of the above vessels burn wood fuel and the others are arranged to burn oil. Five of them attain a speed of 9 to 10 knots an hour and the others from 7 to 8 knots. Their drafts when loaded vary between 4 ft. and 7 ft. 6 in., and their displacement tonnage between 50 and 1,200 tons. The two ships with this maximum displacement, viz., the Usoga and the Rusiuga each carry 750 tons of cargo. Both have a single screw and burn oil fuel and travel at 8 knots. Four of these ships have twin screws, the largest and most powerful being the Clement Hill, with 550 I.H.P., 1,100 tons displacement, 7 ft. draft, 450 tons cargo capacity, speed 10 knots, length 225 ft., breadth 32 ft.

On Lake Kioga (Section 4 of the above route) there are only three steamers, of 80, 90 and 150 tons respectively, carrying passengers and cargo from Namasagali to Masindi Port. In addition there are a flotilla of 16 lighters averaging a carrying capacity of 100 tons.

Having now dealt with the rolling stock on all the various railways on the main Cape to Cairo route as far north as Lake Albert and with that of all the feeder lines that connect already with the main route south of that lake, we come to the White Nile. Two vessels, viz., the "Samuel Baker," a side wheel passenger and cargo steamer, and the "Livingstone," a single screw steamer, take the traffic southwards from Butiaba to the White Nile.

The Sudan Government Railways control this river traffic from Rejaf southwards from which point to the end of the journey, some 1,750 miles as the crow flies, all suggestion of discomfort ceases and luxury increases as we proceed northward.

From Rejaf one may either go the whole way to Khartoum by the river or may join the Sudan Government Railways at Kosti, some 200 miles further south. The flotilla which carries the traffic on the White Nile and also on a section of the Blue Nile from Khartoum to Rosaires, which last is not on our route, consists of 30 well appointed river steamers and 100 barges.

Harking back to Kosti and joining the tram there we have an uninterrupted journey northwards through Khartoum, to Wadi Halfa, the terminus of the
Sudan Government Railways of nearly 800 miles.

Here we find ourselves once more on a 3 ft. 6 in. track with rolling stock which is in many respects similar to the South African Railways and in no respect inferior to that great system in comfort and luxury.

To deal first with the locomotives, of which there are 110 on the main line, we find that 15 of them, all built between 1896 and 1900, are American and all the rest and more recent ones are British. Their details are as follows:

4 Baldwin 4 coupled passenger engines; 11 Baldwin “Mogul” type goods; 27-6 coupled mixed traffic engines 4-6-0 type; 21 goods engines 18 x 24, 4-6-0 type; 5 “Mogul” type engines, 2-6-0; 4 “Atlantic” type 4-4-2, cyls. 18 x 26; 15 “Pacific” type 4-6-2, cyls. 18 x 24; 10 “Mikado” type 2-8-2, cyls. 20 x 26; 15 shunting engines of various types.

The coaching stock consists of about 150 vehicles, comprising luxurious sleeping and dining cars, 1st, 2nd, and 3rd class, and a 4th class for natives. In addition there are about 60 service cars. The sleeping cars and first class coaches are all of the domed type, are 9 ft. wide and built on 60 ft. frames. All are corridor and bogie stock and are marshalled to form four trains de luxe.

The sleeping cars are particularly comfortable, each compartment measuring 6 ft. 4 ins. by 6 ft. 6 in. and containing only two berths, washing accommodation and electric fans. Smoked glass is used for the windows.

There are approximately 1,000 merchandise vehicles which in type follow very closely those of the South African Railways. They are mostly of the bogie type and are vacuum braked throughout.

Leaving the train at Wadi Halfa, the journey northwards is continued by steamer, still under the control of the Sudan Railways, although in Egyptian territory, to Shellal, near Aswán. The flotilla of this section of the journey consists of eleven perfectly appointed stern-wheel steamers and twenty barges.

The steamers on tourist and mail services are well-equipped with cabin accommodation and the standard of catering is high. The largest units of this fleet are about 150 ft. long by 30 ft. beam and are of 150 horse power.

The total fleet of the Sudan Railways on the various sections of the Nile is 44 steamers. Of these ten are allotted to patrol work. Regular postal and passenger services are maintained on all routes. All steamers are controlled by the Engineer-in-Charge when afloat, the actual navigation being done by native reises.

Reverting to the Sudan Railways, the total length of the lines open is approximately 1,550 miles, of which as already stated, the main line measures about 750 miles. The balance
SUDAN RAILWAYS

is made up by various branches of which that which connects the main line with the Red Sea at Port Sudan and Suakin is the most important. This line, which is 305 miles long, is the most northerly feeder from the coast to the Cape to Cairo route.

The next most important branch is westwards from Sennar to El Obeid at the southern extremity of the main line. It is 145 miles in length.

We now find ourselves on the Egyptian State Railways which are dealt with in a separate article.

One of the electric locomotives in use on the recently electrified Natal Railways.
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

South African Railways Coaching Stock.

Top: A First Class Corridor Coach
Bottom: A Composite Bogie Carriage
The progressive developments in the size and tractive force of locomotives on the railways in South Africa are more readily portrayed by illustration than by description. The accompanying selection of photographs, prepared to proportionate scales, shows in progressive comparison, the remarkable developments in dimensions, weight and tractive force, which have taken place since the introduction of the earliest locomotives in South Africa.

The combined weight of the first tender engine placed in traffic in the Cape Province, 45 years ago, was 38 tons, its tractive force being 7,200 lb. The class M.H. or Mallet engines placed in service in South Africa in 1915 have a combined weight of 180 tons with a tractive force of 53,750 lb. This is the largest locomotive in the world working on lines of less than 4ft. 8½in. gauge. The most striking developments have taken place since 1910, and the Union Railways to-day carry some of the heaviest and most powerful 3ft. 6in. gauge locomotives in the world.

A comparison of the locomotives, coaches and wagons used on the 4ft. 8½in. gauge railways in Great Britain and Australia, and on the 5ft. 3in. gauge railways in Australia and the 5ft. 6in. gauge lines in India, with those in use on the 3ft. 6in. gauge railway in South Africa, at once shows the remarkable progress in railway equipment that has taken place in the Union. In spite of the narrower gauge, the Union rolling stock compares very favourably with the British stock as regards power, carrying capacity and dimensions.

A notable feature is the width of the S.A.R. coaches. Though the gauge is 1ft. 2½in. narrower, the S.A.R. 1st class side-door suburban stock is slightly wider than the British stock, with perhaps one or two isolated exceptions, such as a Great Western dining-car, while the
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

South African Railways Rolling Stock

<table>
<thead>
<tr>
<th>Railway</th>
<th>Type of Carriage</th>
<th>Length</th>
<th>Width</th>
<th>Tare</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. &amp; N. E.</td>
<td>1st class sleeping coach</td>
<td>58 6</td>
<td>9 0</td>
<td>78,400</td>
</tr>
<tr>
<td>S. A. Railways</td>
<td>1st</td>
<td>63 0</td>
<td>8 9</td>
<td>76,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. &amp; N. E.</td>
<td>(L. &amp; N. E.) Composite coach</td>
<td>56 0</td>
<td>8 6</td>
<td>77,392</td>
</tr>
<tr>
<td>S. A. Railways</td>
<td></td>
<td>63 0</td>
<td>8 0</td>
<td>78,900</td>
</tr>
<tr>
<td>L. M. &amp; S.</td>
<td></td>
<td>65 0</td>
<td>9 0</td>
<td>94,080</td>
</tr>
<tr>
<td>Gt. Central</td>
<td>(L. &amp; N. E.) 1st class dining car</td>
<td>60 0</td>
<td>8 9</td>
<td>84,000</td>
</tr>
<tr>
<td>S. A. Railways</td>
<td></td>
<td>62 6</td>
<td>8 9</td>
<td>80,000</td>
</tr>
<tr>
<td>Do. G.E.</td>
<td>Section 1st class suburban coach</td>
<td>55 5½</td>
<td>8 10</td>
<td>61,508</td>
</tr>
<tr>
<td>S. A. Railways</td>
<td>(corridor)</td>
<td>63 0</td>
<td>8 9</td>
<td>74,000</td>
</tr>
<tr>
<td>S. A. Railways</td>
<td>(side door)</td>
<td>60 0½</td>
<td>9 1</td>
<td>71,300</td>
</tr>
</tbody>
</table>

Above: A comparison of the coaching stock with that of the leading British Railways. Below: The wagon stock compared with British Railways.

