

Nyasaland — 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.



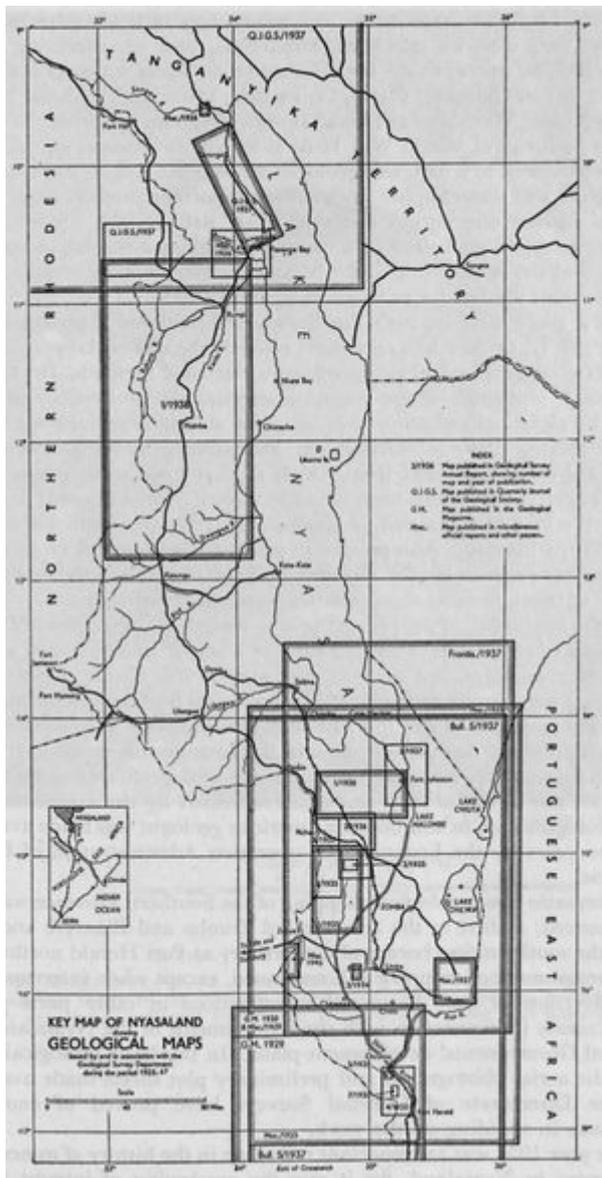
[Mosaic from R.A.F. photographs 1948. Copyright reserved]

Chambe Plateau Ring Structure, Nyasaland. General aerial view, top of photographic mosaic facing due north. Photogeological investigation indicated the presence of three concentric ring-dykes around a central plug, which were later confirmed by detailed petrographic studies. All intrusions are syenites. Mosaic from R.A.F. photographs 1948. Copyright reserved. Plate VIII.

