Sierra Leone — Colonial Geological Surveys 1947–1956

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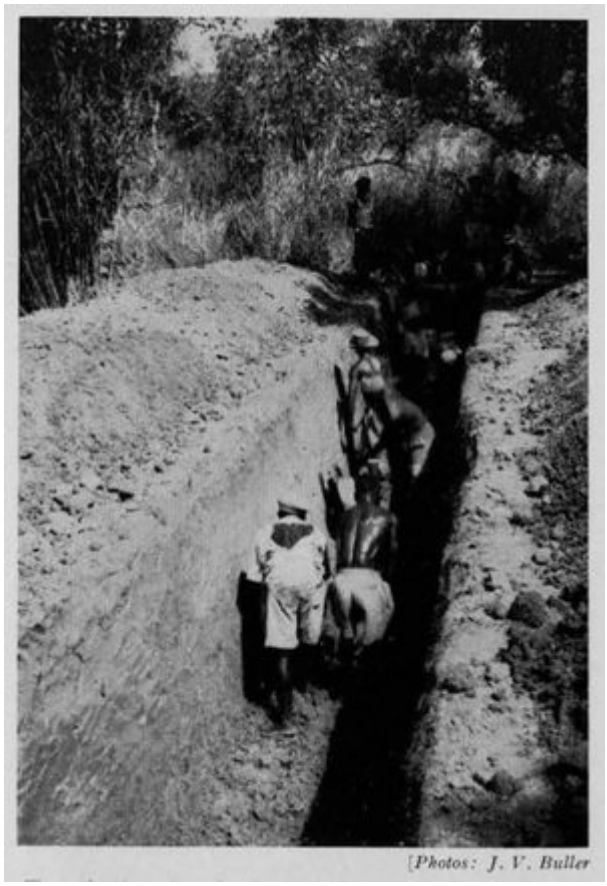
From Dixey, F. 1957. Colonial Geological Surveys 1947–1956: a review of progress during the past ten years. Colonial geology and mineral resources. Bulletin supplement No. 2. London: HMSO.

Field activities of the Sierra Leone Geological Survey. Geological Survey staff at work with Banka drill, Kilimi River, about 4 miles west of Findokhuri, Tambakha Yobanji Chiefdom. Photo: J. V. Buller. Plate XIII.



Field activities of the Sierra Leone Geological Survey. Trench dug by Geological Survey in laterite and rotted rock to ascertain nature of contact south-west of Saionya Scarp. Photo: J. V. Buller. Plate XIII.

Areas mapped, or in course of mapping, by Sierra Leone Geological Survey. In addition, a small triangular area of about 20 sq. miles in the Yana district (top NW of diagram, adjacent to French Guinea border) is being mapped on scale 1 : 62,500. Text-fig. 11.

Sierra Leone

The first Government Geological Survey of Sierra Leone was formed in 1918, when Dr. F. Dixey was appointed Government Geologist. In the course of three field seasons he determined the main outlines of the geology of the country and published its first geological map, but the Survey was disbanded on financial grounds in 1921. A few years later the late Sir Albert Kitson, when Director of Geological Survey of the Gold Coast, advised the Government of Sierra Leone that the geology of the country, as revealed by the work of Dr. Dixey, appeared to be favourable for the occurrence of mineral deposits and would justify a further examination, and early in 1926 Dr. N. R. Junner was seconded from the Gold Coast for this purpose. He met with rapid success, and discovered the high-grade haematite iron-ore deposits near Marampa, alluvial gold in streams near Masumbiri in the Simiria Chiefdom, and alluvial platinum in streams draining the basic igneous complex of the Colony in the vicinity of York. In 1928, a Geological and Mines Department was established and Dr. Junner was appointed its first Director with one Assistant Geologist. During the next two years, extensive reconnaissance geological surveys of the country revealed the extent of the schist areas of the Sula Mountains and the Kangari Hills and of the Kambui and Nimini Hills and of further mineral deposits associated with these rocks, including the Tonkolili haematite iron-ore deposits, the chromite deposits near Hangha and Senduma, and a number of new discoveries of alluvial gold. Alluvial diamonds were found in the Gbogboro stream in Kono District.

