Uganda — Colonial Geological Surveys 1947–1956

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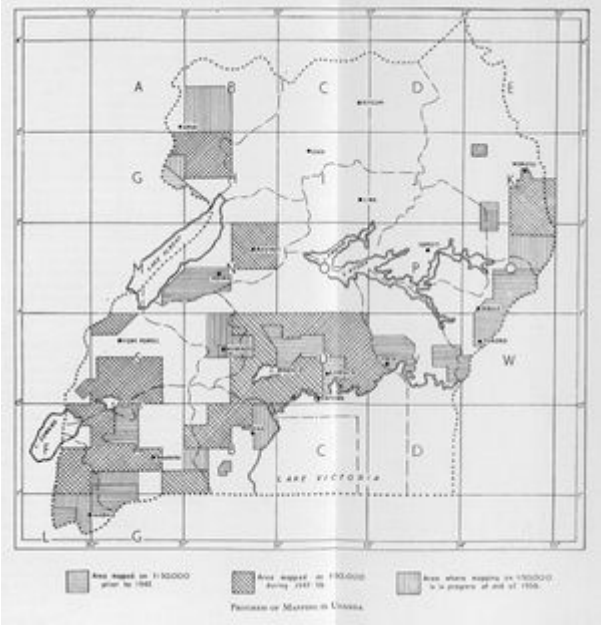
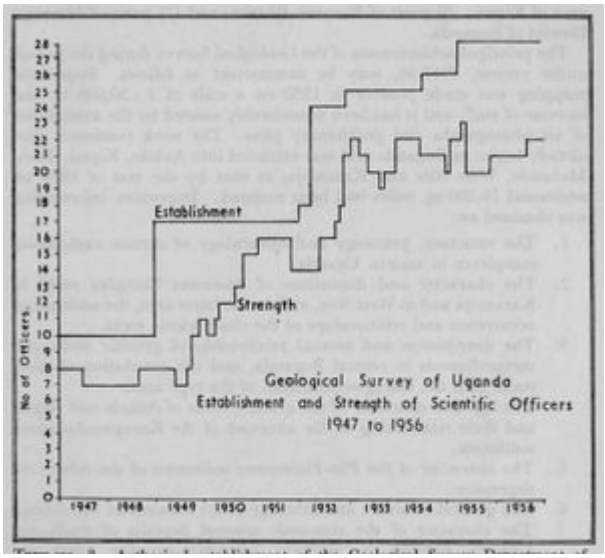
Uganda Geological Survey Headquarters at Entebbe, on the 50-ft. level of Lake Victoria. Photo: J. W. Pallister. Plate III.



Progress of mapping in Uganda. Plate IV.



Authorised establishment of the Geological Survey Department of Uganda compared with the actual strength of scientific officers during 1947 to 1956. Text-fig. 2.

Uganda

The Geological Survey of Uganda came into existence in August, 1918, by the creation of the post of Geological Expert, and E. J. Wayland took up the duties of this post on the 12th January, 1919. Two months later the post was redesignated Government Geologist, and a separate department was formed which included an assistant geologist. In 1920 the title of the head of department was changed once again to become Director of Geological Survey, and has since remained as such. A small laboratory and office overlooking Entebbe Pier were occupied in February, 1925. The headquarters of the Department are still on the same site but with considerably enlarged offices, museum, laboratories and stores.

In 1946 the establishment of scientific officers totalled 9, comprising 1 director, 1 deputy director, 1 senior geologist, 5 geologists and 1 chemist-petrologist. The Water Supply Section had been incorporated into the Geological Survey in 1937 and its establishment included 1 drilling engineer, 1 irrigation engineer and 8 drillers and erectors.

Funds were made available in 1948 under C.D. & W. Scheme No. D.879 for expansion of the department but recruitment did not commence until the following year. The additional personnel were absorbed into the general establishment in 1953 when this Scheme came to an end, and in 1956 the establishment had become 1 director, 1 deputy director, 2 assistant directors (one supernumerary), 1 principal geologist, 16 senior geologists and geologists, 2 field officers, 1 metallurgist-chemist, 2 chemists, 1 spectrochemist, 1 mineral dresser and 1 records officer. As a result of the increase in rural water-supply activities, the establishment of that branch of the department had risen by 1956 to comprise 1 rural water engineer, 2 senior drillers and 31 driller-overseers.