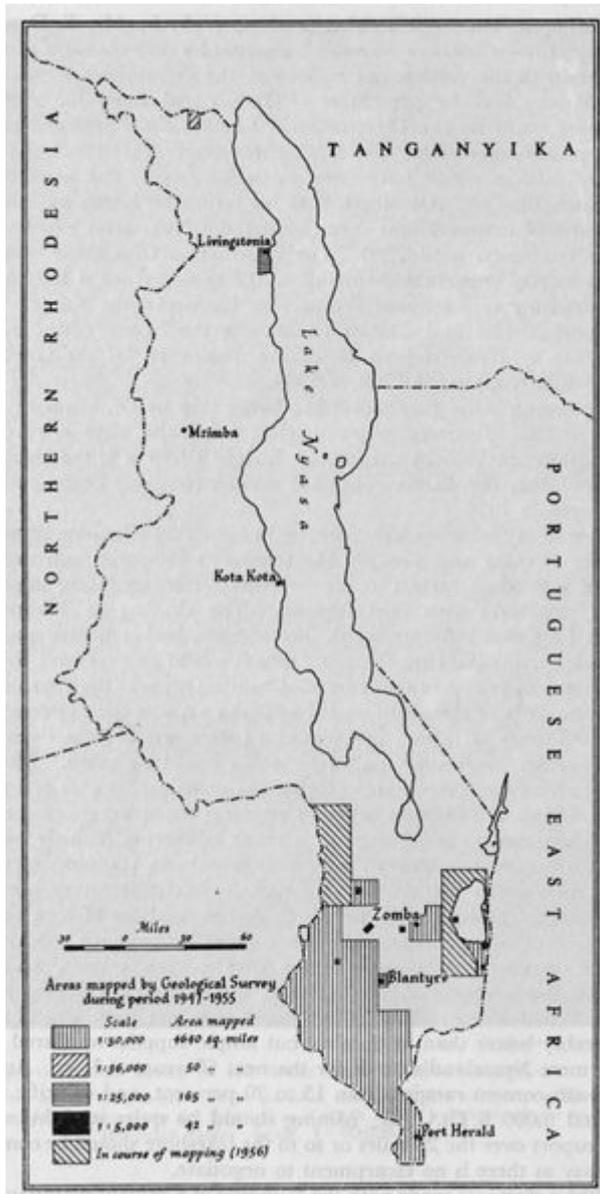


(Photo by Royal Air Force)

Part of Cholo Scarp of the Shire Rift Valley, Nyasaland. The sharp crests of the ridges are due to parallel dolerite dykes of the post-Karoo dyke swarm, and the spurs of the scarp are faceted as a result of late relatively-slight rejuvenation of the main fault. Scale, 1 :40,000 (approx.). Photo by Royal Air Force. Plate IX.



Geological mapping in Nyasaland between 1925 and 1947. Text-fig. 4.



Areas mapped by the Geological Survey Department of Nyasaland during 1947-1955 and those in course of mapping in 1956.

Text-fig. 5.

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Nyasaland

Geological investigations in Nyasaland began with the Mineral Survey of the Protectorate carried out by A. R. Andrew and T. E. G. Bailey between 1906 and 1909, on behalf of the Imperial Institute. In 1918 a Government Geologist was appointed, and from then until his resignation in 1921 he paid particular attention to the mica, coal, limestone and water resources of the territory. In January,

1922, Dr. F. Dixey took up the appointment and was early engaged on the survey of the Sumbu and other coalfields, on coal-boring operations at Chiromo, and on problems connected with water supply. In 1924 he discovered large deposits of bauxite on Mlanje Plateau. Investigations were carried out on limestones and clay deposits with a view to improving the supplies of building materials, and much time was devoted to the study of the Karroo deposits both of Nyasaland and of the section of Portuguese East Africa lying between that territory and the Zambezi River. Fossil reptiles were discovered in Northern Nyasaland. In 1928, an extensive examination was made of the Mafingi Series of Northern Nyasaland, and of the Nachipere and other series of rocks in the extreme south of the territory. Asbestos deposits were also examined in the Ncheu District. The following year saw the start of an investigation of the Chilwa Series of Southern Nyasaland, the results of which were published in 1937 as *Bulletin No. 5* by F. Dixey, W. Campbell Smith and C. B. Bisset, now recognised as the first standard work on carbonatites in Africa.

In 1927 Dr. Dixey became Director of the Geological Survey, and by 1934 three more geologists had been appointed. During 1932 and 1933 the resources of the Department were devoted exclusively to water-supply problems, and on the resumption of geological work in 1934 one section still continued these activities. By the end of 1935 geological investigations had been carried out on occurrences of gold, platinum and corundum in the Lisungwe area, on copper, nickel and gold associated with the Lirangwe basic rocks, on occurrences of gold, asbestos, talc, kyanite and iron in the Kirk Mountains, and on ilmenite, rutile, magnetite and garnet in the Port Herald Hills. Later investigations were carried out in Chiromo, Cholo, Chikwawa, Mwanza, Tambani, Ncheu, South Nyasa, West Nyasa, Dowa, Domira Bay and Mzimba.