A mining industry had been established in Sierra Leone when, towards the end of 1930, Dr. Junner returned to the Gold Coast on promotion to the post of Director of that Survey. The Geological Survey of Sierra Leone carried on its work, however, with one officer, Mr. J. D. Pollett. Further areas of schist were found and outlined in the course of his reconnaissance surveys, and new deposits of minerals were discovered, including the main haematite iron-ore deposit of the Tonkolili area at Simbili Hill, alluvial diamonds both in the Kono District and in the valley of the Moa River near Kenema, alluvial gold in many localities, and extensions of the chromite areas between the Kambui and Gori Hills. Conditions became very difficult during the financial crises of the early 'thirties, when expenditure was cut to a bare minimum, and in 1937 Mr. Pollett was seconded to the Provincial Administration for six months to take charge of a District—an office which he again held from just before the outbreak of war in 1939 until mid-1944. During these periods the work of the Geological Survey was thus discontinued. Mr. Pollett was later recalled to Geological Survey duties with the special task of investigating lignite deposits discovered earlier by the Survey in the vicinity of Yema, and, during the next few years, work was largely confined to this investigation and to the examination of the brickmaking qualities of the clays associated with the lignites. In 1949 a grant from Colonial Development and Welfare funds was approved for a considerable expansion of geological surveys in Sierra Leone, and two geologists were appointed. A block of buildings in the former Royal Air Force camp at New England was taken over and converted to offices and laboratories for the new Geological Survey.

At the end of 1946, or the beginning of the review period, the Geological Survey of Sierra Leone consisted of only one geologist. By the end of 1956, however, there were twelve qualified officers, comprising 1 director, 1 assistant director, 4 geologists, 1 geologist-chemist, 1 mining geologist, 1 petrologist, 1 diamond driller, 1 draughtsman and 1 prospector.

Before 1947 enough geological work had been done in Sierra Leone by F. Dixey, N. R. Junner and J. D. Pollett to permit of the preparation of provisional geological maps on the scales of 1 : 1,000,000 and 1 : 250,000. Since then, all mapping has been to a scale of 1 : 63,360 or larger, the main areas being shown in Table 5 below:

Table 5 Principal areas being mapped in Sierra Leone During 1947–56

Geological Map Sheets	Equivalent Sheets of 1 in. Topo. Survey	Scale of Geological Maps	Area Mapped Geologically (*sq. miles*)	Remarks
Sula Mts. and Kangari Hills, Sheets 1–5	21, 22, 30, 31, 32, 41, 42, 52, 53, 63, 64, 75, 76	1 : 50,000	1,600	In *the press.*
Yana NW	2	1 : 62,500	20	Mapping begun.
Kambia SW and SE	26, 27, 38	1 : 62,500	130	Mapping begun.
Geology of Colony Complex	2 (vicinity of Freetown)	1 : 63,360	170	Completed in MS.
Kambui Hills	78, 89	1 : 50,000	10	Mapping begun.
Gola Forests	99, 100, 107	1 : 50,000	100	Mapping begun.
York Pass Area	2 (vicinity of Freetown)	1 : 10,000	7	Completed in MS.
Guma Water and No. 2 River Drainage	2 (vicinity of Freetown)	1 : 5,000	5	Completed in MS.
Isogam Plans of Songo and Garahun	3 (vicinity of Freetown)	1 : 5,000	8	Completed in MS.
Geological Plan of country round Chrome Mines at Hangha	78 and 79	1 : 5,000	5	Completed in MS. Incorporates plans to larger scales.

In addition, a map of the Sewa Valley on the scale of 1 to 30,000 was prepared from air photographs to show where diamantiferous gravels might be expected to occur. The Sula Mountains of central Sierra Leone and the Kangari Hills to the south form a single range of mountains built up of a series of ancient schists and associated granitic intrusions, and these rocks, which are of considerable importance in the geology of the country, have been the subject of detailed study, because a proper understanding of them should aid the mapping of similar schist belts elsewhere.