<table>
<thead>
<tr>
<th>Railway</th>
<th>Type of Wagon</th>
<th>Length</th>
<th>Width</th>
<th>Tare</th>
<th>Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. &amp; N.E. (N.E.</td>
<td>Hopper Coal Wagons</td>
<td>36 0</td>
<td>8 0</td>
<td>36,400</td>
<td>89,600</td>
</tr>
<tr>
<td>Section)</td>
<td>Hopper Coal Wagons</td>
<td>40 6</td>
<td>8 2</td>
<td>40,880</td>
<td>100,000</td>
</tr>
<tr>
<td>L. M. &amp; S.</td>
<td>Bogie High-sided Wagons</td>
<td>36 0</td>
<td>8 0</td>
<td>29,344</td>
<td>67,200</td>
</tr>
<tr>
<td>S. A. Railways</td>
<td>Bogie High-sided Wagons</td>
<td>40 0</td>
<td>8 0</td>
<td>39,700</td>
<td>100,000</td>
</tr>
<tr>
<td>L. &amp; N.E. (N.E.</td>
<td>Covered Goods Wagons</td>
<td>17 0</td>
<td>8 6</td>
<td>15,080</td>
<td>26,880</td>
</tr>
<tr>
<td>Section)</td>
<td>Covered Goods Wagons</td>
<td>24 7½</td>
<td>7 9½</td>
<td>16,850</td>
<td>30,000</td>
</tr>
<tr>
<td>S. A. Railways</td>
<td>Maize and Covered Goods Wagon</td>
<td>37 0</td>
<td>7 9</td>
<td>40,000</td>
<td>80,000</td>
</tr>
<tr>
<td>L. &amp; N.E. (G.E.</td>
<td>Covered Goods Wagon</td>
<td>19 3</td>
<td>7 9</td>
<td>14,560</td>
<td>22,400</td>
</tr>
<tr>
<td>Section)</td>
<td>Cattle Wagons</td>
<td>19 3</td>
<td>7 11½</td>
<td>16,354</td>
<td>22,400</td>
</tr>
<tr>
<td>S. A. Railways</td>
<td>Cattle Wagons</td>
<td>24 7½</td>
<td>7 9½</td>
<td>15,900</td>
<td>47,000</td>
</tr>
<tr>
<td>S. A. Railways</td>
<td>Whale Wagon</td>
<td>68 0</td>
<td>12 0</td>
<td>74,700</td>
<td>179,200</td>
</tr>
</tbody>
</table>
The standard width of the corridor sleeping coaches is only 3 in. less than the width of coaches of this type on the British Railways. The table on the opposite page is of interest for purposes of comparison.

Very few companies in Great Britain have a longer coach than the S.A.R. standard of 63 ft. The majority of the British coaches of considerable length are carried on six-wheeled bogies, whereas four-wheeled bogies are used on the Union coaching stock. The standard first-class main line saloons have a side corridor running the length of the coach, crossing over from one side to the other at the centre of the vehicle. Two lavatories are fixed in the centre of the coach. At one end of the vehicle there are three four-berth compartments and one two-berth, and at the other end are two four-berth and two two-berth. Each compartment is fitted with wash basin, steam radiator and folding table. All coaches are electrically lighted, and a recent feature is a reading lamp recessed into the side of the coach for the convenience of lower berth passengers.

The statement on the opposite page affords a comparison of the principal dimensions, tare and load of the wagon stock of the Union Railways with a few typical examples of British wagon stock.

It will be seen that the South African Railways have in service a type of vehicle larger than those in general use on the British Railways. The North Eastern and Midland Railways have in service high capacity steel wagons but of a smaller type than those of the S.A.R. The ratio of load to tare is better on the Union Railways, particularly in the case of the 4-wheeled cattle wagons in which the tare is less by 454 lbs. and the load greater by 24,600 lbs. in favour of the Union stock.

Needless to say, traffic conditions in South Africa differ materially from those on the British Railways, but the comparisons quoted serve to show the developments that have taken place in engines and rolling stock in South Africa.

The average weight per engine is now 67.62 tons, compared with 52.16 tons in 1911. There are now 656 engines in traffic capable of exerting a tractive force of over 30,000 lb. each compared with 101 in 1911, while 21 engines are capable of exerting a tractive force of 46,000 lb. and upwards. There were no engines of this capacity in service in 1911. The total number of engines in 1924 was 1,861, and many more were on order. The aggregate tractive force was 46,022,501 lb. A new type of articulated locomotive, the Garratt, has proved very successful, both on 3ft. 6in. and narrow (2ft.) gauge feeder lines.

The number of coaches in service on the South African Railways in 1924 was 3,087.
Early South African Rolling Stock

Engines and "Tram" of the old Netherlands South African Railway Co., commonly known as Z.A.S.M.
compared with 2,140 in 1910. The number and load capacity of merchandise stock on the Union Railways have also increased considerably during the past ten years.

The total carrying capacity of goods stock in 1924 was 647,103 tons of 2,000 lb., an increase since 1909 of 264,745 tons.

For coal traffic and general merchandise of heavier type, steel bogie wagons are used, the latest vehicles having a capacity varying from 100,000 lb. to 80,000 lb. The 100,000 lb. wagons (open bogie type) are 40 ft. long by 8 ft. wide inside, and are constructed of steel throughout. They are carried on two four-wheeled bogies arranged at 27 ft. centres.

Special attention has been given in South Africa to wagons for the various classes of live stock, and a vehicle, designated the universal cattle truck, has been evolved. This truck, of the four-wheeled type, is 22 ft. long over headstocks and 8 ft. 9 1/2 ins. wide over solebars, but owing to the large size of some breeds of horned cattle in South Africa the width increases from solebars to cart rail, where it is 8 ft. 9 3/4 in. The truck is divided into two halves by a partition which is made to fold up when required in order that the whole length of the truck may be used for sheep or other loads. There are four sets of doors, two on each side, each consisting of a lower door opening downwards which forms a ramp when resting on a loading bank, and two upper doors opening outwards.

These vehicles can also be adapted for carrying coal, sliding roof doors having been devised through which the coal can be loaded from the delivery chutes at the collieries. The load of coal is 40,000 lb.

Owing to the heavy frozen meat traffic, attention has also been concentrated on the development of the insulated type of wagon, and a large number of these are now in service. The standard type is carried on two four-wheeled bogies and is 40 ft. over the body, with a width of 8 ft. 1 1/2 in. and a carrying capacity of 35,000 lb. The body is constructed of wood, insulation being arranged with a combination of granulated cork, linofelt, and waterproof paper.

The accompanying illustrations show the developments that have taken place in coaching stock in South Africa. The photographs of the first types of carriages used on main line services recall the earlier days of railway travel in South Africa, when sleeping and catering facilities were primitive. Night travel was restricted, or endured with the greatest discomfort.

In the earlier days travellers had their meals en route at railway refreshment rooms or at hotels in the vicinity of stations. Trains had to wait while hurried meals were obtained. The time thus spent added considerably to the duration of the journey—an
Some of the Workshops of the South African Government Railways
COACHING STOCK

important factor in a country of long distances. The inauguration of dining-car services permitted of the revision of the train schedules and of the time taken on the journey being considerably shortened.

Dining-cars are to-day attached to the through passenger trains between the Union and Rhodesia, in, or from which breakfast, lunch, dinner and light refreshments are served on the 2,000 mile journey from Cape Town to Broken Hill in Northern Rhodesia.

One end of the car contains a well-equipped kitchen and pantry, and the other end forms a dining room accommodating 24 passengers, and there is also a small bar. A new type is the "twin-diner," consisting of two vehicles each 60 ft. long. One seats 46 passengers, the whole of the vehicle, except a small portion partitioned off as a bar, being set apart for serving meals. The adjoining vehicle is divided into two sections, that next to the dining car being the kitchen and pantry, and the other accommodating the staff.

The comforts and convenience of a modern hotel are, therefore, available to the passengers on this lengthy journey, the only point of difference being that space on the train is more circumscribed.

By comparison with the conditions in the earlier days, the facilities which surround the modern traveller are luxurious. The comfort and convenience of passengers have been studied in every way, especially on the long journeys in the interior.

On the South African Railways the saloon stock of main line trains is partitioned into roomy compartments. At night the upholstered seats are swung over and laid with beds, while all the facilities for a convenient toilet are at hand. During the day the compartment is a private sitting-room where the traveller may take his meals if he is not disposed to go to the dining-car. This system of travel has many advantages over that of the Pullman car. It is particularly convenient for families or tourist parties and ensures complete privacy.
Mr. C. L. N. FELLING, C.M.G.,

General Manager of the Uganda Railway and Steamer Services.
Kenya Colony and Uganda Railway Progress, 1921 to 1924

By C. L. FELLING, C.M.G., General Manager of the Uganda Railway.

ANY people will still recall the strenuous Parliamentary opposition in the early 'nineties to the spending of the British taxpayers' money on the building of a railway across British East Africa connecting the seaboard with the head waters of the Nile. The discussions were enlivened by Mr. Labouchere's pithy invective and emphasised in a less serious view by a very humorous cartoon which appeared in "Punch."

It was argued that the railway would never be a paying proposition; that it would be a millstone round the British taxpayers' neck, and that from a political point of view it would be preferable to abandon British interests in Eastern Africa.

Imperial policy has, however, proved its worth, and the country that was once only a wearisome trudge for the missionary and official proceeding or returning from Uganda is now a land of diverse interests and untold potentialities.

It is not intended in this article to give a résumé of the history of Kenya Colony (formerly British East Africa) or of Uganda, but a short precis of the development of railway enterprise and capacity to meet the ever increasing demands for transport facilities as a result of the expansion of these two colonies during the short period under review.

