

Sir A. Geddes, *Memorandum Prepared by Rhokana Corporation Limited on the Copper Mining Industry of Northern Rhodesia* (London: Rhokana Corporation Ltd, 1932).

MEMORANDUM PREPARED BY RHOKANA CORPORATION LIMITED¹ ON THE COPPER MINING INDUSTRY OF NORTHERN RHODESIA

World Production of Copper

The estimated world production of copper in 1900 was 540,000 short tons,² of which about one-half came from the United States, and less than 9 per cent. from the British Empire (Australia: 25,760 tons; Canada: 9,479 tons). Production and consumption rose steadily, and with remarkable regularity, until the outbreak of war, the production in 1914 being 1,018,395 tons. Practically the whole of the increase during this period came from the United States, being due to the development of the large, low-grade deposits in the State of Arizona, made possible by the discovery of the flotation method of treating ores of low metallic content.

Under the stimulus of the war, production expanded rapidly to a peak of 1,585,282 tons in 1917, fell to 601,913 tons in the re-action of 1921, and again rose during the following few years to 2,127,104 tons in 1929. Since that year, copper, in common with all other raw materials, has suffered from reduced consumption, over-production, accumulation of stocks and disastrously low prices. It has, however, suffered less than most other commodities, the consumption in 1930 having been only 28 ½ per cent. below that of the boom year of 1929, and little, if at all, below the mark which it might have been expected to reach had the orderly rate of pre-war progress continued unchecked.

Increase of production outside the United States.

The most striking point of the huge 1929 production is the great expansion outside the United States. American production reached its apparent limit during the war, and, though the great mines of the West can still produce very large

quantities of copper for a number of years, they are definitely on the down grade as regards both tonnage and richness of ore, and it is most unlikely that any large new occurrences of copper ore will be discovered.

The expansion outside the United States began in South America from the large American-owned Mines in Chile and Peru. The next step in the expansion was taken by Canada and the Belgian Congo, and it was not until the present year that the first two great mines of Northern Rhodesia (N'Kana of the Rhokana Corporation, and Roan Antelope belonging to the Company of the same name) completed their equipment and came into production. The Mufulira Mine, owned jointly by the above two Companies, has also been equipped, but production from this property has been postponed for the time being.

Geographical Distribution of the World's Copper Production.

The successive steps of the increase in the copper-producing capacity of the world may be illustrated by the following table:—

EQUIPPED PRODUCTIVE CAPACITY IN SHORT TONS OF COPPER.

	1900.	%	1923.	%	1932.	%
MINES OTHER THAN EMPIRE —						
United States	303,100	55.0	754,000	53.4	1,275,700	43.3
Mexico	25,000	4.5	60,500	4.3	80,000	2.7
Belgian Congo			63,800	4.5	216,000	7.3
Central and South America	40,300	7.3	274,600	19.4	455,000	15.5
Other countries	135,000	24.5	180,000	12.7	305,000	10.4
	503,400	91.3	1,332,900	94.3	2,331,700	79.2
EMPIRE MINES —						
Canada	9,500	1.7	40,200	2.8	258,000	8.8
Australia	26,000	4.7	30,000	2.2	30,000	1.0
N Rhodesia					291,500	9.9
Other Empire Mines	12,000	2.3	10,000	.7	31,500	1.1
	47,500	8.7	80,200	5.7	611,000	20.8
	550,900	100.0	1,413,100	100.0	2,942,700	100.0 /

Comparison of Copper Consumption in Great Britain and in the rest of the World.

The equipped capacity of the two Northern Rhodesia Mines now producing may at this point, be compared with the consumption of copper in Great Britain during the last few years as recorded by the Imperial Institute:—

1927	155,384 short tons.
1928	171,573 short tons.
1929	174,486 short tons.
1930	160,012 short tons.
1931	153,300 short tons.

The figures of world consumption during the same period, as given by the American Bureau of Metal Statistics, were as follows:—

World, <i>less</i> Great Britain.	
1927	1,602,674 short tons.
1928	1,837,810 short tons.
1929	1,910,074 short tons.
1930	1,555,387 short tons.
1931	1,253,676 short tons.

During this period 83.9 per cent. of the total British Imports came from the United States and the American-owned Mines in South America, and only 6–2 per cent. from sources within the British Empire. It will be seen that the present equipped capacity of the two Northern Rhodesia Mines very much exceeds the highest consumption in Great Britain during the past five years.

Scope for Expansion.

The scope for expansion on the part of British manufacture is indicated by the fact that the consumption of copper per head of population in the United States increased from 8.66 lbs. in 1912 to 18.42 lbs. in 1929. In Great Britain it remained almost stationary, rising only from 6.98 lbs. per head in 1912 to 7.18 lbs. in 1929.