Banded ironstones are of special importance in the Sula Mountains in view of the fact that, where folds in them outcrop beneath an old erosion surface, deep weathering has changed them into large workable bodies of lateritic iron ore. The fresh ironstones are laminated and consist of quartz, magnetite, biotite and amphibole, including tremolite and cummingtonite, in varying proportions and combinations.

In 1952, Dr. M. K. Wells of University College, London, collaborated with members of the Department and petrologically mapped the layered basic igneous complex forming the mountainous Colony Peninsula. Parts of it were also surveyed gravimetrically by Dr. M. H. P. Bott of Durham University in 1956. The main types of rock forming the complex are anorthosite and anorthositic gabbro, gabbros with an excess of pyroxene over olivine, and olivine-rich rocks such as troctolite. From above downwards the succession is in roughly the order given in each of five superimposed and distinct zones. Anorthosites and anorthositic gabbros at the top of a zone tend to penetrate into and vein for a few feet the overlying olivine-rich rocks of the zone above, but the reverse relationship is never seen. In addition to the large-scale zones, there are minor and incomplete repetitions of, and variations in, the general zonal succession within the components of each zone. Texturally, units and zones tend to coarsen downwards. Gravity suffices to explain the broad arrangement of the different varieties within the zones, but not the details. A large lens of anorthosite about 2,500 ft. thick is interlayered with the complex at one place. It passes northwards into anorthositic gabbros and is not regarded as a separate intrusion.

Diamond drilling in progress at the base of the complex, east of the Colony Peninsula, reveals that

the gabbros become increasingly rich in hornblende and apatite downwards, then merge into a zone of amphibolite several hundreds of feet thick with the strike and dip of the gabbro layering. The amphibolite rests unconformably upon steeply dipping gneisses.

In 1953 and 1954 Professor K. C. Dunham and Mr. R. Phillips of Durham University, helped by a geologist from the Department, mapped the country round the chromite mines at N'Gerihun as well as the mine workings. N'Gerihun is in the Kambui Hills, the type area for the Kambui Schists. Professor Dunham has submitted a detailed report on his work to the Department, which will be published as Supplement No. 3 of " Colonial Geology and Mineral Resources ". The report, however, may be summarised as follows:

In the Kambui Hills near Hangha, the Kambui Schists, striking consistently NNE and dipping steeply W, consist of hornblendic rocks which are shown to be of igneous parentage, 6,000 ft. thick, enclosing a belt of biotite-gneiss 200300 ft. thick. The gneiss belt is traversed by a zone of shearing which embraces irregular lenses of dunite up to 250 ft. thick, in which chrome-spinel bands and ore-bodies, though steeply inclined, generally fail to conform with the regional foliation. Since the chromite bands exhibit rudimentary gravity-stratification, they are taken to indicate that both spinel and olivine accumulated as horizontal layers by gravitative settling. Chain-structure is typical of the lower-grade chromite bands. The ultrabasic bodies are considered to have been emplaced after the metamorphism of the schists, by " cold intrusion ", during which serpentine, brucite and chrome-clinochlore were formed on a limited scale. The shear zones enclosing the ultrabasics were subsequently invaded by pegmatite fluids, which promoted the metasomatic development of anthophyllite (in water-deficient regions), chrome-tremolite, talc, chrome-muscovite and phlogopite in addition to quartz and felspar. Leaching of chromite occurred at this stage but no hydrothermal formation of spinel.

The Hangha chromite is $Cr_{59}Al_{34}(Mg_{65})$ on Thayer's (1946) shortened formula. Conversion of phlogopite to vermiculite represents a later stage, related to weathering; this also applies to alteration of felspars to kaolinite and metahalloysite. Chromite and, to a less extent, anthophyllite resist lateritic weathering much more effectively than the silicates associated with them.