It is doubtful whether the effects of the war were more keenly felt in any part of the world than in these outposts of the Empire where wastage of man power, with its consequent dislocation of all the producing industries, was proportionately very high, both as regards the white and the black population. In 1921, however, aided by a large influx of new settlers, including Government-aided soldier settlement scheme, the life of the country was resuming its normal aspect, although the new arrivals, not having yet become accustomed to the strange conditions in which they found themselves, were not in a position to meet the full benefits of their efforts.

The large progressive strides which have since been made are forcibly demonstrated by the volume of goods traffic passing over the railway—probably the
The Story of the Cape to Cairo Railway and River Route

At Kilindini Harbour.

Top: The Sea Wall under construction with concrete blocks.
Bottom: Building the New Pier.
truest index of the prosperity of any country:—

<table>
<thead>
<tr>
<th></th>
<th>1921 (9 months)</th>
<th>1922</th>
<th>1923</th>
<th>1924 (6 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tons</td>
<td>490,459</td>
<td>304,774</td>
<td>398,062</td>
<td>251,728</td>
</tr>
</tbody>
</table>

Figures for the nine months, April to December, 1921, only for purposes of comparison, owing to the fact that the official financial year, which previously ran from April to March, was changed in January, 1922, to run from January to December. Assuming however, that the monthly tonnage is more or less of an average, the figures for 1924 show an increase over those of 1921 of 89 per cent.

The increases in downwards traffic are due in most part to the expansion of the export trade of the Colonies. The principal export commodities carried are:—

<table>
<thead>
<tr>
<th></th>
<th>Maize</th>
<th>Cotton</th>
<th>Coffee</th>
<th>Oil Seeds</th>
<th>Fibre</th>
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<tbody>
<tr>
<td>Tons</td>
<td>11,255</td>
<td>14,904</td>
<td>8,012</td>
<td>12,043</td>
<td>4,707</td>
</tr>
<tr>
<td>1921 (9 months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tons</td>
<td>25,501</td>
<td>9,934</td>
<td>12,229</td>
<td>15,124</td>
<td>6,928</td>
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<tr>
<td>1922</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Tons</td>
<td>38,478</td>
<td>17,612</td>
<td>11,862</td>
<td>23,763</td>
<td>9,095</td>
</tr>
<tr>
<td>1923</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tons</td>
<td>24,307</td>
<td>15,034</td>
<td>6,629</td>
<td>10,419</td>
<td>5,635</td>
</tr>
<tr>
<td>1924 (6 months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It has been a generally accepted idea that the territory lying between the eastern seacoast of Kenya and the great inland lakes is a country of sun-burnt deserts and malarious mosquito-infected swamps. Deserts and unhealthy swamps do undoubtedly exist, but it must be remembered that the highlands of Kenya Colony, although on the equator, are sufficiently high to experience several degrees of frost at night during certain seasons of the year, and that the Uganda Railway rises from sea-level to a height of 8,300 ft. before reaching its terminus on Lake Victoria Nyanza at a height of 3,750 ft. The variations of the climate at the varying altitudes of the different parts of the country account for the diversity of the products from the coconut at the coast to coffee and sisal up to an altitude of 6,500 ft.; European cereals, such as wheat and barley, interspersed at altitudes varying from 5,000 to 8,000 ft.; cotton and oil seeds in the neighbourhood of the inland lakes at a height of 3,700 ft. to maize at from 3,000 to 8,000 ft.

There are many other industries which are yet in their infancy, but which have an un-
European market, coupled with the high sea freights then ruling, prohibited the export of the greater part of the harvest, with the result that it is not an uncommon sight to see that a valuable crop like this has been utilised for thatching.

A corollary to the export trade of a country is always to be found in the figures of its imports owing to the increased spending power of the population from the realisation of the harvests. This is illustrated in Kenya in a particularly interesting manner by the figures of the tonnage of motor-cars imported. They are as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1921 (9 months)</td>
<td>500</td>
</tr>
<tr>
<td>1922</td>
<td>691</td>
</tr>
<tr>
<td>1923</td>
<td>1,106</td>
</tr>
<tr>
<td>1924 (6 months)</td>
<td>1,295</td>
</tr>
</tbody>
</table>

The roads in this country not being yet up to the standard required for the heavier types of lorries, these figures represent almost entirely touring cars of touring chassis, which are adapted locally as light lorries. It can, therefore, be safely assumed that each ton will represent at least one car, and although the motor-car is almost as much a necessity as a luxury in these colonies of long distances, scattered populations, and scanty communications, nevertheless these figures are a sure indication of the upward trend of individual prosperity.

It is less than twenty-three years ago—viz., on December 26, 1901—that the first train was run through from the coast at Kilindini to Kisumu, on Lake Victoria Nyanza, and the building of the railway can hardly be said to have been completed till early in 1903, while it was also about this same date—April, 1903—that the first railway steamer made its maiden trip across the lake. From that date till quite recently, with the exception of a line of 61 miles in length in Uganda called the Busoga Railway, built in 1910 to connect Jinja on Lake Victoria Nyanza with Namasagali on Lake Kioga, the Magadi branch of 91 miles, built in 1915 by the Magadi Soda Co. to provide an outlet from their Soda Lake, and a small branch running out from Nairobi, which was built in 1913, railway construction has been practically at a standstill.

The possibilities of the two colonies (Kenya and Uganda), particularly in the production of maize and cotton, have, however, caused serious consideration to be given to the question of the provision of further branch lines.

It can be readily seen that a large margin of profit would be swallowed up by the transport of, say, a crop of maize to the railway, a distance of perhaps 80 to 100 miles by ox wagons over very indifferent roads, taking anything up to 14 days for the return journey, and with a possibility of double that time if caught by the very heavy rains, which often render the roads practically impassable. The anxiety of the settler
PROJECTED EXTENSIONS

population for the provision of railways to counteract these drawbacks and to allow them to compete in the world's markets can also easily be understood.

The first step in the forward direction was the construction of a branch line taking off from the main line at Nakuru in the Great Rift valley and climbing up some 3,000 ft. in 77 miles to the fertile Uasin Gishu plateau facing the South-Eastern slopes of Mount Elgon. The length of this branch line, as at first projected, was approximately 145 miles, and it taps a large maize producing area. The building of this branch was commenced at the end of 1921, and, as originally contemplated, is now almost complete. Some 80 miles are already open for traffic, and before long the remaining 65 miles should be under operation as an open line.

Meanwhile, the possibilities of Uganda as a cotton-producing country had not only been exploited but definitely proved, and the Parliamentary debates on the subject of a loan to further this industry are fresh in everyone's mind. The Imperial Government has given its consent to the flotation, and surveys are now being carried out with a view to continuing this new Uasin Gishu branch skirting the Southern slopes of Mount Elgon into Uganda and connecting up with the Busoga Railway.

The probability is that this branch line from Nakuru to Uganda will then come to be regarded as the main line, while the portion of the present main line from Nakuru to Lake Victoria Nyanza will become the subsidiary line. This fact is somewhat interesting because when the building of the Uganda Railway was first mooted in 1890, for the purpose of fulfilling Great Britain's obligations under the Brussels Conference which was convened for the suppression of slavery in Eastern Africa, the original suggestion was that the line should run to a point on Lake Victoria Nyanza more in the direction where this new construction will connect with the Busoga Railway. The building of the Uganda Railway, however, was considered for some five years before a start was eventually made, and the political situation with regard to the head waters of the Nile then demanded that it should be put through with all possible urgency, with the result that the shortest route to the lake was taken, it being quicker to build steamers to cross a lake than to build a railway round it. Thus, we now have commerce demanding a railway on a route which for political reasons only was projected some 30 years ago, and which for political considerations was later cut down, and this in a country that 30 years ago was practically unknown and unexplored, and was just a blank space on the map of Africa.

The benefits to the cotton-
The growing industry of Uganda, accruing from the projected extension of the Uasin Gishu branch, will be the better appreciated when the vicissitudes which a bale of cotton at present undergoes during its journey to the coast are understood. In some instances it is brought by motor lorry to the shores of Lake Kioga, from there by steamer to Namasagali on the Busoga Railway, thence by rail to Jinja, where it is again shipped by steamer across Lake Victoria Nyanza to Kisumu, and from Kisumu by rail to Kilindini, where it is put aboard the ocean going steamer.

During the cotton season these railways and their steamers are tried to the utmost limit of their capacity, and the avoidance of all this intermediate handling by being able to put a bale of cotton straight on to the new line with a direct run to the coast will be an inestimable boon, not only to the cotton-growing industry, but also to the railway authorities.

A branch line from this Uganda extension is also in project, probably taking off from Tororo just over the Uganda border, and proceeding in a northerly direction past the western slopes of Mount Elgon through Mbale to Kumi, which is the centre of a large cotton-producing area stretching round the eastern shores of Lake Kioga. This branch is at present under survey.

The more immediate signs of railway activities in connection with this industry are to be seen in the provision of a new steamer and attendant lighters which are now on their way out to Lake Kioga. This lake, which is more or less in the nature of a large papyrus swamp, is very shallow, and the steamers being necessarily of shallow draught their carrying capacity is small. To counteract this, therefore, they propel sometimes as many as five 100-ton lighters. Several new lighters have also been provided recently, or are under order, for Lake Victoria Nyanza, while the provision of another tug and further lighters is contemplated in 1925.