Over 50 per cent. of the world's copper production is used in the electrical industry. A measure of the possible extension of this industry is suggested by the comparative figures of K.W. hours produced per head of population in 1928:—

Per cent. increase on 1925 consumption.		
Canada	1,650	38
United States	857	21
Switzerland	1,282	38
Belgium	468	60
Germany	440	35
France	336	34
Great Britain	328	26
Italy	224	33

Copper Ore Reserves of Northern Rhodesia Compared with World Reserves.

The known ore reserves of the Northern Rhodesia field, as at present developed, amount to 548,780,000 tons of an average grade of 4.11 per cent, copper, equivalent to 22,545,260 tons copper. These are the reserves of ore the copper contents of which have been determined, but the copper-bearing material in the known deposits may amount to 1,750,000,000 short tons in the aggregate. All these

figures are regarded as conservative. There are, besides, still vast and promising areas unexplored, and a large staff of highly trained geologists is continuously at work exploring the further possibilities of the country. /

The following table, which is compiled from figures published by the principal Mines of the World, shows the relation which the present known reserves of Copper Ore in Northern Rhodesia bear to the United States and to the World:—

	Tons Ore.	Grade of Ore. %	Tons Copper.
World (exclusive of N. Rhodesia)	3,037,957,318	1.70	51,774,500
United States	1,628,281,792	1.17	18,900,300
Northern Rhodesia	548,780,000	4.11	22,545,260

Economic Effect of the Mining Industry in Northern Rhodesia.

More than £17,000,000 have been spent to date on exploration and on the development and equipment of the copper mines in Northern Rhodesia. Approximately one-half of this sum has been spent in wages and purchases in Rhodesia and most of the balance in Great Britain. The two mines now working give direct employment to about 1,200 white men and some 7,500 natives, though, during 1932, they are only working at one-fifth of their equipped capacity. It is obvious that the number of persons deriving their livelihood indirectly from these mines must continually increase,³ as the standard of living of the natives rises, and increased amenities are provided for the white people.

As a direct outcome of the development of the copper mines, 140 miles of branch railway lines have been built, apart from sidings on the mining properties themselves. In all some £4,000,000 have been spent on improved railway and harbour facilities and additional railway equipment to deal with the increased traffic anticipated as a result of the opening of the Mines. During 1932 these mines will produce and export over 60,000 tons of copper, and can be expected to import from Southern Rhodesia over 100,000 tons of coal. Food and other supplies will also be imported for both the European and native employees and the satellite population of the mining centres. The Mining Companies have made a contract with the railways, providing for the carriage of all produce and materials outwards and inwards for a period of 15 years. On the basis of a copper production as above estimated for 1932 the gross receipts of the railways from traffic created by the copper mining industry should be about £500,000. It is estimated that if the copper production were increased to the full extent of the equipped productive capacity of the Mines the gross receipts of the railways from the corresponding traffic would be increased to a figure of the order of £2,250,000. Care is being taken to foster the local agricultural industry, and, with this object in view, agreements have been concluded with the Northern Rhodesian Farmers' Co-Operative Society⁴ to purchase approximately 50 per

cent. of the requirements of the mining companies for grain for the native employees, and all the requirements of meat from local producers.

The Rhokana Corporation has built a township at N'Kana at a cost of rather over £400,000, which includes 230 residences for married employees, numerous quarters for single employees, and very finely equipped hospitals for both Europeans and natives, schools, recreation halls, etc.

At the Roan Antelope Mine a similar township has been built, and rather smaller, but otherwise comparable, townships at Mufulira, N'Changa and Bwana M'Kubwa.

Under the advice of the best experts obtainable, the mining companies have vigorously attacked the problem of health conditions, with most encouraging results. In the mining centres both the incidence and mortality from tropical diseases have been conspicuously reduced. For example, the native death rate at N'Kana has been reduced from 31.66 per mille per annum in the first quarter of 1930 to 14.32 per mille per annum for the first quarter of 1932. Modern sanitation and housing and successful anti-malarial measures have created conditions favourable to permanent European colonisation. /

The ground has also been prepared for further advance in the future. For the past eight years organised prospecting has been carried on over the 54,000 square miles of prospecting concession areas. Aerial surveys have been financed, and the country has also been geologically mapped in detail. This geological mapping has involved the construction and maintenance of motor roads to keep the scientific parties in the field supplied.

The copper industry has fertilised the whole of the economic life of Northern Rhodesia, and without it the country would revert to the status of a native protectorate.

Owing to its geographical situation, Northern Rhodesia, at least until a large volume of traffic has been built up, cannot be an exporter of low-priced agricultural produce, and minerals are the only natural products which can bear the traffic charges to the coast. Although the work of the past 10 years has done no more than establish a nucleus, the copper mining industry is capable of very great expansion, and will always provide a local market for agricultural produce, while the expanding labour force employed by the mines will necessitate the importation not only of machinery, but of all types of European goods, and there will necessarily be increased activity in trade, and larger commercial communities will follow.

Proposed Copper Refinery in England.