The outbreak of World War II in 1939 almost brought operations in the Department to a halt, one geologist alone remaining to carry on both geological and water-supply work. Two important projects were nevertheless carried out during the war years, namely, the survey of the Sumbu coalfield on behalf of a company holding a special prospecting grant, and the re-sampling of the Mlanje bauxite deposit, because faulty analyses had rendered a previous evaluation useless.

For a short time in 1945 the Survey was without a geologist until Dr. W. G. G. Cooper was appointed towards the end of the year. As an authority on geophysical prospecting by electrical methods, Dr. Cooper immediately introduced the system of selecting sites for wells and bore-holes by electrical resistivity methods, now standard practice in Nyasaland. During 1946 he carried out an extensive investigation of the Tambani corundum field from which at that time small quantities of eluvial crystal corundum were being recovered. He also made a survey of the Western Mzimba and Chinteché Districts, part of which forms the high Vipya Plateau. An application was further prepared for funds for a nine-year programme for the development of rural water supplies by means of boreholes and the construction of small surface dams.

At the beginning of the present review period, in 1947, the staff of the Geological Department consisted only of a senior geologist and a part-time office assistant, but in 1949, following a visit by Dr. Dixey, three geologists were appointed under a Mineralogical Survey Scheme financed by funds provided under the Colonial Development and Welfare Act. Enough diamond drilling was done in the Livingstonia coalfield to show that there was little prospect of mining the coal profitably at that time. In 1950, the technical staff was again increased by the appointment of two geologists and, in addition, an American geologist was made available for two years by the Economic Co-operation Administration of United Nations.

Systematic basic geological mapping of the Southern Province was now commenced, at first in the area around Zomba and Blantyre and then from the southernmost border of the territory at Port Herald northwards. The programme of mapping still continued, except when interrupted by the diversion of staff to special investigations in other parts of the Protectorate in connection with the

requirements of the Nyasaland and Federal Governments' development plans. In this basic geological mapping the aerial photographs and preliminary plot sheets made available by the Directorate of Colonial Surveys have proved of enormous assistance in speeding up the work.

The year 1951 was an important milestone in the history of mineralogical survey in Nyasaland, for it saw the awakening of interest in the carbonatites and ring structures previously described by Dr. Dixey as the Chilwa Series, and the realisation, thanks to the researches carried out by the Mineral Resources Division (and especially by Mr. T. Deans) of the frequent association of rare-earth phosphates and niobium minerals with certain of the carbonatite rocks, *e.g.* the cerium-rich monazite of Kangankunde, and the pyrochlore of Chilwa and Tundulu. Arrangements were made by the Directorate in London for a geologist to visit Norway and Sweden to see the carbonatite occurrences at such places as Alno and Ulefoss which have been made famous by the work of von Eckermann, Bragger, and others. On his return he began an intensive programme of mapping and investigating the Nyasaland carbonatites, and this continued until 1955. The information thus made available promises to pay important dividends to the territory, for it has resulted in the granting of Exclusive Prospecting Licences over Kangankunde Hill, Tundulu Hill and Chilwa Island. In the case of Tundulu, the interest lies in a rich deposit of apatite discovered by the Geological Survey while mapping the hill in 1954.

The mapping of the Tambani-Salambidwe area by Dr. Cooper in 1952 resulted in the discovery of radioactive minerals; after a ratemeter reconnaissance in 1955 by the Atomic Energy Division of the Geological Survey of Great Britain, an important mining company began prospecting the area in 1956.