It may appear at first sight that with the completion of the new railway the subsidiary assistance in the way of steamers and lighters will be superfluous. Not only, however, has the period of construction to be tided over, but considerable developments are in progress in other directions which will eventually utilise this accommodation.

In Tanganyika Territory the administrative officers are making strenuous efforts to foster native production, and already the traffic from their lake ports of Mwanza and Bukoba are demonstrating the results by the increased tonnage in cotton, ground nuts, sim sim grain (an oil seed), and rice, while the trade in hides is also showing signs of a beneficial recovery. Other commodities in which increases are confidently anticipated are sisal from the Speke
Gulf in the south-east corner of the lake, and coffee, sugar, and timber from the Uganda ports. In fact, there is every indication that the miscellaneous traffic of the lake will be calling for all the accommodation that will be released when the cotton traffic can proceed by the overland route.

As will have been gathered from the foregoing, the bulk of the cotton at present originates in Uganda, while a small portion comes from Tanganyika. There is, however, an area in Kenya, on the north-east shores of the lake, towards Mount Elgon, which is inhabited by an industrious tribe of natives called the Kavirondo, who, under the encouragement of the Government, are commencing to grow cotton, and in order to foster their activities a branch line is to be built in the direction of Mumais. The survey of this line has not yet been completed, but it will probably take off from the main Uganda branch some thirty miles before it reaches the Uganda border.

Further contemplated extensions in Kenya, totalling in all some 130 miles, are from Soy on the Uasin Gishu branch to Kitale, on the east of Mount Elgon, approximately forty-five miles, and from Rongai, on the Uasin Gishu branch, through the Solai Valley, some thirty miles, while the Thika branch is being carried on through Fort Hall to Nyeri, on the south-western foothills of Mount Kenya. These are all essentially agricultural branches. The first two which have been surveyed and on which construction will start at an early date, pass through European settled areas, and their principal traffic for the next few years will certainly be maize. The latter is already in course of construction as far as Fort Hall, while survey of the remaining portion is in hand. This extension will traverse one of the principal sisal producing areas, and will also tap large native reserves inhabited by the Wakikuyu and Wakamba, who rank among the most intelligent of the native tribes.

During the war, in order to overcome their transport difficulties, a temporary line was laid by the military authorities from Voi on the Uganda Railway into the neighbouring German territory. For a few years after the war this line was worked by the Tanganyika Railways, but finally it was decided to close it down. Considerable discussion then arose as to whether it should be dismantled, and eventually towards the end of 1923, it was agreed that the Uganda Railway should purchase it from the War Office. It is now being established on a more permanent basis, and the traffic already offering from the fertile districts around Mount Kilimanjaro gives evidence that the purchase will be amply justified.

When all these branch lines now contemplated or under construction have been completed
the total mileage of the Uganda Railway system will be nearly double what it was in 1921, viz., 1,410 miles as compared with 776.

Pari passu with the construction of the new branch lines, relaying and regarding is being effected on the section of the main line between Nairobi and the coast, and the original 50 lb. rails are being replaced by 80 lb. rails. A bigger axle load will thus be available to cope with the increasing traffic, and the 50 lb. rails taken up will be utilised as far as possible on the new branch lines and on sidings.

A further and most important item of development now nearing completion is the provision, at a cost of over a million pounds, of a two-berth deep water pier at Kilindini. This work was commenced towards the end of 1921, and it is anticipated will be finished by the middle of next year. The rapid strides in exports since the commencement of its construction give rise to grave doubts as to whether the two berths will be sufficient, and it is extremely probable that increased accommodation will have to be considered in the near future.

A very pleasing feature from a railway point of view in these two colonies is the increased use which is being made of the railway by the natives, both as a means of locomotion for themselves and their produce and as a source of employment. Whereas a few years ago a native would rather walk (for preference along the railway track) a hundred or even two hundred miles than pay the necessary fare, the reverse is now becoming the case, and he appears to be beginning to appreciate that time is money. This is demonstrated by the fact that over half a million native passengers were carried during 1923, an increase of over 100 per cent. on the figures for 1913.

As regards employment, 10,207 native manual labourers were employed during 1923, while over 1,500 skilled labourers were engaged in the various workshops, this latter figure showing an increase of 50 per cent. over the previous year.

A scheme of apprenticeship for Africans has recently been inaugurated, providing tuition and accommodation for some 200 apprentices, and in a few years the expensive imported Asiatic mechanic will be almost entirely replaced in the workshops by the native, who, under European supervision, is proving himself a very capable and painstaking artisan. Further evidence of the ability of the natives is to be found in their gradually increasing employment as drivers, firemen, telegraphists, clerks, etc., etc.

It is by such innovations, and aided by the annually-increasing output of the colony generally, that the authorities confidently anticipate no difficulties in meeting the capital charges arising out of the recent development programme.
The Egyptian State Railways.

IMPROVEMENTS IN ROLLING STOCK AND EQUIPMENT.

ROBERT Stephenson built the first railway in Egypt, having been commissioned in 1852 to construct a line from Alexandria to Cairo, which was opened in 1856. Next, to complete the overland route to India, a line was built from Cairo to Suez and was opened in 1858. Ten years after a line was laid from Suez to Ismailia, but the opening of the Suez Canal in 1869 ended the overland traffic between Alexandria and Suez, and attention was then concentrated on the section between Cairo and Suez. Some years later a track was laid from Port Said to Ismailia, thus making possible a through journey from Cairo to Port Said.

In 1868 the construction of the line from Cairo southwards to Minia was begun, and the year 1891 saw the extension to Assuan, the present southern terminus in Egypt.

There being no steep mountains to climb or to tunnel through, and no torrential rivers to cross, railway construction in Egypt is comparatively easy, the only engineering works of importance being a few bridges over the Nile.

In the Egyptian State Railway system there are now open to traffic about 1,500 miles of standard gauge (4 ft. 8½ ins.) and 138 miles of narrow gauge (3 ft. 6 ins.). The latter is the section from Luxor to Assuan, and as it is a continuation of the direct route southwards a change-over is necessary at Luxor for passengers and freight proceeding further south. A through run can, however, be made from Cairo to Luxor (424 miles) in 11 hours, by trains de luxe. Each of these trains is made up of sleeping cars and a dining car for night travelling, and on the day expresses a restaurant car is attached. A new departure is being made in the 1925 season by the addition of Pullman cars.

Until recently the Egyptian State Railways have always been under foreign administration, the present general manager, Abdel Hamid Pasha Suliman, who took over control in 1924, being the first Egyptian
Egypt's Railway Manager

H.E. Abdel Hamid Soliman Pasha.

H.E. Abdel Hamid Soliman Pasha, the first Egyptian to be appointed—in April, 1924—general manager of the Egyptian State Railways, Telegraphs and Telephones. Graduated as a civil engineer in 1902, he joined the Egyptian Government Irrigation Service, and in 1907 was promoted Chief Engineer. In 1917 he became Inspector of Irrigation. In 1922 he was appointed Under-Secretary of State to the Ministry of Public Works, and in June, 1923, became Minister of Public Works.

H.E. Abdel Hamid Soliman is exceedingly energetic, and combines a passion for efficiency with great urbanity of manner. He has shown his best qualities in administrative work, and his position as general manager is mainly administrative.
to occupy that post. From 1876 to 1905 a board, consisting of a president and two directors, controlled the system, but in the last mentioned year the management was put under one head. Following a report in 1906 by Sir Charles Scotter the administration was again reformed and over £3,000,000 were made available for new rolling stock and equipment. This led to a vast improvement in the service; traffic increased, and at the present time the State Railways carry an annual average of over 35,000,000 passengers, the revenue from this source in 1924 being £E.4,500,000, almost the same as that derived from goods traffic. According to a statement made by the Finance Committee the capital of the railways at March 31st, 1924, was placed at £E30,126,028, and the net estimated revenue for 1924-25 constituted 6 per cent. of that sum.

The war made excessive demands on the rolling stock and equipment, Egypt having been a point of vital strategic importance. There has been considerable criticism of the service since the war, and owing largely to political considerations improvements, in some respects, have been slow. Certain improvements have, however, been carried out under difficult circumstances. At the close of the war the Egyptian State Railways had 640 locomotives. Many of these were the worse for wear, but since then a number of new engines have replaced old ones. In the year 1920-1 a total of 30 express passenger engines and 20 heavy goods engines were added; in 1922-3 twenty tank engines and a further 30 in 1923-4. In 1925 fifty new locomotives were ordered—35 from a British company and 15 from Germany.

The number of coaches at the end of the war was 1,398. Many new ones have since been added and a large number have been rebuilt at the Boulac shops of the Egyptian State Railways. The stock of wagons at the end of the war numbered 12,550, with an average capacity of 13 tons, and some hundreds have since been added—largely replacements of worn-out stock.

Regarding the track, immediately the war was over the State Railways started to carry out a programme of main line renewals. The bridges of Abu Tig and Abu Shath were rebuilt; the new double-line railway and road bridge over the Nile at Embaba is nearing completion; and work is proceeding with the replacement of the Nile Bridge at Dessouk.