It is the considered view of the Directors of the Northern Rhodesian copper industry that the erection of a Copper Refinery in England is ultimately essential to the successful development of the industry. The possibility of refining the copper in Northern Rhodesia was carefully considered, but the disadvantages of

severing the refinery from the consuming centres are so many and so grave that the idea was abandoned.⁵

If the refinery were to be in Rhodesia, English manufacturers would have to reckon on a delay of at least a month, even by mail steamer, between the placing of an order for copper and the delivery of the metal, and to secure good freight rates orders would have to be for large quantities. On the other hand, with the refinery situated near the chief consuming centres in England, delivery could be made at a few hours' notice, and in quantities of a ton or even less. Moreover, it is a matter of experience that copper manufacturers may call for the metal to be supplied in any one of about sixty different shapes. If the refinery is distant from the consumer large stocks of these different shapes have to be held ready for delivery, but when the refinery is close to the consumer this is not necessary.

But the advantage is mutual. If it is to the advantage of the refinery to be close to the manufacturers, there are equal advantages to the manufacturer in being close to the refinery. There can be no doubt that the great predominance of the United States as a consumer of copper is in part due to the fact that the refining of copper has gravitated so largely in that country. It is noteworthy in passing that while the copper mines are in the Western States of America, the refineries are mainly on the Eastern seaboard close to the manufacturing centre in the Connecticut Valley. From what has already been said, it is clear that the copper manufacturer at, say, Bridgeport, Connecticut, or Shenectady, N.Y., has an impregnable advantage over the manufacturer in, say, the Birmingham district, in facilities for obtaining his raw material with convenience. If Rhodesian copper is refined in America, the American manufacturer then will be able to obtain that copper more cheaply, as the English manufacturer will have to pay the cost of shipping the refined copper back across the Atlantic, and will still labour under the disadvantage of being unable to get as prompt and flexible delivery.

With these facts in mind, the Rhokana Corporation Limited has made a careful study of the position, and has employed an expert of the highest standing to investigate the question. /

SITE OF THE REFINERY. – After prolonged and careful study it has been decided that a site in the Mersey area offers the best advantages both to the English manufacturer and for export to the Continent. Several suitable sites in this area have been examined and all data obtained as to shipping and rail facilities, power available, etc.

CAPITAL COST AND LABOUR STATISTICS. – The total capital cost of a refinery of suitable capacity, including all accessories other than workmen's houses, is estimated at £1,205,847. Except possibly for a few items of equipment, which it might be necessary to obtain from foreign manufacturers specialising in them, all the material would be purchased in England, and it would not be necessary to import any labour. Roughly over 1,000 men might be expected to

be employed on construction, which would probably take 18 months or two years to complete.

A refinery of the size suggested would give permanent employment to about 575 men earning £8,100 a month, while the total disbursements by the refinery would be of the order of £22,000 a month. Local rates and employees' insurance, but no other taxation, have been included in the above costs.

OPERATING COSTS. – The total operating cost of such a refinery is estimated at £2.5521 per long ton of copper. Assuming interest at 6 per cent. on the cost of the plant, wharf, land and operating capital, and amortization over a 20 year term at 4 per cent. on plant and wharf, the total operating cost and capital charges will be £3.6108 per long ton of copper. These figures may be compared with the figure of £5.75 per long ton which is the best quotation which has been obtained by the Northern Rhodesian Mines for refining in America, to which must be added freight, insurance, and handling charges from the American refinery to the manufacturer in England. This quotation depends to a very limited extent on the market price of copper, but the above figure may be taken as substantially the price which will have to be paid. As negotiations are still in progress, this quotation must be regarded as strictly confidential.

The study of the refining problem made by the Directors of the Northern Rhodesian copper industry has established two facts as indisputable. Firstly, copper refined in England will have a real preferential position in supplying the English market over copper refined elsewhere. Secondly, until a refinery is producing refined copper in England on a scale commensurate with the demand, the manufacturing industry in this country must be at a real disadvantage whether in the home markets or the foreign, as compared with foreign manufacturers in close touch with refineries. In other words, the establishment of a refinery or refineries in this country should be followed by an expansion of manufacturing industries, utilizing electrolytic copper as a raw material, by putting them on favourable terms to compete with the foreign manufacturer, in all markets.

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N. R. Junner, *An Address delivered in London on the 12th October, 1932 ... on the Gold and other Mineral Resources of the Gold Coast and Sierra Leone* (Accra: Government Printer, 1933).

No. 1 of 1933. Gold Coast.

An Address delivered in London on the 12th October, 1932

BY

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ON

The Gold and other Mineral Resources
of the Gold Coast and Sierra Leone.

[...]

1. Probably the first authentic record of the export of gold from the Gold Coast dates back to 1471, when the Portuguese landed at Elmina, opened up mines near by, and established a trade in gold dust. From this date until 1877 the winning of gold was almost entirely in the hands of the Africans. Estimates of the amount of gold shipped to Europe between 1471 and 1877 vary widely and are obviously unreliable. From 1858 to 1875 declared exports of gold from British possessions in West Africa are recorded as £187,000, that is, an average of about £10,000 a year. In addition, a large amount of the gold won was used and hoarded by the Chiefs and their people.