Prior to 1947 the principal achievements of the Geological Survey during the 28 years of its then existence included the recognition and description of the main rock groups of the Protectorate, the discovery of the mineralised areas of the south-west (cassiterite, wolfram, columbitetantalite, beryl, bismuth), the south-east (gold, pyrochlore, apatite, vermiculite, iron ores), central Buganda (wolfram, bismuto-tantalite, gold, ambiygonite) and the northern area (mica, asbestos), and the encouragement of prospecting and mining in those areas. Noteworthy results also included the re-

discovery of copper ores on the Ruwenzori mountain range; research into the mode of occurrence of gold-bearing veins in north-west Ankole from which the rich alluvial deposits of that area were derived; and the investigation of the occurrences of petroleum in the Lake Albert rift valley and of the mineral springs and salt lakes of western Uganda. Other prominent activities included extensive field and petrological research in collaboration with Professor A. Holmes and Dr. H. F. Harwood into the potash-rich volcanic field of south-west and west Uganda, and the initiation of similar departmental research work on the soda-rich volcanics in the east. Detailed archaeological investigations were also made of previously unrecognised Old Stone Age cultures, including the Kafuan, Sangoan and Magosian, and studies were carried out on the mechanism of rift faulting and the geomorphological development of the Protectorate.

Most of Uganda prior to 1947 had been examined by reconnaissance traverses carried out along existing roads and tracks, and a number of manuscript maps on a scale of 1 : 250,000 were prepared. In addition, limited areas of definite economic or of special geological interest, totalling some 7,100 sq. miles, had been mapped on scales of 1 : 50,000 or larger. These included the following main regions : (1) south-east Uganda with small gold workings on the Kenya border and the carbonatite complexes; (2) Napak Mountain, a dissected volcano; (3) the Buhwezu Plateau of north-west Ankole with its alluvial gold deposits; (4) the tin province of south-west Ankole; (5) the Bufumbira volcanic area of Kigezi; (6) parts of Bunyoro District; and (7) parts of Mmengo District of Buganda.

The principal achievements of the Geological Survey during the period under review, 1947–56, may be summarised as follows. Systematic mapping was made possible in 1950 on a scale of 1 : 50,000 by the increase of staff, and it has been considerably assisted by the availability of air photographs and preliminary plots. The work continued that already begun in Buganda and was extended into Ankole, Kigezi, Toro, Mubende, West Nile and Karamoja, so that by the end of 1956 an additional 16,500 sq. miles had been mapped. Important information was obtained on :# The structure, petrology and mineralogy of certain carbonatite complexes in eastern Uganda.

1. The character and disposition of Basement Complex rocks in Karamoja and in West Nile, and, in the latter area, the widespread occurrence and relationships of the charnockitic rocks.
2. The distribution and mutual relationship of granitic rocks and metasediments in central Buganda, and the correlation of these rocks with the Karagwe-Ankolean of the type area.
3. The age and character of the granitic rocks of Ankole and Kigezi and their relationship to the structure of the Karagwe-Ankolean sediments.
4. The character of the Plio-Pleistocene sediments of the Albert rift depression.
5. The general structure and Ethology of the Ruwenzori Mountains.
6. The character of the economic mineral deposits of south-west Uganda, notably tin, wolfram, columbite-tantalite, beryl and bismuth.

The expanded Geological Survey has also been able during the period under review to re-investigate and assist in the development of many of the small, but varied, occurrences of economic mineral deposits that had previously been revealed by extensive prospecting by commercial firms and by the Survey itself. Among the Geological Survey's more important mineral investigations during post-war years, reference may be made, for instance, to the drilling for coal in 1948 in the Karroo beds on Dagusi Island in Lake Victoria, although the results were negative. Geological mapping, geophysical surveys and drilling were also continued in the Albert rift depression for oil. Investigations into limestone resources were carried out intermittently and, following a preliminary examination of surface deposits in the Lake George depression in 1947, more exhaustive surveys during 1954 to 1956 by pitting, drilling and chemical assays have indicated two valuable deposits of 1 I million and 20 million tons respectively of high-grade limestone, both deposits being close to the western extension of the railway; commercial working of the former deposit has recently begun.

