



**ECONOMIC GEOLOGY
RESEARCH UNIT**

University of the Witwatersrand
Johannesburg

**BIBLIOGRAPHY OF THE GEOLOGY AND
MINERAL RESOURCES OF THE PALAEOPROTEROZOIC
BUGANDA-TORO SEQUENCE,
THE KILEMBE MINE, AND THE
RUWENZORI MOUNTAINS,
UGANDA AND ZAIRE (1890-1997)**

S MASTER

• INFORMATION CIRCULAR No. 308



**UNIVERSITY OF THE WITWATERSRAND
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**UNESCO/IUGS
International Geological Correlation Programme**

**IGCP PROJECT 363:
LOWER PROTEROZOIC OF SUB-EQUATORIAL AFRICA**

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PALAEOPROTEROZOIC BUGANDA-TORO SEQUENCE, THE KILEMBE
MINE, AND THE RUWENZORI MOUNTAINS, UGANDA AND ZAIRE
(1890-1997)**

by

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BIBLIOGRAPHY OF THE GEOLOGY AND MINERAL RESOURCES OF THE PALAEOPROTEROZOIC BUGANDA-TORO SEQUENCE, THE KILEMBE MINE, AND THE RUWENZORI MOUNTAINS, UGANDA AND ZAIRE (1890-1997)

INTRODUCTION

This bibliography deals with the Palaeoproterozoic Buganda-Toro Sequence and correlated formations of SW Uganda and NE Zaire, as well as the Kilembe Mine (which occurs in Buganda-Toro rocks), and the Ruwenzori Mountains (which are partly composed of rocks assigned to the Buganda-Toro Sequence). The bibliography aims at being exhaustively comprehensive, and covers both published and unpublished articles and reports covering the period 1890 to the present (1997). Although the main part of the bibliography lists works dealing with the geology and mineral resources of the Buganda-Toro Sequence and its correlatives, there is also a General bibliography in the section dealing with the Ruwenzori Mountains, which covers topics such as mountaineering, ecology, botany, general books and articles, and book reviews. Because of the economic importance of Kilembe Mine and its surroundings, many unpublished reports of the Kilembe Mines Limited (KML) and the Department of Geological Survey and Mines (DGSM) have been included. There is also a section on correlative sequences to the Buganda-Toro in adjacent parts of Zaire. The purpose of this bibliography is to make known and accessible the large amount of published and unpublished material on this poorly known Palaeoproterozoic terrain, in the context of the UNESCO/IUGS International Geological Correlation Programme Project No. 363: Lower Proterozoic of Sub-Equatorial Africa. It is hoped that the bibliography will make a small contribution to the aims of IGCP Project 363, which is intended to stimulate international geological collaboration in the study of Palaeoproterozoic fold belts in Central and East Africa.

The Buganda-Toro Sequence, comprising the Buganda and Toro Supergroups, is a mainly metasedimentary sequence of argillites, phyllites, mica-schists and quartzites, with minor metavolcanics and tuffs, which forms part of the Palaeoproterozoic Ruwenzori Fold Belt of southwestern Uganda, East Africa (Tanner, 1973; Schlüter, 1996). The Buganda-Toro Sequence which is between <1 to >7 km thick (Pallister et al., 1953; Pallister, 1959), overlies Archaean basement gneisses (Harper et al., 1972; Leggo, 1974), and is in turn overlain by metasediments of the Mesoproterozoic (Kibaran) Karagwe-Ankolean Supergroup (Cahen et al., 1984). The Toro Supergroup (Tanner, 1973) was originally described by Combe (1934), and formalised as the Toro Quartzites by Wayland (1938). It was defined as the Toro System by Pallister & Barnes (1954), and as the Toro Supergroup by Tanner (1973). The Buganda Supergroup (Tanner, 1973) was originally defined as the Buganda Group by McConnell (1959).