2. The year 1878 witnessed the commencement of European mining on the banket reefs at Tarkwa, and in 1882 there were four companies in operation. From this time until about 1897 European mining was practically confined to the Tarkwa goldfield, although several reef prospects in the coastal region of the Western Province were also explored to shallow depths. Precise statistics of the outputs during the years 1878 to 1897 are not available, but in the year 1875 the

export of gold appears to have been less than £10,000, and according to official statistics the output from 1891 to 1897 averaged about £86,000 per annum. Progress was hampered by shortage of labour, transport difficulties, and the climate.

3. Interest at the beginning of the present century was mainly centred on the Tarkwa goldfield, owing to the arrival of the railway at Tarkwa and to the growing recognition of the similarity of the Tarkwa basket to that of the Rand. Another goldfield of the dimensions of the Rand was predicted. In 1901 there were approximately 150 companies with an aggregate paid-up capital of £9,000,000 interested in gold mining in the Gold Coast. Speculation ran riot, and the jungle boom resulted, which although unfortunate in many respects, led to a great increase in gold production.

4. The gold-quartz mines of the Ashanti Goldfields Corporation, Prestea (Ariston), Brumasi, and Bibiani, which together have produced more than half the gold won from the Gold Coast during the past 30 years, were opened up during the period 1897–1914, and hundreds of other prospects were examined and some of them developed to shallow depths.

5. During the same period, and even until 1920, portions of the Ankobra, Fura, Ofin, Birim and Pra rivers were dredged. Approximately £650,000 of gold were won, but the recovery, which averaged between 2 and 4 grains per cubic yard, was disappointingly low and costs were high. One of the reasons for the low recovery is that a large proportion of the alluvial gold in these rivers is so finely divided that it is difficult to recover. The gold-saving appliances on the dredges were also inefficient, and it is said that 'whole villages along the river banks used to turn out and wash the dredge tailings with considerable profit'.

6. In 1901 the output of gold from the Gold Coast fell to £22,187, the lowest figure recorded in the past 40 years. By 1903 the output had risen to £254,790, and for the year 1914 to £1,744,500, the peak production to the present date.

7. The inevitable slump following the boom, and the commencement of the war, resulted in the disorganisation of the gold mining industry and the wholesale closing down of prospecting and development in outside areas, and, with a few exceptions, only the larger mines situated on the railway survived. /

8. During the war an enormous demand arose for base metals and commodities needed for waging war, and gold mining suffered in consequence. The demand for these metals and commodities continued in the unsettled reconstruction period after the war, and in the Gold Coast the gold mines were also handicapped by an acute shortage of labour, brought about by the cacao boom, road, railway and harbour construction, and the rapid growth of the manganese and diamond mines. This state of affairs continued until about 1928, when, with

the adoption of labour-saving devices and a more adequate supply of labour, conditions in the gold mines began to mend.

9. From 1914 the gold production decreased steadily and reached the low figure of £710,000 in the year 1928–29. Since then the output has gradually risen, and for 1931–32 amounted to £1,123,266 (excluding the value of the gold premium), the highest figure for the past twelve years. The departure of Great Britain from the gold standard last year and the resulting increase in the value of gold gave a great impetus to gold mining in the Gold Coast, the effect of which accumulated when it was realised that costs did not rise as was anticipated, and more so when it became reasonably certain that Great Britain was unlikely to return to the gold standard – at least for some considerable time – with the pound at its old parity.

10. The producing mines are now making good profits, and developments in practically all the mines during the last two or three years, have been promising. The Bibiani mine, which produced £900,000 of gold from shallow depths, has been re-opened, and so has the Cinnamon Bippo mine, which was closed down in 1918 after having produced nearly £400,000 of gold from the surface to a depth of about 250 feet. Some of the smaller mines are also being re-opened.

11. Now let us compare conditions to-day with those existing immediately prior to the war, and attempt to gauge the future possibilities of gold mining in the Gold Coast. Transport and health conditions have been vastly improved, improvements in methods of mining and recovery of gold have taken place, and mining costs have been considerably reduced. Labour is now relatively plentiful and cheap, and management and labour much more efficient than of old.

12. In 1914 very little was known regarding the geological mode of occurrence of gold in the Gold Coast. Since that date the country has been mapped and prospected by the Geological Survey. The main goldfields of Tarkwa, Obuasi, and Prestea have been very carefully studied, and the results, except in the case of the Prestea area (which has only recently been surveyed), published in *Memoirs of the Survey*. Other fields, such as the Ashanti blanket occurrences and the Akropong gold belt, have been mapped and prospected at the surface, and hundreds of other auriferous² occurrences investigated.

13. The work of the Geological Survey has shown that lode and alluvial gold are widely distributed over an area of about 20,000 square miles underlain by mineralised Birrimian and Tarkwaian rocks of pre-Cambrian age. Very little of this area has been tested except by surface prospecting.

