# Chapter I: Introduction

The Central African Copperbelt straddles Zambia and the Democratic Republic of Congo (D.R.C., ex-Zaïre), between the 25th and 29th East meridians and between the 11th and 13th South parallels. The region is located in the great plateau of Central Africa where altitudes range from 1200 m to 1400 m above sea level (Figure 1).

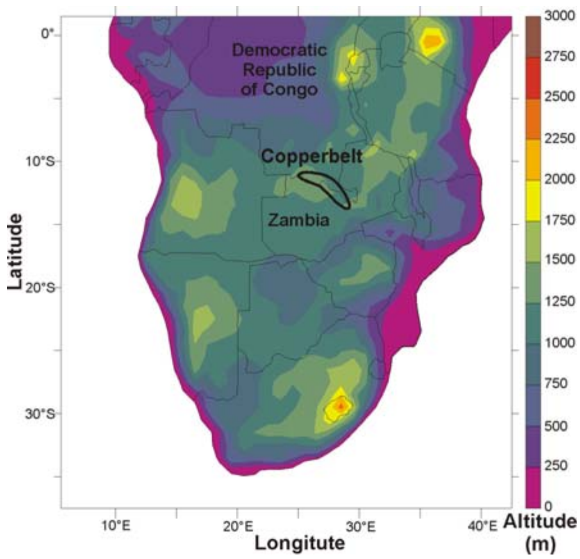


Figure 1: Topographical map of the sub-equatorial Africa
After a map downloaded from Internet.

The Central African Copperbelt has been recognised as a Cu-Co rich province by Europeans over a century ago. Locally, copper has been known to occur for centuries and local workings are presumed to have started between the 12th and 14th centuries (Roger, 1950). First European copper discoveries are related to British and Belgium explorations of Central Africa in the late 19th century (Robert, 1956), which led to the creation of the colonies of the Congo Belge and Northern Rhodesia. Research studies were undertaken only on either side of the border separating the two countries. This led to major differences in naming stratigraphic units and obvious misunderstandings in the evolution of the Central African Copperbelt as a whole.

The Central African Copperbelt is a world class Cu-Co metallogenic province. With a strike length of 700 km in the Lufilian Arc, it is bounded by the Bangwelu Block on the northeast, the Irumide Belt in the south, the Congo-Kasai craton and the Kibaran belt in the northwest (Figure 2). It

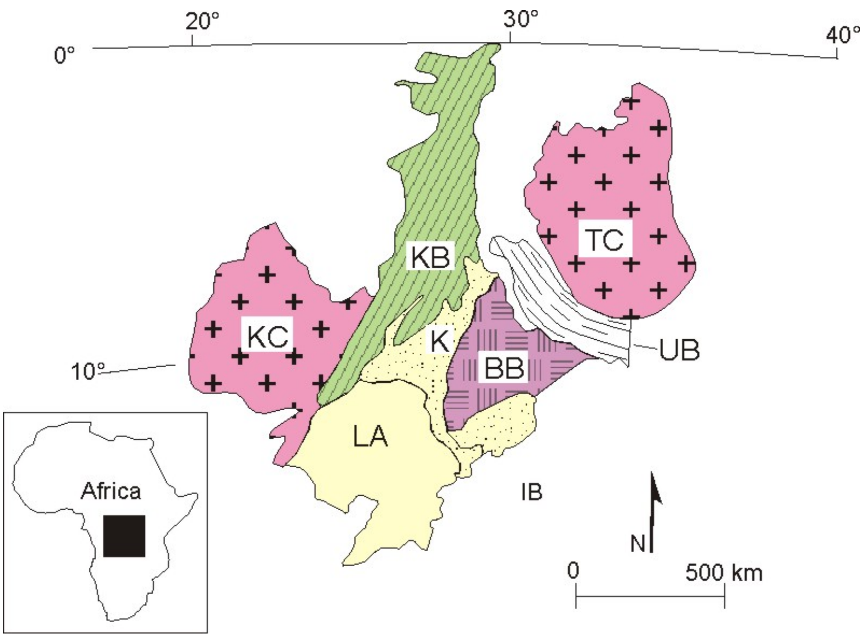


Figure 2: Sketch map of central Africa showing the major lithostructural units. BB – Bangweulu Block; IB – Irumide Belt; K – Kundelungu Plateau; KB – Kibaran Belt; KC – Kasai Craton; LA – Lufilian Arc; TC – Tanzanian Craton; UB – Ubendian Belt.