The Kambui Schist area is surrounded by Basement granite, and with this the late pegmatites may be associated. The complex alterations of the chromiferous ultrabasics at Hangha may be regarded as an early phase of granitisation; at Bendu-Yawie, near the Gori Hills, a lens of chromite totally enclosed in later granite represents a more advanced stage. Lenses of chromite in granite-gneiss at Jaluahun are interpreted in the same way; abundant mariposite intimately associated with the chromite suggests accession of potash. [*Authors' abstract.*] The existence of chromite in substantial quantity in the south-eastern part of the Sierra Leone Protectorate was first discovered in 1929 by Dr. N. R. Junner and Mr. J. D. Pollett in the course of Geological Survey fieldwork. The initial discoveries were at Jaluahun, near Senduma, 12 miles south of Blama, and in the Kambui Hills west of N'Gerihun, 5 miles north-east of the Sierra Leone Government Railway at Hangha. Other deposits were subsequently found by the Geological Survey on the Moa River between Potoru and Zimi, and on the eastern slope of the Gori Hills near Bandajuma.

In the district around the confluence of the Mabole and Little Scarcies rivers, complicated geology has been disclosed by the mapping which began in 1952. Andesitic lavas of the Rokell River System rest with unconformity upon granites and gneisses and upon small areas of Marampa Schist. The Marampa Schists are thought to have been thrust over the granite and not to have been intruded or granitised by it. Included in the granite with wide migmatitic haloes are areas of hornblende- and mica-gneisses, probably belonging to the Kasila System. The western part of the largest area is covered by conglomerates, arkoses and grits of late pre-Cambrian, or early Palaeozoic, age. The alluvial rutile, so plentiful in the Mabole and Scarcies and their tributaries, appears to have been

shed by sheared quartzites belonging to the Kasila System, well known for its richness in titanium. Mapping is at present in progress on the scale of 1 : 50,000 in the Kambui Schist Belt and in the Gola Forests near the Liberian Frontier, where gabbros and banded ironstones are reported.

Analyses of galena specimens from veins cutting the Sula Mountains schists were made independently by Professor Tuzo Wilson and associates of Toronto University, and by Professor F. G. Houtermans and associates of Berne University. The analyses give isotopic lead ratios much like those from galenas in veins cutting the Bulawayan of Southern Rhodesia and the Nyanzian of East Africa. According to present notions about the rates of decay of radioactive elements and of the age of the earth, the conventional age indicated by the isotopic ratios is about 2.9 units of a thousand million years. Professor Wilson fixed upon a similar figure for the thorium age of alluvial monazite from the Sula Mountains. To what events the ages refer is by no means certain; some would connect them with the orogeny during which the rocks of the Schist Belt were first folded.

Ideas about the geomorphology of Sierra Leone are taking shape as the 1 : 50,000 geological mapping progresses. It appears possible that the old duricrusted erosion surface capping the Sula Mountains may be a resistant part of the 1,200–1,700 ft. erosion surface of Sierra Leone. As features in the Tertiary and Quaternary sediments, and river-captures in the country to the north-east of them, lend some support to the supposition that the coastal belt has been tilted south-westerly, it is not inconceivable that the 1,200–1,700 ft. erosion surface may be a continuation of the lateritised surface found by drilling beneath the sediments east of the Colony Peninsula. If so, as the sediments have been dated tentatively by Dr. Errol White as Eocene and later, the maximum age of the erosion surface might be Mesozoic. The age is certainly later than Palaeozoic, as there are no traces of the Saionya Scarp System or of the dolerite sills associated with it anywhere in the Sula Mountains. Lake Sonfon, at the northern end of the Sula Mountains, is thought to have been formed by tilting which, together with repeated uplifts, might account for the reversals in the directions of the rivers in the surrounding country and in the repeated river-captures there.