Detailed examination of the carbonatite rocks of Tororo and Sukulu from 1948 to 1952 led to the establishment of a cement factory which commenced production in 1953. At the Bukusu carbonatite complex, the massive iron-ore of Nangalwe and the magnetite rubble associated with vermiculite at Namekara were investigated; so, too, was the magnetite by-product from the Sukulu apatite-pyrochlore bearing soils, but all these iron ores have so far failed to attract commercial interests. Extensive pitting at Namekara and Busumbu proved some 100,000 tons of medium-grade vermiculite and more than a million tons of readily upgradable phosphate rock of 15 per cent. P205 content associated with lesser quantities of 30 per cent. grade hard phosphate rock; the phosphate is being commercially produced, and interest is now being shown in the production of exfoliated vermiculite. In the search by the Geological Survey in 1950 for secondary limestone around the.Sukulu carbonatite complex, the presence of apatite and pyrochlore in possibly economic quantities in residual soils overlying the carbonatite had been recognised. As a result of detailed prospecting operations between 1950 and 1952, a commercial organisation took over the prospecting rights and continued the task of assessing the workability of the deposit. Over 200 million tons of apatite-pyrochlore bearing material was proved. The Geological Survey assisted by providing geophysical surveys and by drilling of the deposits.

In south-west Uganda, investigations were continued throughout the period under review on tin and wolfram deposits. Bismuth carbonate discoveries were recorded in 1948 in Kigezi; they were investigated and small workers were assisted. Small lead deposits of north-west Ankole were surveyed, and galena and sphalerite were identified in Kigezi in 1952 but not in economic quantities. Beryl-, microlite- and columbitetantalite-bearing pegmatites have been sporadically worked. Other mineral occurrences investigated in Uganda, although not found to be economically workable, included diatomite in West Nile, and magnesite, graphite and barytes in Karamoja. A single small diamond was found in 1955 by a prospector in northern Ankole.

During the 10-year period commercial development was carried out at the Kilembe copper-cobalt deposits, and the property recently commenced production. The Department helped on occasion by carrying out geophysical surveys, and a team from the Geochemical Prospecting Research Centre of the Royal School of Mines, London, investigated and reported upon the application of geochemical work under the local conditions. Small copper indications in Karamoja were examined geophysically, but rejected as merely representing local copper staining of amphibolite. The Geological Survey also helped during 1947 and 1948 in prospecting for gold in the Eastern Province where reefs had previously been discovered by the Survey. In 1954 and 1956 old workings in Buganda and Kigezi were re-examined and sampled, but proved to be of very low grade.

Various problems dealing with engineering geology were undertaken by the Geological Survey during the period under review. Investigations at the sites of three major engineering projects took the form of studies of the variation in rock types at the sites, together with the estimation of the thicknesses of overburden by geophysical methods. The different rock types and degree of decomposition were observed at the site of the Katonga River dam and tunnel. Resistivity methods were employed to ascertain the depths to bedrock, but interpretation was rendered difficult because of the rapid variation in the rock types and of their differing degrees of decomposition. Sufficient information was obtained from these measurements, however, which when supplemented by that obtained by pitting, enabled the areas of minimum and maximum thickness to be outlined. The Department prepared a comprehensive geological report of the site of the Owen Falls hydro-electric scheme, on the Upper Nile, giving particular attention to the direction and nature of the jointing, faulting, hardness and strength of the rocks. Study was made of the variations in the rock types at the site, and the foundations were investigated by drilling. Gravity measurements were made to determine the mean depths to bedrock on the banks of the river in order to assist in selecting the most suitable positions for the cut-off walls. The availability of aggregate, building stone, sands and

clays was also reported upon. Geological and geophysical study of the proposed site of a hydro-electric scheme similar to that at Owen Falls, and some four miles downstream, is now in progress. The site is being mapped on a large scale to ascertain the directions and degree of jointing, the presence or absence of faulting or shearing, and to obtain precise information about the underlying rocks. Gravity and seismic surveys have been undertaken to determine the depth to solid rock and to obtain information about rock strengths.

By the end of 1946 the drilling of water boreholes, which was initiated in 1931, had been built up into an organisation comprising four departmental rigs and eight contractor machines. During 1946, 104 boreholes were drilled with a footage of 16,000, and, for the first time, the number of boreholes completed in a year exceeded 100. With the aid of C.D. & W. funds, the number of machines was increased to 21 between the years 1947 to 1953, and 15 of these were employed on contract drilling. Towards the end of 1953, additional assistance was made available by a grant from Uganda's African Development Fund and a marked increase in the number of machines was thus made possible so that in 1956 there were 6 departmental and 25 contractor rigs continuously at work in rural areas. In 1955, the number of boreholes drilled exceeded 200 for the first time, 248 being completed, with a footage of slightly over 80,000, representing an increased output of 100 per cent. within two years. Yields were on the whole small, averaging about 400 g.p.h., although the greatest delivery recorded was 4,460 g.p.h. ; about 10 per cent. of the total number of holes drilled provide over 1,000 g.p.h. The rate of success has remained remarkably constant at about 85 per cent. but the highest rate recorded was 94 per cent. in 1954 by the departmental drills; contractors' drills, however, had done almost as well, with 93 per cent. in 1952. The total of successful boreholes at the end of 1956 will be of the order of 2,100.