As a result of the increasing difficulty in obtaining adequate supplies of coal from Wankie and Tete for the territory's industries and railways, attention was again turned to the necessity for investigating in greater detail Nyasaland's own coal deposits. The drilling at Livingstonia between 1948 and 1951, although inconclusive, had indicated that coal of suitable quality did exist there but that it would be expensive to work. From what was known of the other coal-bearing areas of the Protectorate, the Sumbu area in the south and the Nkana area in the extreme north appeared worthy of further investigation before any definite decision to expend further large sums on Livingstonia could be taken. After the preparation by the Directorate of Colonial Geological Surveys of a photo-geological map of Sumbu in order to interpret the structure of the area, which is extremely complicated as a result of intense faulting and the presence of numerous igneous intrusions mainly in the form of sills, a ground survey was carried out and sites for six exploratory boreholes were selected. Five were drilled in 1955, but analyses of core samples were uniformly disappointing, the ash content being much too high for economic mining. A ground survey of the Nkana area, including trenching and sampling of coal outcrops, was carried out during part of the 1955 field season. Results indicated that not only was the coal considerably better than at Sumbu, but ample supplies appeared available to meet Nyasaland's needs for the next 60 years at least. Analyses showed ash content ranging from 15 to 20 per cent. and calorific values of around 9,000 B.Th.U./lb. Mining should be quite straightforward, and transport over the 20 miles or so to the Lakeshore should be comparatively easy as there is no escarpment to negotiate.

In 1954 a start was made with the founding of a cement manufacturing industry. A deposit of limestone at Changalumi Hill, 7 miles west of Zomba, was sampled and mapped in detail by the Department, who also supervised the diamond drilling. Neighbouring deposits of clays were subsequently investigated for material suitable for blending with the limestone to make high-quality portland cement.

Since the inception of the Shire Valley Project the Department has given geological advice to the Consulting Engineers, and has carried out geological surveys of dam sites and the logging of

borehole cores. The large Seco diamond drill, formerly used on the Livingstonia coalfield investigation, has recently been loaned by the Department for use in testing the proposed dam site at Matope.

In the course of geological mapping in the Middle Shire area in 1954, several bodies of high-quality vermiculite were located, and these are at present being investigated by a South African firm.

Exploratory work for an English firm interested in the manufacture of titanium products is about to begin on extensive alluvial deposits containing rutile and ilmenite in the Port Herald District. These deposits were first examined and reported on by the Geological Survey in 1935. An area of 35½ sq. miles extending on both sides of the railway line between Chiromo and Port Herald has been demarcated for an Exclusive Prospecting Licence.

Nyasaland, situated as it is on one of the lines of the East African Rift Valley System, is subject to frequent earth tremors and consequently a system of collecting reports of such tremors from observers in different parts of the country was inaugurated by Dr. Cooper in 1947, as none of the Central African territories has a seismograph. The system is still retained by the Department, and results are tabulated and published each year in the Annual Report.

Between 1947 and the end of 1955 the area covered by basic geological mapping on a scale of 1 : 100,000 amounted to 4,640 sq. miles. A further 1,000 sq. miles now in hand should be completed by the end of 1956. In addition, smaller detached areas amounting to 257 sq. miles in various parts of the territory, such as the Livingstonia and Nkana coalfields and the carbonatite occurrences, have also been mapped on a larger scale.

As previously indicated, the technical staff of the Department in 1947 consisted only of 1 senior geologist; by 1956, however, it had increased to 1 director and 6 geologists, two of these belonging to the water-supply section. Nominally there are no geophysicists, but one or two of the geologists are continually employed on geophysical work connected with the selection of borehole sites. The only other technical post is for a draughtsman, but this has not yet been filled.

The Survey has recently moved into a fine new office block consisting of 8 office rooms, museum, library, laboratory, drawing office, rock grinding room, rock store, dark room and equipment store rooms, especially constructed for it at a cost of £17,600. Over the 10-year period under review contributions from C.D. and W. funds to the Mineralogical Survey have amounted to £53,716, and, in addition, £5,403 was granted to provide for an E.C.A. geologist who was in the territory from April, 1950, to March, 1952. During the same 10-year period special expenditure, mainly on the investigation of coal deposits, was provided from Territorial and Federal Government funds to the amount of £44,008, bringing the total expenditure on Mineralogical Survey over this period to £103,127.

The principal post-War publications of the Department, including those on hand, are as follows:

Annual Reports for the years 1947 to 1955.