The Buganda-Toro Sequence forms the host-rocks for the most important base-metal deposit in Uganda, the Kilembe Cu-Co mine, which was opened in 1956 (Jones, 1956; Nussey, 1956, 1957; Langevad, 1959). Despite numerous Ph.D., M.Sc. and B.Sc. theses having been written on Kilembe geology over the past 40 years, very few papers on Kilembe have been published (Barnes et al., 1963; Davis, 1963a,b, 1969, 1978; Tanner & Bailey, 1971; Tanner, 1972; Warden, 1984). The highly deformed and faulted Kilembe orebodies consist of massive sulphide lenses composed of chalcopyrite, pyrrhotite and cobaltiferous pyrite, enclosed within

banded amphibolites and metasedimentary gneisses and schists of the Buganda-Toro Sequence. The deposit has been compared to volcanogenic massive sulphide (VMS) deposits of the Besshi type (Maiden, 1993). During its productive years, from 1956 to 1978, only Cu was extracted from the Kilembe Mine's ores, while the cobaltiferous pyrite was stockpiled. The Kilembe Mine ceased official production in 1978, since when it has been placed on a care and maintenance basis. In recent years, the cobaltiferous pyrite stockpiles have been looked at in detail (Selstrust Engineering Limited, 1983; Warden, 1984), and a new joint-venture company called Kasese Cobalt Co. (Ltd) has been formed to extract Co from pyrite using a bacterial leach technique (Kasese Cobalt Co., 1993; Blanchard, 1995; Luganda, 1997; Mfite Basaza, 1997; Ollivier et al., 1997).

The Ruwenzori Mountains, which form an uplifted horst block on the border between Uganda and Zaire in the Western Rift Valley of the East African Rift System (Wayland, 1930, 1932; Michot, 1933a,b,c, 1938; Willis, 1934; Dixey, 1946; Davies, 1951), are composed of basement (Archaean) gneisses together with the Buganda-Toro Sequence (McConnell, 1959b; Tanner, 1973).

The Ruwenzori Mountains were equated by Stanley (1890) with the fabled Mountains of the Moon (Lunes Montes) mentioned by Ptolemy in his *Geographia* (2nd Century A.D.), as the source of the Nile river. The Mountains of the Moon were shown on medieval maps such as those of Fra Mauro (15th Century A.D.), and of Arab geographers (Crawford, 1949). The snow-clad peaks of the Ruwenzori Mountains were first spotted by western explorers in 1888- initially by Parke and Mountenay-Jephson on 20th April, 1888 (Parke, 1891), and then a month later by H.M. Stanley's expedition, one of whose members, Captain W.G. Stairs, climbed to about 3500 m (Stanley, 1890; Stairs, 1891). Whereas Stairs believed the Ruwenzori Mountains were of volcanic origin, it was Stuhlmann (1894) who first showed that they were composed of gneisses and schists. The Ruwenzori Mountains were first mapped geologically by Elliot and Gregory (1895), and the Central Peaks were first climbed and mapped by the Duke of Abruzzi's expedition in 1906 (de Filippi, 1908; di Savoia, 1909; Roccati, 1908, 1909). Further geological mapping was done (on the Zairean side) by the Belgian Ruwenzori Expedition of 1932 (De Grunne, 1932; De Grunne et al., 1937; Michot, 1933a,b,c, 1934, 1935, 1937, 1938). The last major geological expedition to the Ruwenzori Mountains was the 1951-1953 British expedition led by Prof. W. Q. Kennedy of Leeds University (McConnell, 1951, 1959b; Johnson & McConnell, 1951; Mathews, 1951a,b, 1953; Menzies, 1951a,b; Bergström, 1955). Since then there have been several smaller expeditions which concentrated mainly on glaciological observations (e.g. de Heinzelin, 1952, 1953, 1960, 1962; Whittow 1958a,b,c, 1959a,b, 1960, Whittow & Shepherd 1959; Whittow et al., 1963; Temple, 1961, 1968, 1969), while some were geological expeditions of a reconnaissance nature (Morton & Nixon, 1969; Hadoto & Ssali, 1973). The most recent detailed geological work on the Ruwenzori Mountains has been the Ph.D. theses of Barrett (1970) and Bailey (1972), who worked on the Ugandan side, and the work of Félix (1969a,b, 1972, 1975), who studied the Zairean side.

Whereas formerly the Buganda-Toro Sequence had been correlated with the Nyanzian-Kavirondian of Kenya and SE Uganda (McConnell, 1959), and with the Kibalian of Zaire (Cahen, 1954; Steenstra, 1954; Woodtli, 1957; Cahen & Lepersonne, 1966; Cahen & Snelling, 1966), it is now regarded as being younger than these sequences (Tanner, 1973; Cahen et al., 1984), and may correlate with the poorly known Bilati sequence of NE Zaire (Lhoest, 1948; Lavreau, 1978, 1980).

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RUWENZORI MOUNTAINS

Geology

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