Prior to 1947 some 270 small dams and tanks had been provided for the watering of stock in the cattle-rearing areas. Only hand labour construction was employed, but the period 1947 to 1956 has witnessed a virtually complete changeover to the use of heavy earth-moving machinery, and the Department now possesses 12 Caterpillar D7 tractors, 8 Le Tourneau 8-cu. yd. scrapers and ancillary equipment divided into four units of equal size. By the end of 1956, some 540 reservoirs of various types were constructed. Storage varies from as little as 5 million gallons in the case of tanks, to 460 million gallons in the largest reservoir, with an overall average of about 40 million gallons.

The maintenance of boreholes prior to 1952 was divided between African local governments for surface installations and general light servicing, and the Geological Survey for heavier repairs and the replacement of pump cylinders and rising mains. This division of responsibility led to difficulties, and in 1952 the Geological Survey took over all mechanical maintenance. Borehole maintenance officers were appointed and, wherever possible, their duties were arranged on a district basis. This consolidation of duties led naturally to African local governments becoming responsible for all maintenance of boreholes within their administrative areas. On the 1st July, 1956, boreholes maintenance officers and their staffs in six districts were either seconded or transferred to the local authorities for this purpose and it is hoped that similar action will be possible in other districts in the near future. The responsibility for the maintenance of reservoirs has been regarded as the responsibility of the local authorities since work began in 1935, and the Department acts merely in an advisory capacity.

In addition to the mineral investigations already described, search has been made, in co-operation with the Public Works Department, for clays suitable for brick and tile manufacture, and has resulted in the establishment of a factory at Bugungu, near Jinja. Beach sand at Entebbe is eminently suitable for clear glass and sodium silicate manufacture, but its excavation was disturbing the amenities of the township. Alternative sources of supply with satisfactory screen and chemical analysis were located in large quantities near Port Bell. The Mineral Dresser has been available both to conduct beneficiation tests in the laboratory and to visit mills to advise on treatment problems,

while the chemical laboratories are in constant service to the mining industry in the analysis of samples of parcels of ores prior to sale. Other directions in which advice and assistance have been given include the measurement of earth-resistivity along high voltage distribution lines; the siting of quarries for road metal and concrete aggregate; the foundations of buildings; the construction of fish ponds; road and railway alignments; the foundations of landing strips for aircraft; the testing of building materials; and soil sampling in possible sugar growing areas.

The principal post-War publications of the Department are:

1952 Memoir No. VI Pleistocene Geology and Prehistory of Uganda, by C. van Riet Lowe. Pt. II, Prehistory.

1952 Memoir No. VII The Building of Mount Elgon, by K. A. Davies.

1956 Memoir No. VIII Geology of S.E. Uganda with particular reference to the Alkaline Complexes, by K. A. Davies.

1956 Memoir No. IX Oil in Uganda, by N. Harris, J. W. Pallister, and J. M. Brown.

Records of the Geological Survey Department for 1950, 1951–52, 1953 and 1954; 1955 is in the press.

Publications in preparation include:

Memoir No. VI Pleistocene Geology and Prehistory of Uganda. Pt. I. Pleistocene Geology, by E. J. Wayland.

Report No. 1 Geology of South Mmengo, by J. W. Pallister *et al.*

Report No. 2 Geology of South-west Toro, by D. W. Powell.

Report No. 3 Geology of North-west Ankole, by A. W. Reece.

Report No. 4 Geology of Kigezi, by R. G. Seal.

Mineral occurences

Amblygonite

Apatite

Asbestos

Barytes

Beryl

Bismuth

Bismuto-tantalite

Brick clay

Carbonatite

Cement and cement materials

Coal

Cobalt

Columbite-tantalite

Copper and copper ores

Diamonds

Diatomite

Glass sands

Gold

Graphite

Iron and iron ores

Lead and lead ores

Limestone

Magnesite

Mica

Microlite

Mineral springs

Oil

Phosphates

Pyrochlore

Salt

Tin and tin ores

Tungsten and tungsten ores

Vermiculite

Water supply

Zinc

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