Bulletin No. 6 The Geology and Mineral Resources of Nyasaland, by W. G. G. Cooper, 1st Edition 1950. (*New edition in the press.*)

Bulletin No. 7 Electrical Aids in Water Finding, by W. G. G. Cooper, 1950.

Bulletin No. 8 Geology of the Nkana Coalfield, Karonga District, by K. Bloomfield. (*In the press.*)

Report on the Recent Investigation of the Nkombedzi-Sumbu Coalfield, Chikwawa District, by F. Habgood. (*In the press.*)

Bulletin on The Geology of the Port Herald Area, by K. Bloomfield. (*Ready for printing.*)

Memoir No. 1 Chilwa Island, by M. S. Garson and Dr. W. Campbell Smith. (*Almost ready for printing.*)

Bulletin on The Geology and Mineral Resources of the Middle Shire Area, by S. W. Morel. (*Ready for printing.*)

Bulletin on The Geology of the Tambani (corundum-bearing) Area, by W. G. G. Cooper. (*In hand.*)

The following papers have been presented by members of the staff of the Department:

The Nachipere Series of Southern Nyasaland, by K. Bloomfield, to the Geological Society of South Africa, appeared in the Transactions of that Society for 1954.

An outline of the Karroo System in Nyasaland, by F. Habgood, to the Inter-Territorial Geological Conference, Salisbury, Southern Rhodesia, April, 1955.

Origin of Economic Minerals in Nyasaland Carbonatites, by M. S. Garson, to the inaugural meeting of the C.C.T.A. Southern Regional Committee for Geology, Salisbury, Southern Rhodesia, September, 1955.

Two papers, Stress Pattern of Carbonatite and Alkaline Dykes at Tundulu Ring Structure, Southern Nyasaland, by M. S. Garson, and The Nepheline-Gneisses of Southern Nyasaland, by K. Bloomfield, were submitted to the Association of African Geological Surveys for presentation at their meeting during the International Geological Congress at Mexico City in September 1956.

A third paper, Manganiferous Rocks in Nyasaland, by M. S. Garson, was contributed to the Congress Symposium on Manganese Ores.

A paper on The Chambe Plateau Ring Complex of Nyasaland, by K. V. Stringer, D. N. Holt and A. W. Groves, appeared in *Colon. Geol. min. Resour.*, 1956, Vol. 6, No. 1, pp. 3-18.

Other papers recently published include:

Flow Phenomena in a Limestone on Changgalumi Hill, Southern Nyasaland, by M. S. Garson, *Geol. Mag.*, March-April, 1955, Vol. 92, No. 2, pp. 155-161.

Biotitite in the Basement Complex of Southern Nyasaland, by S. W. Morel, *Geol. Mag.*, May-June, 1955, Vol. 92, No. 3, pp. 241-254.

Flow Phenomena in Carbonatites in Southern Nyasaland, by M. S. Garson, *Colon. Geol. min. Resour.*, 1955, Vol. 5, No. 3, pp. 311-318.

The Location of Underground Water Supplies in Nyasaland, by D. N. Holt, *Colon. Geol. min. Resour.*, 1955, Vol. 5, No. 4, pp. 438-440.

Bulletin No. 5, The Chilwa Series of Southern Nyasaland, by F. Dixey, W. Campbell Smith and C. B. Bisset, first published in 1937, has now been reprinted, with a certain amount of revision of the text and references to bring it up to date.

The Physical Map of Nyasaland on the 1 : 1,000,000 scale prepared by Dr. Dixey in 1931 has also been reprinted and is now on sale to the public.

Water supply section

In 1947, at the same time as application was made to the C.D. and W. Fund for a grant for Mineralogical Survey Work, a programme for the development of rural water supplies by means of boreholes and small surface dams was prepared. This was finally covered by three schemes as follows :

D813 and 813A	Approved late 1947	£123,395 (Period 5 years)
D1625	Approved June 1951	£52,500 (Up to 1955)
D2568	Approved Sept. 1955	£23,142 (To July 1956)

In addition, from the beginning of 1953 to the end of June, 1956, reimbursement to the amount of £65,758 was received from the Native Development and Welfare Fund of the Nyasaland Government, making a grand total of £264,795.