14. At the present time practically 90 per cent of the world's gold is being obtained from rocks of pre-Cambrian age and all of the deepest gold mines

in the world are situated in areas of pre-Cambrian rocks. Put in another way, mineralised areas of pre-Cambrian rocks, such as those of the Gold Coast, are relatively favourable for the development of gold mines and for the persistence of the gold in depth.

15. Very few of the numerous prospects, which were opened up by prospectors and small syndicates to shallow depths and abandoned about 1914 or earlier, have since been re-opened, although, in several cases, results that would to-day be regarded as promising were then obtained.

16. Although one cannot but admire the pioneering work done under great difficulties by the many small syndicates and companies in the Gold Coast, one is forced to the conclusion that the chances were, and still are, all against them. If these numerous gold prospects are to be thoroughly tested it is my opinion that the work can only effectively be done by enterprising, large, well-financed companies experienced in the opening up of mining properties in the tropics. Nowadays, gold / mines are rarely found; they have to be made. Capital is required to test the deposits to depths of 200 or 300 feet or more, *i.e.* to below the zone of any secondary enrichment, before it can be determined whether or not the prospect is likely to become a payable proposition. All the difficulties of climate, transport, labour, finance, faulting, and water, can be effectively overcome by large well-financed companies, but any one or two of these difficulties may defeat the prospector or small company. The prospection and development of the immense copper deposits of Northern Rhodesia is a good case in point. The Nkana, Roan Antelope, and N'changa deposits were found by prospectors many years ago, but they remained undeveloped, and their magnitude and value unrecognised until about eight years ago, when the Rhodesian Selection Trust, the Anglo-American Corporation, and the Rhodesia Congo Border company commenced intensively to prospect the country by modern scientific methods. If it were not for the work of these large companies it is practically certain that these copper deposits would have remained undeveloped to the present day.

17. A great deal of courage, determination, rational optimism, and the element of luck are also required for success in gold mining. The Ashanti Goldfields Corporation, when it commenced operations at the end of the last century, was fortunate in having three important reefs to develop, namely, the Ashanti, Obuasi and Cote d'Or reefs. In his report for 1907 the consulting engineer stated – 'Obuasi reef is very irregular and costly to work. Operations are being suspended.' In 1909 work ceased on the Cote d'Or reef owing to a fire in the bottom level, No. 7, and the exhaustion of the ore reserves. Development was continued on the Ashanti reef, and later a prospecting cross-cut intersected the Obuasi reef and, to the surprise of the management, revealed a strong body of

rich ore. Since then the Obuasi reef has been continuously developed, and has yielded more than £7,000,000 of gold. The Cote d'Or reef remained undeveloped from 1909 until 1927, when it was intersected in the main shaft at the 22nd level. Some phenomenally rich ore over great widths has since been developed in this reef. The ore worked by the Ashanti Goldfields Corporation is richer than that being worked by any other gold mine of similar or greater size in the world. More than £11,000,000 of gold have been produced and over £4,000,000 returned to shareholders in dividends.

18. Let us now briefly consider the areas which, in the light of our present knowledge, appear to offer the greatest scope for future development. These are (1) the blanket deposits of the Tarkwa goldfield; (2) the strong gold channel extending in an approximately straight line for nearly 100 miles from the Ankobra river near Akropong to Obuasi and beyond to Konongo; (3) the Prestea gold belt; and (4) parts of the Ashanti blanket formation. In addition there are numerous partly developed and undeveloped mines and prospects in other areas which should be thoroughly tested. It is proposed to prepare a map showing the position of these mines and prospects.

19. Large areas underlain by the blanket formation near Tarkwa remain unexplored. The richest mine of the field – the Taquah mine – which was developed to a vertical depth of 1,200 feet and yielded £2,951,276 of gold from 1,035,347 tons of ore, an average value of 57 shillings per ton, from a reef 4 to 5 feet wide, was closed some years ago owing to difficulty in locating and working the reef in the disturbed area west of the 14th level. It has not since been re-opened. Now that the geological structure and the nature of the faulting of the Tarkwa goldfield are appreciated it should not be difficult to locate the ore-bodies; it does not seem reasonable to believe that they have petered out.

20. Many of the fissure reefs are lenticular³ in shape, and one lens may die out and give place to another which may be found some distance from the first lens. Impoverished zones, extending for as much as 200 or 300 feet vertically, have also been encountered in the Ashanti and Ariston mines. The Broomassie mine produced £1,000,000 of gold to the 9th level, where the reef and the ore-shoot pinched out. It seems reasonable to expect that the shoot will again make in depth. /

21. Of the partly-developed prospects, the line of auriferous reefs along the motor-road from Akropong to Ayanfuri appears to be worthy of careful investigation. The reefs are situated in a very persistent gold channel, and in some of the prospects the reefs are 15 feet or more wide, and according to old reports average 10 to 20 dwts. of gold per ton over this width. If payable values are maintained to below the oxidised zone there is a good chance of them persisting to considerable depths, as the ore channel is of very great strength.