During the period under review, considerable attention was given to the discovery of mineral deposits. Thus, between 1949 and 1954, about 12 sq. miles of Quaternary and Tertiary sediments—just east of the Bunce River in the Protectorate—were prospected for lignite. Ten areas were found to be underlain by lignite seams of an average of 3 ft. in thickness, and are covered by anything up to 100 ft. of overburden. They contain about 3 million tons of lignite, of which 800,000 tons might be suitable for open-cast mining. In 1952, a car-borne geiger-counter survey was run over about 2,300 miles of the Sierra Leone roads by the Atomic Energy Division of the British Geological Survey in co-operation with the Department. The survey found two main areas, both in granite adjoining Kambui Schists, where detailed prospecting for monazite may be fruitful in times to come. Lateritic bauxites in the Colony, the Sula Mountains and around Kangahun were examined and drilled by the British Aluminium Company at the Department's suggestion during 1953 and 1954, and about 250,000 tons of bauxite were found in the Sula Mountains containing more than 40 per cent. of alumina and less than 7½ per cent. of silica. Prospecting for lower-grade bauxites may be undertaken later.

The Guma Water and Big Water drainages in the layered basic igneous complex of the Colony Peninsula produced 5,242 oz. of crude alluvial platinum. In 1950 and 1951 the platinum was traced to some of its sources in the rock by geological mapping on the scale of 1 : 5,000 and 1 : 10,000, and by loaming along lines cut at regular intervals through the forest. Sources recognised as a result of this work are : (1) Pyroxene-rich bands in troctolite and troctolitic gabbro; (2) Pyroxenerich bands associated with titaniferous magnetite seams in the anorthositic gabbro; (3) Pegmatitic pyroxene schlieren and bands or zones rich in titaniferous magnetite in the anorthosite. Conclusions about the Guma Water sources are being checked by channel sampling of the walls of a tunnel which is being driven (in connection with the Freetown water-supply scheme) through one of the platiniferous

zones. Platinum in the sources that have been found so far is, unfortunately, far too dispersed to be worth working.

The following prospects have been found as a result of geological mapping in the Sula Mountains :

Table 6 Mineral prospects in the Sula Mountains

Name of Prospect	Principal Metals Found	Remarks
Yirisen	Gold, zinc, arsenic, antimony, lead	Trenched and sampled by the Depart-went, then explored underground to some extent by Sierra Leone Development Company
Worowaia	Molybdenum	Trenched by Sierra Leone Chrome Mines Limited
Yafarina	Gold	Trenched by the Department
Fundiburu	Gold	Trenched by the Department
Sende	Molybdenum and lead	Trenched by the Department and by Sierra Leone Chrome Mines Limited
Singeri	Iron	No excavations have been dug, as trenching and sampling the lateritic ironstone would be too expensive and time-consuming

Geochemical work has been carried out in varying detail on the first five prospects by a geologist from the Department and a colleague from the Royal School of Mines. Diamond drilling may be undertaken later at the first two prospects.

Indications of other mineralisations, *e.g.* in the Signakolo and Matorni Valleys, have been noticed in the Sula Mountains, and systematic sediment samples for geochemical examination are to be taken from streams in their neighbourhood. Mapping at the old Baomahun Mine towards the southern end of the Kangari Hills reveals that the auriferous arsenopyrite zones are usually in garnet-cummingtonite-schists and banded ironstones near contacts with cordierite-schist. This discovery may help in tracing auriferous zones northwards by geochemical and other means.

At the Department's suggestion, a mining company explored some low-grade manganese deposits near Bradford and banka-drilled in search of workable rutile-bearing gravels near the confluence of the Mabole and Little Scarcies rivers. The manganese deposits proved disappointing, but because of the big rise in the price of rutile the gravels may possibly be worth further sampling. A mining company also prospected and mined columbite gravels discovered by the Department to the east of the Sula Mountains and round the south end of the Kangari Hills. The columbitebearing gravels also carry ilmenorutile, but so far the mineral has not been worked. The initial prospecting for it was done by the Department.

In 1952 an officer of the Department, who had found concentrations of titanium minerals in the streams draining the hills round Gbangbama and Gbangbatok, invited the attention of the consulting geologist of British Titan Products Company, Limited, to his discoveries. When, in 1954, the company found that many of the concentrates submitted to them by the Department were a good deal richer in rutile than in ilmenite, they decided to apply for a special exclusive prospecting licence stretching along the coast from Shenge to Sulima and extending inland to Sembehun, Sumbuya and Pujehun. Subsequent banka-drilling by the company in the Lanti—which rises in the Gbangbama Hills—is said to have indicated a million tons of recoverable rutile with a possibility of at least as much more. Fourteen other streams rising in the Gbangbama Hills are said to be worth prospecting.