comprises a basement overlain by the Neoproterozoic metasedimentary Katanga Supergroup, host to the major Cu-Co deposits. The pre-Katangan basement is mainly exposed in Zambia and immediately adjacent areas of the Democratic Republic of Congo (Brock, 1961; Demesmaeker et al., 1963) while it is buried under a thick pile of Katanga sediments in the Democratic Republic of Congo. About half of the pre-Katangan basement consists of the Lufubu schists, and the rest consists mainly of a variety of supposedly intrusive granitoids (Gray, 1929; Mendelsohn, 1961b,c) and of quartzites and schists of the Muva Group, which unconformably overlain the Lufubu schists and the granitoids (Garlick, 1961). The Katangan Supergroup consists of metasedimentary rocks traditionally divided into the Roan, Nguba, Fungurume and Biano Groups (Wendorff, 2001a,b; 2002a,b; 2003) which are further subdivided into Subgroups.

Much of the age data relating to the Central African Copperbelt was produced in the period 1960-1980 using the U-Pb technique on zircon fractions, the Rb-Sr technique on whole rocks and the K-Ar technique on mainly microcline and biotite (Snelling et al., 1964; Cahen et al., 1966, 1968, 1978,1984). These existing data are generally imprecise and their interpretation controversial. Regarding the basement, chronological studies stayed focused on the intrusive granites and no direct dating has been done on the Muva Group and the Lufubu schists. Age data regarding the deposition of the Katanga Supergroup are also very scarce.

From the early 1990's, conferences and projects sponsored by IGCP and mining companies were started and are still continuing. The aim is to constrain the evolution of the Central African Copperbelt and understand the mineralising processes, which led to the formation of the Copperbelt deposits. The topics covered by these studies are varied and include geochronology, stable isotopes, sedimentology, petrology, detailed mapping, fluid inclusion studies, ore modelling, rocks-fluid interactions…This study comes within the scope of this program.

This study presents results of a wide geochronological study of the Central African Copperbelt and its basement that aimed at constraining the nature and evolution of the Central African Copperbelt.

The following chapters present the results as four papers, which are published (chapter III), in press (chapters IV and V) or submitted (chapter VI). In this introductory chapter, regional setting of the Central African Copperbelt, stratigraphy, previous geochronological or earlier sedimentological studies are not detailed as they are fully developed in the chapters/ papers presented further.

Chapter III, IV, V and VI are presented in the format accepted by the journals and contain their relevant abstracts, introductions and conclusions. The formatting (references) and language styles are those of the journals, all of which use English spelling.

All papers are multi-authored. Both L. J. Robb and S. Master are included on all the papers as they supervised the project and assisted in the interpretation of the data. Additional authors were included on the papers for the reasons outlined below. Sample preparation, the bulk of data collection and the writing of the papers were done by the author.

Chapter III provides the first evidence of a Mesoarchaean terrane located in the basement of the Central African Copperbelt. This chapter was published in the Journal of the Geological Society, London, 2003, vol. 160, pp. 11-14. Sample collection was done by the author and S. Master. Analyses and petrography were performed by the author.

Chapter IV provides informations on the nature and the evolution of the basement of the Central African Copperbelt. Samples were collected by P. Mumba, S. Master, L. J. Robb and the author on different fieldtrips. Geochemistry on the Lufubu schists was performed by S. Master. Petrography and U-Pb analyses of all samples (except the Mkushi gneiss and associated aplites, the Mulungushi gneiss and, the Mufulira Pink Granite) were undertaken by the author. The remaining samples were analysed by R. A. Armstrong.

Chapter V provides informations on the ages and provenance of sediments forming the Katanga Supergroup and the age of maximum deposition of the uppermost formation of the Katanga Supergroup. All U-Pb analyses on detrital zircons were performed by the author while Ar-Ar analyses were performed by D. Phillips. All sedimentological findings are from S. Master.

Chapter VI provides informations on the metamorphic events which affected the Katanga Supergroup. U-Pb analyses on monazites were performed by R. A. Armstrong while all $^{40}Ar$-$^{39}Ar$ analyses were undertaken by D. Phillips.

The Appendix shows all abstracts presented at conferences.

**References**

Brock, B.B., 1961. The structural setting of the Copperbelt. In: Mendelsohn, F. (Ed.), The Geology of the Northern Rhodesian Copperbelt. Macdonald, London, 81-89.