But while improvements in recent years have been slow, a programme, which will make up for the neglect since the outbreak of the war in 1914, was approved in 1924. This provides for the expenditure of £E3,105,000 on abnormal renewals of track and rolling
The STORY of the CAPE to CAIRO RAILWAY and RIVER ROUTE

Former Egyptian Railway Managers

Names will be found on opposite page.
RENEWAL PROGRAMMES OF STOCK AND TRACK

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>600 kilometres of rails</td>
<td></td>
<td>£880,000</td>
</tr>
<tr>
<td>120 new locomotives</td>
<td></td>
<td>£600,000</td>
</tr>
<tr>
<td>1,500 goods wagons</td>
<td></td>
<td>£525,000</td>
</tr>
<tr>
<td>200 passenger coaches</td>
<td></td>
<td>£700,000</td>
</tr>
<tr>
<td>Bridges</td>
<td></td>
<td>£200,000</td>
</tr>
<tr>
<td>Signals</td>
<td></td>
<td>£200,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>£3,105,000</strong></td>
</tr>
</tbody>
</table>

The above programme is to be spread over the three financial years, 1925-6 to 1927-8.

In addition, an annual credit is provided for normal current renewals amounting to £567,000.

With conditions of stability and the above programmes of renewals carried out, the Egyptian State Railways will be amongst the best equipped railways of any country.

FORMER EGYPTIAN RAILWAY MANAGERS (see photographs on opposite page)

17. M. TIMMERMAN, 6th April, 1887, to 31st March, 1889.
18. Colonel Le MESLIER, 13th February, 1887; to 2nd Jan., 1887.
Irrigation in South and North Africa.

The effect of heavy rains on the Kamanassie Dam, near Oudtshoorn.

The first train crossing the newly completed Makwar Dam on the Blue Nile.
Irrigation Works

on the

Cape to Cairo Route.
The Great Vaal River Barrage.

25 miles south of Vereeniging. Completed in 1923 at a cost of £1,550,000.

This Barrage is the largest work of its kind in the Southern Hemisphere. It holds back the river for 42 miles and impounds 13,653 million gallons of water.
Irrigation Development in South Africa

By A. COLLY, B.Sc., A.M.I.C.E. (Late of Union Irrigation Department).*

Irrigation—the artificial application of water to soil to assist in the production of crops—has been practised in South Africa since the days of the first settlements. At first of primitive form, irrigation methods have developed until to-day they follow on organised scientific lines.

The history of irrigation in South Africa shows the same characteristics as generally mark its progress in all countries in early stages of development. First settlements are naturally placed along rivers from which water can be drawn with little difficulty by means of primitive and cheap dams and furrows. The really expensive maintenance of such cheaply constructed works is disregarded because unpriced farm labour is used for effecting repairs. Then as population increases the water available is not equal to the demand for it and disputes arise as to its just division amongst the riparian owners. Water legislation has then to be laid down. At this stage, too, the increasing scarcity leads to greater care in the use of water and more permanent and efficient irrigation works are constructed. These, more expensive in first cost, require less maintenance and prove cheaper in the long run. With this stage reached the way is paved for co-operative effort amongst the owners along a stretch of river who, combining, are able to construct works of considerable magnitude giving benefit to all far greater than would accrue from the individual efforts of those participating.

Such community effort is highly desirable, but unfortunately the physical characteristics of some parts of the country preclude it. In Natal, for example, the steep fall of the rivers and the broken conformation of the country lead to there being few continuous tracts of soil fit for co-operative cultivation. Each patch must be worked to its best advantage by individual development. Elsewhere, as along the Orange and the Vaal Rivers, conditions are such that dams must be of great size and distribution works cover tremendous distances for successful commercial operation. Works on such a scale must be state-owned and operated.

The most satisfactory progress will occur when every stream and

* The writer is indebted to the published Departmental Reports for much of the material on which this article is based.
river is developed by that type of work, be it individual, co-operative, or state-owned, most suited to the river's own peculiar conditions.

The Cape Colony, as the locale of the earliest settlements, was the scene of the first irrigation projects. A very definite step was taken in 1862 when the Government sought information from the Civil Commissioners as to existing, projected, and possible irrigation works in their districts. Then in 1875 John Gamble was appointed hydraulic engineer for the Colony.

Irrigation now attracted the increasing attention of the Legislature. The first Irrigation Act was passed in 1877 and laid the foundation of modern co-operative enterprise by creating machinery for the formation of Irrigation Boards and giving power to such to borrow from the Government. In 1903 irrigation became a separate branch of the activities of the P.W.D., under W. B. Gordon, C.I.E., M. Inst. C.E., an engineer from India. Development proceeded apace despite the drawback of severe depression.

In the Orange Free State and Natal there is far less irrigation history. In the former, physical conditions are such that co-operative schemes must generally be on a large scale and in Natal such schemes are either impossible, or, in the well-watered coastal belt, not required.

But in the Transvaal a very promising situation existed at Union. In 1903 an Irrigation Department had been established under W. L. Strange, M. Inst. C.E., of India, and at Union the Transvaal brought with it a valuable fund of reconnaissance studies and hydrographic data. Strange had laid firm foundations for future rapid progress by initiating this much needed preliminary work.

At Union irrigation work for the whole country was placed in the hands of a distinct department under Mr. F. E. Kanthack, C.M.G., M. Inst. C.E. The Department is now under Mr. A. D. Lewis, M. Inst. C.E., with Mr. J. L. Hill as Assistant Director.

The work of the Department as it is constituted to-day falls into nine sections, Hydrographic, Meteorological, Reconnaissance, Professional Advice, Loans and Boards, Constructional, Boring, General, and Legal, dealt with by 150 professional and technical staff and 100 clerical assistants with 150 others in the Boring Branch. The first three sections are concerned mainly with the future of irrigation. Continuous gaugings of 28 rivers are correlated with the rainfall returns of 2,500 stations. From the results is determined the practicability of the possibilities disclosed by reconnaissance survey. The position to-day is that many projects can be planned upon information already collected but requiring classification and evaluation.

Irrigation of to-day is largely dealt with by the section giving professional advice to farmers and Irrigation Boards. To do this work efficiently the Union has been divided into eight Districts or Circles, each with a headquarters office in charge of an experienced engineer.
The nature of the work may be gauged from the definition of a Circle Office as "a local bureau for disseminating information and advice tending to promote irrigation development."

The Irrigation Department works on the basis of the Irrigation and Conservation of Waters Act of 1912. Included in that Act provision was made for groups of riparian owners to co-operate and form Irrigation Districts for the carrying out of schemes of mutual benefit. These schemes are each under the control of a Board, elected from the owners concerned, which has power to borrow from Government against the security of the irrigation rates levied by the Board. Ninety-eight Boards have been proclaimed. Over fifty are already in active existence with an irrigable area of 250,000 acres coming under works completed or in course of construction, to the value of £4½ millions.

Boring work has, as its purpose, the provision of water for domestic and stock needs on farms away from ordinary available supplies. Irrigation from South African boreholes is not commercially practicable. The average yield of each of the 9,000 holes sunk since 1904 is 20,000 gallons per day—sufficient barely for 4 acres of land, but of far greater worth for the legitimate purpose of catering for humans and stock.

Since 1916 there has been almost a complete change in the nature of the requirements which the Department meets. Previously, irrigation in the Cape had had practically as its sole aim the production of ostrich for the ostrich feather industry. For this, there was no need to construct other than flood irrigation works comprising weirs and canal systems which diverted floods as and when they came.

Then occurred, in quick succession, a slump in the ostrich feather industry, the outbreak of war, drought and disastrous floods, and farmers quickly began to realise the necessity of conserving floodwaters if the cultivation of land under irrigation was to proceed upon an assured basis. The early advocacy of flood irrigation is not to be condemned. In the early development of the country, cheap structures were necessary. The high cost of conservation dams could not have been borne then but to-day, with the greater capital of the country, conservation is the keynote of irrigation policy.

Conservation schemes under construction are of two classes, those intended to store water for the irrigation of new lands, and those ensuring definite supplies to lands already served by flood irrigation systems. The schemes now mentioned are all on a fairly large scale. Recently completed are the works on the Olifant’s River in Van Rhynsdorp, at Lake Mentz on the Sunday’s River, not far from Port Elizabeth, and at the Kaffir River, south of Bloemfontein; well-advanced are the Kamanassie works near Oudtshoorn, the Bon-Accord scheme near Pretoria, the works at Tarka and Grassridge, near Cradock, to serve the existing Fish River flood schemes, and the new project on the Sunday’s River.
at Graaff-Reinet. Also, a commencement has been made on the Modder River, near Bloemfontein. Finally, there is the great Hartebeestpoort scheme, on the Crocodile River, close to Pretoria, primarily intended for closer settlement and with construction entirely carried out by Government itself, employing white labour.

Between them these schemes will bring 100,000 acres of new lands under water. Large in itself, this figure is yet small compared with the area of the Union, 473,000 sq. miles or about 300 million acres. Of this latter 1,000,000 acres are already irrigated and it has been estimated that about another $2\frac{3}{4}$ millions may be irrigated in the future. The possible area is thus far less than is commonly thought to be the case.