22. In such a relatively undeveloped country as the Gold Coast it is possible, if not probable, that many new discoveries of valuable mineral deposits will be made in the future. One suspects the existence of ore-bodies composed mainly of massive or disseminated sulphides, but, owing to the difficulty of recognising the leached outcrops of such ore-bodies in the humid tropics, only one ore-body of the kind has been found; namely Justice's, which yielded £400,000 of gold to shallow depths. One of my colleagues, Dr. Cooper, has recently completed a course in geophysical prospecting, and when the necessary instruments can be purchased it is proposed to test selected areas in an attempt to locate ore-bodies of this type.

23. In the time available it was not possible to deal with the extensive manganese, diamond, and bauxite deposits of the Gold Coast.⁴

SIERRA LEONE.

24. Prior to 1926 no minerals had been worked in the Colony or Protectorate of Sierra Leone, and it was generally believed, even in 1926, that there was nothing of value in the way of mineral deposits in Sierra Leone. Sir Ransford Slater,⁵ who was Governor at the time, did not, however, share this belief, and arranged for the loan of a geologist from the Gold Coast Geological Survey for 2½ months to make a preliminary survey of parts of the Protectorate.⁶ The survey resulted in the discovery at Marampa of large deposits of haematitic iron-ore, which are now being developed, and, also, payable deposits of gold and platinum, but, curiously enough, the belt of country in which the main hopes were centred yielded nothing of economic interest. Sir Ransford was so impressed by these discoveries that he decided to form a small geological department. To-day gold and platinum to the value of about £50,000 per annum are being exported, and by the middle of next year shipments of iron-ore from Marampa should commence. Vast deposits of hæmatite have been discovered by the Geological Survey in the Koinadugu district, and also valuable deposits of chromite, ilmenite, diamonds and corundum.

25. It is not generally recognised that the great progress made in the mineral industry in Sierra Leone is so largely due to the foresight and vision of Sir Ransford Slater and his faith in the value of geological surveys. The speaker also paid tribute to the keen interest taken by Sir Joseph Byrne and Sir Arnold Hodson in the development of the mineral resources of Sierra Leone.

26. *Gold.* – When we consider the enormous extent of the old African gold workings in the Gold Coast and also the fact that gold has been won and shipped from West Africa for more than 500 years, it is surprising that there is no evidence that the rich alluvial gold occurrences of Sierra Leone were ever worked by the Africans. The main deposits are associated with a belt of schists

forming the Sula-Kangari hills, situated in the Central and Northern Provinces and stretching for 90 miles in a meridional direction. Promising prospects have also been found in association with similar schists in the Nimi and Gori hills in the Kono District. Four areas are being worked for alluvial gold, namely, Boama-bun, Makong, and Gbulia, which are being exploited by Maroc, Limited, and Masumbiri by Sierra Leone Goldfields, Limited.

27. The first gold was won in 1929 and since then the outputs have been as follows:—

	£
1930 – 958 ozs. valued at	3,058
1931 – 6,650 ozs. valued at	27,722

For 1982 the value of the output will probably be about £45,000. /

28. The source of the alluvial gold lies in the schists in the vicinity of the contact with an intrusive granite, and in two areas bands of mineralised rock and quartz carrying visible gold have been located immediately upstream from the alluvial deposits. Systematic prospecting of these occurrences is being undertaken and it is hoped that payable ore-bodies will be located.

29. *Platinum.* – The deposits are situated near the foot of the hills about 15 miles from Freetown. The platinum is coarse and many nuggets of from 10 to 20 dwts. have been found. Such coarse platinum is not found anywhere else in the British Empire, but larger nuggets of osmiridium – an allied metal – are found in Tasmania. The Sierra Leone deposits are fairly rich, but, owing to the frequent fluctuations in the price of platinum, it is difficult to estimate the quantity of payable ground and the life of the deposits. When they were found in 1926 refined platinum was worth more than £20 an ounce. Since then the price has been down to under £5 an ounce, and is now £9 to £10 an ounce.

30. The deposits have been worked on a small scale since 1929. The output is averaging about 550 to 600 ozs. per annum and could be considerably increased if the market for platinum justified it.

31. *Ilmenite.* – In the vicinity of York and Hastings, situated between 10 and 20 miles from Freetown, there are large deposits of high-grade ilmenite occurring as lodes and in the form of black sands. Ilmenite sands assaying 50 per cent or more titanium-dioxide and 1 to 12 dwts. of platinum per ton, are recovered as a by-product of the alluvial platinum workings near York. Samples of the ilmenite were tested by a commercial firm and found to be suitable for the manufacture of titanium-white, a pigment which is largely replacing white lead owing to the fact that it is nonpoisonous and possesses twice the covering capacity of white lead.