Cahen, L., Snelling, N. J., Delhal, J., Vail, J. R., 1966. The geochronology of Equatorial Africa, Oxord Science Publications, Amsterdam, 195pp.

Cahen, L., Ledent, D., Pasteels, P., Delhal, J., Grogler, N., 1968. Détermination d'âge sur des granites anciens (anté-katangiens) et jeunes (katangiens) du Copperbelt de Zambie et du Katanga sud-oriental, Annales de la Société Géologique de Belgique, 91, 313-315.

Cahen, L., Delhal, J., Deutsch, S., Grögler, N., Pasteels, P., 1970. The age of the Roan Antelope and Mufulira granites (Copperbelt of Zambia), Annales du Musée Royal de l'Afrique Centrale, Sciences géologiques, 65, 15-42.

Cahen, L., Snelling, N. J., Delhal, J., Vail, J. R., Bonhomme, M., Ledent, D., 1984. The geochronology and evolution of Africa, Clarendon, Oxford, 512 pp.

Demesmaeker, G., François, A., Oosterbosch, R., 1963. La tectonique des gisements cuprifères stratiformes du Katanga. In: Lombard, J., Nicolini, P. (Eds.), Stratiform Copper Deposits in Africa, 2nd Part: Tectonics. Assoc. Afr. Geol. Surveys, Paris, 47-115.

Garlick, W. G., Brummer, J. J., 1951. The age of the granites of the Northern Rhodesian Copperbelt. Economic Geology, 46, 478-497.

Garlick, W.G., 1961. Basement complex: Muva system. In: Mendelsohn, F. (Ed.), The Geology of the Northern Rhodesian Copperbelt. Macdonald, London, 21-30.

Gray, A., 1929. An outline of the geology and ore deposits of the Nkana Concession. 15th International Geological Congress Guide Book (Excursion C22). Pretoria, South Africa, 34-40.

Mendelsohn, F., 1961a. *The Geology of the Northern Rhodesian Copperbelt*. (Ed.) Macdonald, London, 523 pp.

Mendelsohn, F., 1961b. Basement Complex: Lufubu System. In: Mendelsohn, F. (Ed.), *The Geology of the Northern Rhodesian Copperbelt*. Macdonald, London, 18-19.

Robert, M., 1956. Géologie et géographie du Katanga, Union minière du Haut-Katanga, Bruxelles, 620 pp.

Roger, E., 1950. L'évolution de la métallurgie du cuivre au Katanga. Communications et résumés, Cong. Sci. Elisabethville, Comité Spécial du Katanga, Bruxelles, 174-213.

Snelling, N. J., Hamilton, E. I., Drysdall, A. R., Stillman, C. J., 1964. A review of age determinations from Northern Rhodesia. Economic Geology, 59, 961-981.

Wendorff, M., 2001a. New exploration criteria for 'megabreccia'-hosted Cu-Co deposits in the Katangan belt, central Africa. In: Piestrzynski, A. et al. (Eds.), Mineral Deposits at the Beginning of the 21st Century. Swets & Zeitlinger Publishers, Lisse, Netherlands, pp. 19-22.

Wendorff, M., 2001b. Evolution of the Katangan belt foreland basins: Neoproterozoic-Lower Palaeozoic of Zambia and the Democratic Republic of Congo. Abstract, 21st IAS-Meeting of Sedimentology, 3 - 5 September 2001, Davos, Switzerland.

Wendorff, M., 2002a. Megabreccias of the Katangan orogen (Neoproterozoic-Lower Palaeozoic of Central Africa): criteria for re-interpretation as synorogenic conglomerates. 16th International Sedimentological Congress, Abstracts Volume, Rand Afrikaans University, Johannesburg, South Africa, 395-396.

Wendorff, W., 2002b. Synorogenic conglomerates and evolution of foreland basins in the external fold-thrust belt of the Katangan orogen, Neoproterozoic-L. Palaeozoic of Zambia and the Democratic Republic of Congo. 16th International Sedimentological Congress, Abstracts Volume, Rand Afrikaans University, Johannesburg, South Africa, 397-398.

Wendorff, M., 2003a. Stratigraphy of the Fungurume Group- evolving foreland basin succession in the Lufilian fold-thrust belt, Neoproterozoic-Lower Palaeozoic, Democratic Republic of Congo. South African Journal of Geology, 106, 47-64.