But it must be remembered irrigation possibilities are strictly determined by three main factors: rainfall, run-off, and land available. All three factors must be in favourable conjunction for successful irrigation. Even when the first two factors are satisfactory the third is often missing. Of the $2\frac{3}{4}$ million acres still to be developed much lies in isolated patches whose irrigation can only take place through the construction of numerous small dams by individual farmers. The conservation of all available and suitable flood-flow throughout the country is a vital necessity.

Then of the remaining area much can only be dealt with by schemes of national magnitude—such as will be necessary along the Vaal and the Orange. Contrary to what is often thought, the possibilities of such large schemes have not been lost sight of, but before any construction can be commenced the rivers concerned must be studied in their entirety. Detailed reconnaissance to this end has been proceeding for some time past.

Finally, it must be remembered that, granted suitable conditions and the best use made of them, success or failure, in the last place, rests with the man on the land.

South Africa, with its small population in its early days, was a country in which life, even if it meant pioneering, was easy. As the result of those early conditions much of the farming community has still deeply ingrained in it a spirit of slackness.

As the forerunner of sound irrigation development there must be a vigorous educational campaign calculated to raise the morale, stamina, and vigour of the South African nation.
Irrigation in Southern Rhodesia

UNDER the Department of Agriculture of Southern Rhodesia there is an Irrigation Branch which deals with all matters concerning irrigation, farm water supplies, and general farm engineering. Its work, however, consists chiefly in investigating and reporting upon irrigation schemes, but up to the present the Government has not undertaken any large schemes, those carried out having been done by individual farmers, Irrigation Boards, or large land companies.

Besides the preliminary work connected with such schemes, the Branch prepares, when required, all necessary designs, and undertakes the supervision of works under construction, for which certain fees are charged by the Government. For informal advice, however, no fee is charged.

Up to the present reports have been submitted upon approximately 36,000 acres of land, comprising several hundred individual schemes. There are at present about 16,000 acres under irrigation, the largest scheme being that of the British South Africa Company in the Mazoe River. This comprises an arched concrete dam 100 feet high in the Mazoe River impounding about 18,000 acre feet, or 780 million cubic feet of water; about 25 miles of canals with flumes and pipe syphons and other subsidiary works. The dam, when full, is capable of irrigating 6,000 acres of land, of which at present over 1,000 acres are under established citrus trees. Altogether, the value of crops grown under irrigation is estimated at about £150,000 per annum, but this is rapidly increasing particularly with the extension of the citrus industry.

Under the Water Ordinance two or more owners can combine to carry out schemes of irrigation for their mutual benefit. Such schemes are controlled by Irrigation Boards, the members being elected by the participants in the scheme. Up to the present three boards have been created with an irrigable area of 3,050 acres. Loans are granted to farmers and others for carrying out irrigation schemes.

In the southern areas, where the rainfall is lower than in Northern Mashonaland, irrigation is essential, and irrigation schemes are under way for the growing of cotton on a large scale.

Extensive boring for water has recently been carried out in the Native Reserves of Matabeleland. A total of some 5,000 feet has been drilled, and drilling is also being undertaken on European-owned farms.

All water, both public and storm, in the rivers, is regarded as part of the public domain, and the State controls and apportions such water for the general benefit. It is illegal to divert and use water for any purpose without obtaining authority.
A Great Pioneer of Nile Valley Irrigation.

Sir MURDOCH MACDONALD, K.C.M.G., C.B.
Late Adviser and Under-Secretary of State for Public Works in Egypt.
Irrigation in the Sudan

By SIR MURDOCH MACDONALD, K.C.M.G., C.B.

WHEN the pioneers laying the railway northwards from the Cape reach the summit of the African Continent and look down on the sources of the Nile, one of the most wonderful rivers in the world, the causes of whose annual flood are only now beginning to be understood, though it is, as it has been from all time, of such vital interest to the millions who live on its banks and who solely depend on its recurrence for their very existence.

This yearly flood reaches its maximum height about the 5th of September at Assouan, a date which is seldom varied more than 10 days either way. From this maximum a fairly regular fall takes place until the minimum level is annually reached, about the 1st of June. The amount of water flowing past the same point, Assouan, either at the maximum or the minimum periods is subject to considerable variation when one year is compared with another.

At the crest of the flood the volume may range between 5,000 and 15,000 tons per second, and in the case of the low river stage from 250 to 1,000 tons per second. It was the flood variations either in point of date or of volume, and more particularly the latter, which from time immemorial were alone of such deep concern to all Egyptians and some Sudanese, as an excess might bring ruin and even loss of life whereas until recently famine stalked in the wake of low floods. The low river variations became of interest to Egyptians alone (and it is an interest which since then has yearly increased in intensity) when the great Khedive Mohammed Ali Pasha, early in the last century changed the old basin or one annual flooding of the soil system, to the newer perennial system of irrigation with its waterings at regular intervals during the growth of the crop, as a preliminary to the introduction of cotton growing on a national scale.

Following the British occupation, great steps forward were taken in the control of the low river period, and towards the abolition of its variations. The Delta Barrage was made capable of diverting all the water flowing in the summer season which the canal systems taking off the river upstream of it were capable of carrying, and the agricultural community quickly absorbed all the water it could thus get in all years except those of exceptionally abundant summer flow.

Further land development was only possible if an increased supply could be got. The Assouan Dam built in 1902 to contain about 1,000,000,000 tons of water partially met the demand. The heightened and thickened Assouan Dam built in 1912 to contain 2,400,000,000 tons
Constructing the Makwar Dam.

1. Showing spillways on the main portion of dam. The projections of blocks of granite will break the water passing through, thus preventing a strong current undermining the foundations of the dam. 2. Sluice gates in course of erection in main section of dam. 3. Sectional view of dam in course of construction showing depth to which the foundations are made.
MORE CONTROLLING WORKS WANTED

of water still further met the need, but almost as soon as it was completed, even greater supplies were required and controlling works have been proposed further up the river to provide these also; this process will continue until all Egypt is fully cultivated and the Nile controlled to its furthest source. While all this provision was being made or contemplated for the increase of the summer supply of the river, attention was also given to the better regulation of the flood levels.

During the lowest flood which has ever been known to occur there has always been enough water for all the irrigation hitherto required at that season of the year if it could only be passed on to the soil, but when the volume is below the average, the level attained is not high enough to fill adequately the feeder canals, taking off the river at various points. The barrages built at Asiut in 1902 and Isna in 1909 immediately downstream of the heads of the more important of these feeder canals permit of the heading up of low floods sufficiently to fill them, and thus give the same supply as more normal years would provide.

It will almost certainly occur in future, when one of the abnormally low flood years recurs, and these happen at long intervals apart, that a greater demand for irrigation water will arise than even the flood river in such a year can supply; this contingency has been foreseen and can be provided for by suitable control of the waters issuing from Lake Albert.

The final form of control, the prevention of excessive flood which occasionally in the past caused disaster in Egypt, though considered, has not yet been dealt with, but the proposed White Nile Dam, designed to augment the low stage supply for the benefit of Egypt, if built as proposed, will be a most valuable factor in this direction.

While all the requirements of Egypt can thus be met no matter in which direction control is desired, the Sudan, awakening in recent years to the potentialities of her own soil, is now demanding a share of the river water and as none of what Egypt now uses must be interfered with, this will necessitate still more control, but before discussing how and where this can be achieved, it may be as well to consider briefly the sources from whence the river springs, and the territory through which it flows.

The River Nile, originating as it does in the heart of Africa, drains a vast area round its head waters, but as little or no rainfall takes place along the greater part of its northern course, there is no drainage in this long stretch to increase its flow; in fact instead of increasing in size as most rivers do as they near the sea, the Nile actually pays toll by evaporation from the surface of its waters owing to the great heat prevalent in those torrid regions. So great has this loss been that only about one half of the waters flowing out of Lake Albert have been estimated to ultimately reach the southern borders of Egypt at Assouan.

That huge inland sea, Lake Victoria, is the nominal source of this wonderful river, known here as the Victoria Nile. It issues from the Lake over the Ripon Falls and debouches after a passage of about one hundred miles into the swampy region of Lake Chioga.
After leaving this latter Lake, the river drops over the Murchison Falls into Lake Albert. The outlet from Lake Albert is the source of the White Nile, and probably at this point will be erected the most southerly work necessary to control the river for the benefit of the dense population lying on its course some thousands of miles to the north in the fertile, but as yet not entirely utilised, fields of Egypt.

Lakes Victoria and Chioga are wholly in Uganda so far as the Nile is concerned, whereas the waters of Lake Albert have been divided equally between the Uganda and the Congo territories. The actual exit however is in Uganda.

From Lake Albert the Nile continues to traverse Uganda territory for about 100 miles, but at this point the Sudan begins and lies along and around the course of the river for about 2,200 miles. Mongalla is the first point of importance on it, as near here begins that wilderness of marsh known as the Sudd which lies along the course of the river for about 300 miles and which forms the sponge which to-day automatically regulates the volume of water flowing from these equatorial regions.