Professor Dunham's work near Hangha has not only provided records of the geology in the chromite quarries, which were rapidly filling with landslide debris, but has given Sierra Leone Chrome Mines, Limited, some assurance that the density with which the ore-bodies are distributed in depth is much the same as that ruling in the ground already developed. Professor Dunham's suggestion that anthophyllite fragments surviving in the soil could be used to trace buried bodies of dunite should be valuable in surface prospecting.

The diamond drilling, magnetometry and gravimetry in selected strips on the eastern side of the Colony's layered-basic-igneous-complex is chiefly intended to help in the prospecting for copper or nickel, as well as platinum ores, that may occur near the contact of the gabbro with the gneisses in the footwall. Diamond drilling has now indicated the general position of the contact, and the discovery in a mangrove swamp of sparsely disseminated chalcopyrite in an amphibolitic rock towards the base of the gabbro is a decided encouragement to persevere with the work.

When it was decided that Sierra Leonean should be allowed to dig for diamonds in certain parts of the Protectorate, the Department had the important task of choosing which areas within the original special exclusive prospecting licence of Sierra Leone Selection Trust, Limited, should be surrendered for working by licensed diggers. As the 1-inch sheets of the Topographical Survey were not detailed enough for the purposes of the choice, special maps showing correctly all streams in the diamantiferous country round Sefadu had to be prepared in the Department from Royal Air Force photographs.

The principal contributions that the Department has made to local economic development have been as follows:

Table 7 Contributions of the Geological Survey to local economic development

Item	Department's Contribution
Aggregate and railway ballast for extension of line from Marampa to Pepel	Location and examination of quarries.
Brickmaking	Experiments with local clays and a full-size brick-kiln.
Bridge foundations	Five have been drilled and sections have been prepared; advice has been given about a sixth.
Building foundations	Twelve foundations have been tested by drilling and pitting. A general report (with map) on Mount Aureol as a building site has been prepared.
Clay prospecting for brickmaking	Some drilling has been done at Kumrabai, as well as near Yema where the holes drilled for lignite also prospected the associated clays.
Dam foundations	Advice was given about the foundations of a dam proposed at Kambia.
Loans of banka drills	Twenty-two, or more, loans of banka drilling equipment have been made to the public and to Government departments for investigations connected with civil engineering.
Quarry	A geological map was prepared of the Blackhall Road quarry near Freetown.
Reservoir foundations	The foundations of the Wilberforce reservoir were examined by drilling, and sections were drawn.
Roads	Reports with accompanying geological plans and sketches were made on three roads near Freetown.
Swamp rice schemes	Two swamps were drilled by the Department and mapped geologically.

Water supply schemes (Freetown)	A comprehensive programme of diamond drilling, banka drilling and mapping has been undertaken in connection with the Freetown Water Supply Scheme.
Water supply schemes (local)	Banka drilling has been done for five water schemes, and advice based on the drilling has been given.
Wharf, jetty and quay	Drilling has been done at a wharf, at a jetty and at the Freetown Deep Water Quay.

A kiln with a capacity of 10,000 bricks at one heat was built during 1948 and 1949 at Yema. It was fired with lignite and firewood, and demonstrated that excellent bricks could be manufactured entirely from local materials.

At Guma Water a reservoir taking 4.6 x 109 gallons when full is being constructed together with a draw-off tunnel half a mile long that is to lead the water from the reservoir to the Freetown pipeline. The Department mapped the country on the scale of 1 : 5,000, where the reservoir will be, using Royal Air Force photographs, scale 1 : 15,000, 1951 edition, and discovered important faults, some of which have since been proved at the Department's suggestion by diamond drilling. The Department has also collaborated with the constructional engineers in the examination by diamond drilling of two possible sites for the main dam wall, in an examination by pitting and with the Mackintosh drill of an auxiliary dam site, and in an examination of the surface traces of the draw-off tunnel and of a diversion tunnel.