The slimes remaining from the treatment were found by the Imperial Institute to contain about 1 ¼ ozs. of platinum metals per ton of slimes.

32. In view of the very great expansion in the use of ilmenite in recent years, and the very favourable geographical position of the Sierra Leone deposits, it seems likely that attention will be turned to them when world conditions improve.

33. *Iron Ore.* – Sierra Leone possesses the largest known reserves of high-grade iron-ore in West Africa. In size they are probably larger than the immense deposits of bauxite in the Gold Coast.

34. There are two main ore fields, (a) Tonkolili and (b) Marampa. The Tonkolili deposits are situated in the hills in the south-western portion of the Koinadugu District, about 125 miles from the new port at Pepel Point on the estuary of the Sierra Leone river. The ore-bodies are of great width and continuity, and consist essentially of hæmatite assaying from 52 per cent to 69 per cent iron and relatively low in injurious constituents. The area covered by the deposits has been temporarily closed to prospecting.

35. The Marampa deposits are very much smaller, but much closer to the sea than those of the Tonkolili field. They contain some 10 to 12 million tons of first-grade hard ore assaying 57 per cent to 58 per cent iron and in addition a very large quantity of high-grade powdery ore. A 3-foot 6-inch gauge railway, 50 to 55 miles long, is being constructed from Marampa to the port at Pepel Point, and it is expected that shipments of iron-ore will commence about the middle of 1933.

36. Of the large Empire reserves of high-grade iron-ore those of Sierra Leone are, with the exception of those of Newfoundland, the nearest to the United Kingdom.

37. *Chromite.* – Of the several occurrences of chromite the most important are the deposits situated about 6 miles north of Hangha, a town on the railway 186 miles from Freetown. The chromite occurs in a series of lenses which are stated to contain from 43.5 per cent to 47.72 per cent chromium sesquioxide. It is estimated that 80,000 tons of ore are available to a depth of 70 feet. The deposits have not yet been prospected below this depth, and until this is done their magnitude cannot be fully gauged. /

38. *Diamonds.* – Diamonds were first discovered by the Geological Survey near Jaiama early in 1930, and another discovery was made near Kenema about a year later. For the past twelve months the Consolidated African Selection Trust has been prospecting a large strip of country surrounding the original discoveries. It is said that encouraging results have been obtained and that the diamonds recovered are much larger and more valuable than those from the Gold Coast.⁷

39. The development of the mineral resources has arisen at an opportune time for Sierra Leone. A large number of Europeans and several thousand Africans are being employed in the mining industry and the Government are benefiting directly from mineral rents and royalties and increased customs duties, and indirectly from increased wealth in the hands of the Africans.

40. In concluding his remarks the speaker expressed his optimism regarding the future development of the mineral resources of the Gold Coast and Sierra Leone, and particularly so with regard to gold. Gold mining is prospering to-day and the mines are in the enviable position of being able to dispose of all the gold they can produce at favourable prices. Furthermore, it is becoming increasingly evident that these favourable conditions will continue for some time to come.

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Geddes, Memorandum on the Copper Mining Industry of Northern Rhodesia

1. *RHOKANA CORPORATION LIMITED*: The Rhokana Corporation was formed in December 1930 to take over the assets of the Rhodesian Congo Border Concession, N'Changa and Bwana M'Kubwa companies. The merger was sponsored by Rio Tinto and Rhodesian Anglo-American and two years later Rio Tinto acquired 17.6 per cent of the shares of the enterprise. See B. W. E. Alford and C. E. Harvey, 'Copperbelt Merger: The Formation of the Rhokana Corporation, 1930–32', *Business History Review*, 54:3 (1980), pp. 330–45; C. Harvey, *The Rio Tinto Company: An Economic History of a Leading International Mining Concern, 1873–1954* (Penzance: Alison Hodge, 1981), p. 316.
2. *short tons*: A short ton is equal to 2,000 lbs.
3. *It is obvious ... must continually increase*: Geddes's optimism as regards the sector was fulfilled. From 1935 to 1937, the price of copper rose sharply, partly due to an international producers' restriction agreement, but mainly to increasing demand from Britain and Germany, both of which were rearming. By 1938, Northern Rhodesia produced 213,000 tons of copper worth £9m (13.42 per cent of the non-communist world's supply), which made up 90 per cent of the country's total exports. See J. McCracken, 'British Central Africa', in A. D. Roberts (ed.), *The Cambridge History of Africa, Volume 7: 1905–1940* (Cambridge: Cambridge University Press, 1986), pp. 602–48, on pp. 626, 629; R. E. Baldwin, 'The Northern Rhodesian Economy and the Rise of the Copper Industry', in Z. A. Konczacki and J. M. Konczacki (eds), *An Economic History of Tropical Africa, Volume 2: The Colonial Period* (London: Frank Cass, 1977), pp. 60–76, on p. 66.
4. *the Northern Rhodesian Farmers' Co-Operative Society*: The Northern Rhodesian Farmers' Co-Operative Society was formed in 1914 by the European settler farmers as a means of marketing agricultural produce to the newly opened copper mines.
5. *refining the copper in Northern Rhodesia ... was abandoned*: A refinery was eventually built in Northern Rhodesia at Nkana. This was sold in 1949 to a new company, Rhodesia Copper Refineries Ltd. See F. L. Coleman, *The Northern Rhodesia Copperbelt, 1899–1962: Technological Development up to the End of the Central African Federation* (Manchester: Manchester University Press, 1971), p. 159.
6. *A. C. GEDDES*: Auckland Campbell Geddes was born in 1879 and had four careers. He was a soldier, serving as a lieutenant in the Boer War and as a major in the First World War. He was also an academic, a politician and a businessman. Assistant professor of anatomy at Edinburgh University in 1909–13, he then became professor of anatomy at the Royal College of Surgeons in Ireland (1913–14) and professor of anatomy at McGill University, Montreal, Canada (1914–15). His political career began in 1917 when he was elected the Unionist MP for Basingstoke. He subsequently became Director General and Minister for National Service (1917–19), president of the Local Government Board (1918–19), Minister of Reconstruction (January–May 1919), president of the Board of Trade (May 1919–March 1920), British delegate in Washington to the Conference on Limitation of Armaments (1917–20), Ambassador Extraordinaire and Minister Plenipotentiary to the USA (1920–4) and Regional Commander for Civil Defence (1939–43). From 1924 until 1947, he was chairman of the Rio Tinto Company and Rhokana Corporation, as well as a director of various other companies. He became a baron in 1942 and died in 1954.