On the right and left banks, the Zeraf and the Sobat, tributary streams, join the main flow in the vicinity of Malakal, where the Sudd region may be said to end at a point some 500 miles south of Khartoum. The discharge of the Zeraf is small but it is believed that when necessary it could be greatly increased by embanking the course of the river through its Sudd region or diverting it on to a higher ground, and thus prevent the great waste by evaporation in the marshes. On the other hand the Sobat has at times a very considerable flow which varies approximately between 30 and 1,000 tons per second, dependent on the time of year.

No further tributaries fall into the main stream until Khartoum is reached, where the Blue Nile joins the White Nile in their united progress to the sea. It is the Blue Nile which brings down the annual volume of silt to which the joint waters owe a considerable degree their fertilising properties.

Khartoum may be said to be the southern limit of civilisation. South of it and especially on the left bank the tribes are pastoral more than agricultural in habit. It is not that the country is not capable of being developed in an agricultural or arboricultural sense but simply that the great distances to be traversed, the want of rapid means of communication, and the pestilential nature of the climate, all militate against development. Here there will be one day immense possibilities, particularly when the new water requirements of Egypt are met by the better regulation of the fluctuating volume passing down the river during the different seasons, and even in different years, through this locality.

The conversion of Lake Albert into an enormous reservoir, exceeding by far any other contemplated in the whole world, will be one of the main adjuncts in the control, as the proposal is that it should be made to contain forty thousand millions of tons of water, so also will be a huge channel
The Gezira Irrigation Scheme

The map below shows how the Gezira scheme would look if it were being undertaken in England, with the dam at London, and Khartoum and the junction of the Niles at Manchester. It will be seen that the three million acres would comprise the best part of the midland counties of England, while the main canal would run from London to Bletchley.

The Makwar Dam, on the Blue Nile, completed in July, 1925.
capable of carrying whatever volume of water it may be desired to pass through the Sudd region. The remainder will be allowed to spill as formerly into the marshes but as the volume thus disposed of will be only relatively small, the swamps will to a great extent dry up, the reeds decay, and timber may be expected to replace them, and after the timber will come the farmer.

The first stage of development in this region will then be the construction of engineering works for the benefit of Egypt, the second stage will be arboricultural, and the last, agricultural, when the population develops and medical science renders it possible for human life to survive and engage in work in spite of the mosquito and the ills which follow in the train of that pestilential insect.

On the Blue Nile a different picture presents itself. Here the rain upon which the river is dependent for its supply falls mainly in Abyssinia with phenomenal regularity over a short period in each year and with consequent great flooding in the river towards the end of the wet period. The maximum discharge, reaching about ten thousand tons per second, is always succeeded by a gradually falling river, and the volume may drop to about fifty tons, or even less per second at the extreme low stage, until a following year brings with it another rainy season.

The Blue Nile rises in Lake Tsana in Abyssinia, and its course is to a great extent in the bottom of a deep and gloomy gorge, where the passing waters cannot be utilised unless it be that, in future generations, dams should be built across the channel for the production of hydro-electric energy.

When the Blue Nile reaches Sudan territory the gorge gradually dwindles down, and particularly on the left bank a great plain stretches away to the White Nile. This vast area is in general only a very few metres above the high flood level of the Blue Nile.

The tract of land thus enclosed in the fork between these two rivers, the White and the Blue Niles, is known as the Ghezireh and is extraordinarily productive. The rainfall on it, however, is inadequate both in quantity and duration, and it is necessary if full advantage is to be taken of the fertility of the soil to lift water from the Blue Nile on to the plain for its irrigation.

The magnificent project of irrigating this great tract was considered by Sir William Garstin, G.C.M.G., late Adviser for Public Works to the Egyptian Government and the Sudan Government, soon after the occupation of the Sudan. At that time the possibility of cotton growing in these areas was unknown and the matter was considered entirely from the point of view of cereal production.

Nothing was done about the matter, however, until the late Mr. D. P. MacGillivray, who was deeply interested in the development of the Sudan and Abyssinia for many years, conceived the idea of growing cotton on the Ghezireh in winter and commenced an experimental farm.
to prove it. Mr. MacGillivray's idea was to some extent revolutionary, as in Egypt and in the Sudan as far south as Khartoum cotton is a summer crop, sown in March and reaped in October, but beyond Khartoum on the Ghezireh Plain the summer heat is said to be excessive, and, probably more important still, there is no water in the Blue Nile in the spring and summer months to spare for irrigation, as at that time of year Egypt requires all the water passing down the river, and her claim of priority of use entitles her for all time to prevent others drawing upon it. By the 15th of July, however, the Blue Nile is rising fast towards its peak volume of discharge and has more than sufficient water flowing in it for all requirements of Egypt, consequently, it has then some to spare for the Sudan.

Mr. MacGillivray, installing a pump on the river-bank, lifted water at that date, planted cotton, and fertilized it with an adequate supply of water throughout the winter months, reaping his crop in February and March, thus actually growing it at the opposite season of the year to that done in Egypt.

Lord Kitchener of Khartoum took a deep interest in these experiments and on finding them to be successful ordered the prosecution of a large scheme of development.

Water can be either lifted from the river by pumps or its level raised by a dam and thus allow of free flow by gravitation. As fuel is costly in such a remote region, the Sudan Government decided to adopt the latter method. Many designs and proposals for the necessary works were considered, and eventually the erection of a dam for the irrigation of part of the Ghezireh Plain was begun across the Blue Nile near Sennar, the ancient capital of the Fung Kingdom which flourished here for centuries.

As long as there is water in a river a dam will divert it on to the soil, but as Egypt is to-day always short of summer water, none can be abstracted from the Blue Nile, or for the matter of that from any of the Niles while Egypt's present demands are not fully met at the season of low flow. To overcome this difficulty, the Makwar Dam is so designed that it can store about four hundred and eighty million tons of water; this quantity will adequately meet the requirements of more than one hundred thousand acres of cotton crop at such times as water cannot be withdrawn from any of the rivers on account of Egypt needing all they can supply. There are, however, about three million acres on the Ghezireh which might be cultivated by irrigation and of which it is conceivable one million acres per annum may be eventually laid under cotton.

The reservoir provided by the Makwar Dam can only contain water for a little more than one hundred thousand acres. The other nine hundred thousand or less can only be irrigated, it is believed, by regulating the discharge from Lake Tsana, the great Lake lying high up in the Abyssinian Mountains, and that regulation cannot be done except with
the permission of the Abyssinian Government. There is no reason why the Abyssinian Government should not grant permission, as, so far as it is known, no public or private interest in Abyssinia need be affected, or if affected, can be compensated for.

Under the scheme now being dealt with, the area originally considered as desirable to bring under cultivation was about one hundred thousand acres, of which of course, at most, only one half could be laid down annually in cotton.

Subsequently, to make the return from the crop meet the interests on the expenditure and other charges, and at the same time leave a profit on the transaction, the area was increased to three hundred thousand acres, of which not less than one hundred thousand acres would each year be planted with cotton, that is to say, cotton would be grown on a three years' rotation system. In Egypt, a two years' rotation practically holds sway, but climatic influence, the condition of the soil, the absence of cattle for manurial purposes, and other causes make it necessary to adopt the longer period in this area of the Sudan if an adequate return of crop is to be obtained in all years.

The greatly increased cost of labour and materials has caused a corresponding increase in the cost of these works and the Sudan Government has had difficulty in financing them. These difficulties have, however, been overcome and the great works have just been completed, adding at least one hundred thousand acres of cotton to the world's supply. From past experience the annual return may be four hundred pounds weight of ginned cotton per acre, thus the cotton produced will reach the formidable total of forty million pounds weight per annum.

This cotton will be of very high-class quality. As is well-known the Egyptian staple is usually worth nearly double the money value of American. The Sudan cotton grown on experimental farms is better than Egyptian and commands a slightly better price in the world's markets. Its cultivation therefore is not only of advantage to the Sudan but a distinct asset to the British Empire.

The United States of America is said to be growing less cotton, consequently it will send less and less to Lancashire mills. Here in the Sudan and within the Empire, is a field where Lancashire can obtain a supply of a high grade product and need not fear the working up of this product on the spot into cotton fabrics, as the climate of the Sudan strongly militates against such a process.

With the completion of the Makwar Dam, and when arrangements have been come to with Abyssinia, then as much as possible of the remaining area of the Ghezireh Plain should gradually be brought into cultivation until ultimately a huge tract of country will produce many times the weight of cotton to be obtained from the present scheme and so benefit the whole world.

Below Khartoum, irrigation by pump is gradually replacing the old basin system, but the areas are small and, as far as the outside world is
concerned, of no great moment. What can be done is to provide a livelihood for the natural increase in the population in these restricted areas until they are all brought into perennial cultivation, but development is restricted because here the Nile once again enters a narrow gorge-like region, of which the river itself occupies a considerable part of the trough, leaving little room on either bank for the deposit of its mud on which crops can be grown. As soon as full perennial cultivation takes place and the population becomes too dense, irrigation of the new and as yet almost untouched fields of the Ghezireh, Kassala, and the Southern Sudan can be undertaken by the surplus population, as these regions will be ready by that time to accommodate vast numbers of people.