The following works have been published, or are in the press, or in preparation:

The Lignite Deposits of Sierra Leone, by J. D. Pollett and H. J. Broughton. *Colon. Geol. min. Resour.,* 1950, Vol. 1, No. 1, pp. 37–50.

The Geology and Mineral Resources of Sierra Leone, by J. D. Pollett. *Colon. Geol. min. Resour.,* 1951, Vol. 2, No. 1, pp. 3–28.

Iron Ore Deposits in Sierra Leone, by N. W. Wilson, Symposium stu. les Gisements de Fer du Monde. *C.R.* 19e *Congr. geol. int. Alger,* 1952, Tome 1, pp. 175–182.

Geology of an Elliptic Drainage System North of Bumbuna, Sierra Leone, by V. Marmo. *Colon. Geol. min. Resour.,* 1955, Vol. 5, No. 2, pp. 156–165.

The Petrochemistry of some Precambrian Granites of West Africa and a Petrochemical Comparison with Svecofennidic Granites of Finland, by V. Marmo. *Amer. 3. Sci.,* 1955, Vol. 253, pp. 391–417.

On the Microcline of the Granitic Rocks of Central Sierra Leone. Part I by V. Marmo, Part II by V. Marmo and Toini Mikkola. *Schweiz. Min. Petr. Mitt.,* 1955, Bd. 35, pp. 155–167 and 287–295.

On the Classification of Precambrian Granites, by V. Marmo. *Colon. Geol. min. Resour.,* 1955, Vol. 5, No. 4, pp. 429–437.

On the Myrmekite of Central Sierra Leone, by V. Marmo.

Molybdenite-bearing Granite at the Wankatana River, Sierra Leone, by V. Marmo. To be published in *Colon. Geol. min. Resour.*

Anthophyllite of Central Sierra Leone, by V. Marmo. *Schweiz. Min. Petr. Mitt.,* Bd. 36, Zurich.

Banded Ironstone of the Kangari Hills, Central Sierra Leone, by V. Marmo. *Econ. Geol.,* 1956, Vol.

51, pp. 798–810.

The Ijolites at Songo, Sierra Leone, by C. 0. Baker, V. Marmo, M. K. Wells. *Colon. Geol. min. Resour.,* 1957, Vol. 6, No. 4, pp. 407–415.

A report by Professor K. C. Dunham, F.R.S., on the Geology of the Hangha Chromite Mines and their Neighbourhood .

The Anorthosites in the Colony Complex near Freetown, by M. K. Wells and C. 0. Baker *Colon. Geol. min. Resour.,* 1956, Vol. 6, pp. 137–158.

Bulletin No. 1. Geology, Geomorphology and Mineral Resources of the Sula Mountains Schist Belt, by N. W. Wilson, V. Marmo and J. D. Pollett.

Bulletin No. 2. Geology and Mineral Resources of the Kangari Hills Schist Belt, by V. Marmo.

A report by Dr. M. K. Wells on the Petrology of the Layered Basic Gabbroid Complex in the Colony of Sierra Leone .

On the Serpentinites of Central Sierra Leone, by V. Marmo. To be published in *Bull. Comm. Geolo. Finlande.*

Petrology of the Drill Cores at Samuel Town in the Marginal Part of the Colony Gabbro, by V. Marmo and C. O. Baker.

A Gravity Survey over the Norite Complex of the Colony Peninsula, Sierra Leone, by M. H. P. Bott and C. O. Baker.

Mineral occurences

Antimony

Arsenic

Arsenopyrite

Bauxite

Brick clay

Chromite

Columbite

Copper and copper ores

Diamonds

Gold

Ilmenite

Ilmenorutile

Iron and iron ores

Lead and lead ores

Lignite

Manganese

Molybdenite

Monazite

Nickel

Platinum

Radioactive minerals

Rutile

Water supply

Zinc

Sierra Leone — Staff list

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- History of the British Geological Survey

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