*Junner, An Address on the Gold and other Mineral Resources of the
Gold Coast and Sierra Leone*

1. N. R. JUNNER: Norman Ross Junner was the director of the Sierra Leone Geological Survey. Junner was the first to find alluvial gold in the Sula Mountains of Sierra Leone (1926), and, it was he and his assistant, J. D. Pollet, who in 1930 discovered diamonds in Kono. Surprisingly, the colonial authorities were uninterested in the latter discovery and it was Junner who brought it to the attention of the Consolidated African Selection Trust, who prospected the site, and, as discussed in the general introduction to this collection and in the source text, obtained 99 years of exclusive rights to diamond mining and dealing in the territory (see I. Smillie, L. Gberie and R. Hazleton, *The Heart of the Matter* (Ontario: Partnership Africa Canada, 2000), p. 40). Junner was also the author of a number of reports, including *Chemical Analyses of Gold Coast Rocks, Ores and Minerals* (London, 1947); *The Diamond Deposits of the Gold Coast, with Notes on other Diamond Deposits in West Africa* (London, 1943); *Gold Coast Geological Survey: The Geology and Mineral Resources of the Gold Coast* (Accra, 1938); and *Geology of the Gold Coast and Western Togoland, with Revised Geological Map* (Colchester, 1940).
2. *auriferous*: containing gold; gold-bearing.
3. *lenticular*: an adjective describing an ore formation with a lens-shaped cross-section.
4. *extensive manganese, diamond ... Gold Coast*: Manganese was first discovered in 1915 in Nsuta in the western part of the country and mining commenced immediately. By 1937, the country exported £1.026m worth of the mineral and was the fourth-largest producer in the world. Deposits of bauxite were found in 1921 in the regions south and north-east of Obuasi. Unfortunately, exploitation of the deposits was prevented by a lack of transportation and it was only on the outbreak of the Second World War, when Britain was denied supplies from elsewhere, that the government built the required railway line and commercial mining by the British Aluminium Company Ltd began. Diamond mining, meanwhile, started in the 1920s, and in 1937 the colony exported £648,057 of stones. See F. M. Bourret, *Ghana: The Road to Independence, 1919–1957* (Oxford: Oxford University Press, 1960), pp. 7, 127.
5. *Sir Ransford Slater*: Sir Alexander Ransford Slater was Governor of the Gold Coast from 4 May 1922 to 24 September 1927.
6. *a preliminary survey of parts of the Protectorate*: The surveys were also undertaken in the hope of reducing the country's dependence on palm products. See D. C. Dorward, 'British West Africa and Liberia', in Roberts (ed), *The Cambridge History of Africa, Volume 7*, pp. 399–459, on p. 445.
7. *diamonds recovered ... from the Gold Coast*: The Consolidated African Selection Trust soon began mining operations. Its monopoly of production was repeatedly broken. By the 1950s, there were an estimated 75,000 illegal miners in Kono district, the main diamond-producing area, and there was much smuggling. In 1955, therefore, the government removed the company's nationwide monopoly and confined its operations to Yengema and Tongo Field, an area of about 450 square miles. In return, the company obtained £1.6 million in compensation (D. H. Houghton, 'Economic Development, 1865–1965', in M. Wilson and L. Thompson (eds), *The Oxford History of South Africa* (Oxford: Clarendon Press, 1971), pp. 1–48, on p. 13).