SKETCH MAP OF THE GEZIRA SCHEME SHOWING DAMS, CANAL AND AREAS FOR CULTIVATION WITH RESERVOIRS

Initial Area of 300,000 feddans
Ultimate Scheme 3,000,000 feddans
Area affected by Reservoirs of both Dams
The Makwar Dam and the Gezira Scheme.

GREAT SUDAN IRRIGATION PROJECT COMPLETED

By Edward Stephens, late Editor of the "Sudan Herald," Khartoum

No mantle of romance, like that bestowed on many present-day projects, can be said to have shrouded the conception and development of the Gezira scheme in mystic charm or even added a little golden lustre to the undertaking. Nevertheless, the completed whole will be regarded by the British public as a work of immense economic value, a brilliant engineering achievement, and the key to the future prosperity of the Sudan.

Whilst it does not appear necessary to give a detailed account of the preliminary research and experimental work extending over a period of nearly twenty years, it is most interesting to record that as early as 1899, the year following the reoccupation of the Sudan, Sir W. Garstin recognised the possibility of irrigating the northern portion of the Gezira plain by building a barrage across the Blue Nile at some suitable spot between Roseires and Sennar. One of his recommendations was the formation of a branch service of the Egyptian Ministry of Public Works to study the various problems of irrigation in the Sudan. This service was established in 1904 and survey operations on the Gezira plain were commenced early in 1905. From the data obtained, Mr. Dupuis, then Inspector-General of Irrigation in the Sudan, prepared a preliminary report in which he suggested a method whereby the area in question could be suitably irrigated. This report formed a basis of a project subsequently proceeded with by Mr. P. M. Tottenham, C.B.E., who, with Sir Murdoch MacDonald, K.C.M.G., C.B., assisted by other irrigation experts, devised the scheme which was completed in July, 1925.

The "Gezira," or island, as the ancients considered it to be, is that huge stretch of land lying between the two Niles and bounded on the southern side by the Abyssinian tableland and the River Sobat. For the purpose of this article, however, it may be described as the triangular area lying between the Blue and White Niles with the apex at Khartoum and bounded on the south by the Sudan Government Railways from Sennar to Kosti. This area, (embracing the districts of Sennar, Wad Medani, Managil, Messalema, and Kamlin) ; from the junction of the two rivers to the railway measures approximately 5,000,000 feddans, 3,000,000
feddans of which is considered as being capable of excellent irrigation. It is on this triangle, following the completion of the Makwar Dam, 103,000 feddans of cotton will, in the first instance be cultivated annually.

Although Sennar is the most northerly part which gives full command of the Gezira by the free flow of the Blue Nile, examination proved that only at one point could a dam be built and that was at Makwar, situated some 8 kilometres south of Sennar. There a ridge of crystalline rock crosses the bed of the Nile and outcrops in the centre forming a small island. This site was finally selected and subsequent boring operations showed that underneath the crystalline rock, at suitable levels, was solid gabbro thoroughly suitable for the construction of the proposed dam.

The Makwar Dam is constructed of solid masonry and built of granite, which was obtained from certain quarries situated within easy distance of the site. It is founded on the reef of gabbro which, as previously mentioned, outcrops in the centre of the river and forms an island, and is then carried through both banks for some considerable distance. From east to west it measures a total of 3,500 metres.

For the purpose of explaining the method of construction it may be said that the dam is divided into sections of varying lengths. The central and most important portion, measuring 759 metres, is termed the sluice dam and contains 100 sluices of 2 metres width and 8 metres to springers. Situated immediately above these sluices are 90 spillways of 3 metres width by 2 metres to springer.

On both sides of this main section is a spillway dam both 190 metres in length and containing 18 spillways each measuring 7 metres wide by 2 metres to springer.

Extending from the spillway dam on the east side is a solid dam wall of 97 metres followed by core walling which runs to the terminal and measures 833 metres in length.

From the spillway dam on the west there is a solid dam wall of 305 metres followed by a regulator of sufficient capacity to serve one million feddans of land. This regulator, measuring 150 metres, lets the water into the main canal. It consists of 14 sluices of 3 metres wide by 5 metres to springer. When, at some future date, it is considered possible to irrigate and place under cotton the full area of 3,000,000 feddans this regulator can be extended in a very simple manner by the addition of a further 40 sluices.

As on the east side the dam completes its run to the terminal by core walling of 475 metres length.

The height of the structure from the foundations to the roadway is 33 metres and the width of the base measures 26 metres of solid rubble masonry in cement mortar. It narrows towards the top, but this will be sufficiently wide to conveniently carry a foot road and the Kassala Railway.
FUNCTION OF THE MAKWAR DAM

line which will, in due course, complete its loop of the Eastern Sudan and link up with the main line at Sennar.

It should be interesting to note that the waterway of the sluices and spillways is capable of discharging 15,000 cubic metres of water per second. This is considered sufficient to cover all flood contingencies as the maximum Blue Nile Flood for which any records exist occurred in 1878, and computation approximates the maximum discharge of that flood as 12,000 cubic metres per second.

From the foregoing description of the Makwar Dam it will be readily realised that it has been designed to act mainly as a barrage and partly as a reservoir.

In the first instance it raises the level of the river to such a height that from the 15th July to 18th January the gravitation canal, taking off immediately above the regulator, will irrigate the desired area by free flow, or in other words, from the normal flow of the river. From the 18th January to mid July the requisite supply of water to flood the cotton area will be obtained from that stored in the reservoir, so during the period of low Nile and low supply, the whole normal flow of the river is permitted to pass on to Egypt.

As previously explained, the area to be sown to cotton in the early stages of development is 100,000 feddans, and as all crops will be cultivated on a three course rotation principle, which means that the same land will only carry cotton once every three years, a block of 300,000 feddans will be necessary to provide the 100,000 feddans of cotton annually.

The first block for development in the Gezira plain commences at a point near Hag Abdalla, approximately 36 miles north of Makwar, and runs northwards, parallel to the Blue Nile and in the main to the west of the railway at Hassaheissa. It measures some 85 kilometres long and from 24 to 25 kilometres wide, though, because of the narrowness of both extremities, the width only averages 18 to 16 kilometres. As a site for an irrigation scheme it is certainly ideal.

It may be remarked that this section is particularly small in comparison to the large area possible of irrigation between the boundary railway on the south of the apex at Khartoum. This is, however, as far as immediate development can go, as cultivation depends, not on the area available for irrigation, but on the quantity of water necessary to irrigate it. From calculations already made it has been proved beyond doubt that to develop more than 300,000 feddans of land at this juncture, water must be taken from the river when Egypt cannot spare it, consequently the extension of the area depends on the quantity of water which can be found from some other source. To provide this the Egyptian Government have now started operations to erect a dam across the White Nile at Jejel Aulia so that by conserving the waters of the White Nile during flood period and
providing compensation water during low Nile, more water may be abstracted from the Blue Nile for the Gezira. Further conservation of water can also be effected in the upper reaches of both rivers. In the case of the Blue Nile, should a dam or barrage be erected near the Abyssinian border or on the outlet of Lake Tsuna and store the water which would otherwise flow as waste to the sea, the water thus stored could be all used on the Gezira area, making the possibilities of that scheme extremely good. It would be quite sufficient to completely irrigate 1,000,000 feddans of land.

The soil of the Gezira throughout consists of the heavy black so-called cotton soil which may be described as a stiff loam containing a considerable percentage of clay. It is a type of soil entirely suitable for cultivation and supports excellent crops on the whole of the plain where there is an adequate rainfall. During the kareef (rainy season) the soil swells to an astonishing degree with the result, when the kareef is over and the hot weather sets in, the soil contracts and leaves enormous cracks. This applies, though to a lesser degree, with land artificially irrigated.

The method of cultivation in the Gezira naturally differs from that employed at such places as Tokar, Kassala, and other sections where rain crops are sown. At all of these places the work is carried out by "Seluka," but in the Gezira more modern methods are in vogue, the land being ploughed by steam driven implements and afterwards ridged by steam tackle. These operations are conducted by the Sudan Plantations Syndicate, the cost of such work being charged against each tenant and deducted at the end of the season from his share of profits.

The sowing of seed occurs between the 15th of July and the first few days of August. It is sown on the sides of the ridges where the soil is dry, and if no resowing is necessary the whole 10 feddan plot can be covered by one ardeh of seed.

The period of watering differs according to climatic conditions. It is given every 12 to 18 days, but during the warm weather of October waterings are rather more frequent than is usually the case during December and January when the weather is cooler.

When the plants have broken through the soil and stand about two inches in height they are thinned, only two plants being left to each stand. After two "fassings" have been given the owner runs a native plough along the top of the ridge. This throws the soil on both sides, forming a ridge for both plants and leaving a duct in the centre which is used for future waterways.

Picking begins during the later part of December, and extends to April or early May. Picking presents a very difficult problem as there is generally a shortage of labour and the cotton must be gathered within a fixed period.

When all the cotton has been picked, the stalks are cut down and burnt, thus creating a dead season and minimising the risk of pests at some later growing.
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