Approval for D813 came too late in 1947 for anything to be done that year, and, as equipment had to be ordered from the United Kingdom and deliveries were then very slow, work did not get under way until 1949 when 11 boreholes were successfully completed. The scheme included provision for the employment of two geologists for water-supply work, but as this was more than sufficient for the number of drilling machines in use it often proved possible for one to be employed on work more directly connected with the Mineral Survey. In practice, no one geologist was kept continuously on borehole siting, and it was arranged that each geologist in turn should do approximately one year on borehole siting and then return to geological mapping.

The first drilling machines which were ordered were three lightweight " Edeco " combination percussion and shot type. Experience showed, however, that these were too light for general use in this territory and two heavy " Steyn " drills were consequently purchased from South Africa. In 1953, opportunity was taken to purchase a Ruston Bucyrus percussion drill that had been brought into the territory by the Colonial Development Corporation, but little used. Delivery has recently been taken of three new Ruston Bucyrus machines to replace the original " Edecos " which will now be used by the Wells Maintenance Section for cleaning out boreholes which have silted.

Table 1 Boreholes constructed in Nyasaland under C.D. & W. and N.D. & W. schemes 1st January, 1949, to 30th June, 1956

	1949	1950	1951	1952	1953	1954	1955	1956 (1st half)	Totals and Averages
Boreholes drilled	11	47	68	102	79	96	100	57	560
Boreholes successful.	11	42	60	98	71	89	91	54	516
Percentage success.	100	89	88	96	90	93	91	95	92.14
Total footage drilled feet	2,060	5,876	7,047	10,062	10,014	12,808	13,495	6,890	68,252
Average depth per borehole	187	125	103½	98	127	133	135	121	122
Total potential water supply g.p.h.	13,140	27,600	36,400	86,000	53,000	66,400	71,800	34,980	389,320
Average yield per borehole	1,185	657	607	878	745	746	787	648	754

The staff of the Water Supply Section at the end of the period under review consisted of 1 drilling superintendent, 5 European drillers, 1 mechanic and 4 wells maintenance officers, along with African clerk, storekeeper, 12 drivers, 5 wells maintenance supervisors, 6 drill operators, 6 blacksmiths, 2 mechanics, 1 carpenter and over 100 subordinate African personnel.

In addition to siting all boreholes for Government departments, township water schemes, and rural village water supplies by geophysical IE (resistivity) methods, the Section also sites boreholes for business firms, estates and private individuals. A charge of £15 for the first day and £7 10s. for every additional day is made for this service, but these sites have to be drilled by private contract, as Government machines may not be used for private drilling. Figures are not available for every one of the years covered by this report, but between the beginning of 1952 and 30th June, 1956, a total of 635 sites had been selected by geophysical methods. The number of surveys made was, however, considerably more than this, as every survey made will not necessarily result in a suitable site being located.

As all assistance under these C.D. and W. Schemes terminated on 30th June, 1956, and work was not actually started until 1949, the programme outlined above covered only 7} years. The results obtained are set out in Table 1, which shows that 560 boreholes were completed of which 516, or 92 per cent., were successful. Apart from a few bore-holes which were to be mechanised, all were fitted with hand pumps consisting of foot valve, pump cylinder, rising main, rods, and hand-operated pump head of the wheel or lever variety. The latter were manufactured cheaply in the Department's own workshop to a design drawn up by the Drilling Superintendent.

Mineral occurrences

Apatite

Asbestos

Bauxite

Building materials

Carbonatite

Cement and cement materials

Clay

Coal

Copper and copper ores

Corundum

Garnet

Gold

Ilmenite

Iron and iron ores

Kyanite

Limestone

Mica

Monazite

Nickel

Platinum

Pyrochlore

Radioactive minerals

Rare-earths

Rutile

Talc

Vermiculite

Water supply

Nyasaland — Staff list

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