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Gondwana Research 11 (2007) 414–431
www.elsevier.com/locate/gr

The Neoproterozoic Mwashya–Kansuki sedimentary rock succession in the central African Copperbelt, its Cu–Co mineralisation, and regional correlations

J.L.H. Cailteux [a,*], A.B. Kampunzu [b,✠], C. Lerouge [c]

[a] *Department of Research and Development, Groupe G. Forrest International, Lubumbashi, Congo*
[b] *Department of Geology, University of Botswana, Private Bag 0022, Gaborone, Botswana*
[c] *B.R.G.M., B.P. 6009, 45060 Orléans Cedex 2, France*

Received 29 April 2005; accepted 14 March 2006
Available online 22 August 2006

Abstract

Rocks of the Neoproterozoic Mwashya Subgroup (former Upper Mwashya) form the uppermost sedimentary unit of the Roan Group. Based on new field and drill hole observations, the Mwashya is subdivided into three formations: (1) Kamoya, characterized by dolomitic silty shales/siltstones/sandstones and containing a regional marker (the "Conglomerate de Mwashya" bed or complex); (2) Kafubu, formed by finely bedded black carbonaceous shales; and (3) Kanzadi, marked by feldspathic sandstones. Rocks of the Mwashya Subgroup are overlain by the Sturtian age Grand Conglomérat diamictite (equivalent to the Varianto/Brazil and Chuos/Namibia diamictites), and conformably overlie rocks of the Kansuki Formation (former Lower Mwashya), a carbonate unit containing volcaniclastic beds. New geochemical data confirm the continental rift context of this magmatism, which is contemporaneous with rift-related volcanism of the Askevold Formation (Nosib Group, Namibia). A gradational lithological transition between rocks of the Kansuki and the underlying Kanwangungu Formations, and similar petrological composition of these two formations, support the hypothesis that the Kansuki is the uppermost unit of the carbonate-dominated Dipeta/Kanwangungu sequence, and does not form part of the Mwashya Subgroup. Base metal deposits, mostly hosted in rocks of the Kansuki Formation, include weakly disseminated early-stage low-grade Cu–Co mineralisation, which was reworked and enriched, or initially deposited, by metamorphic fluids associated with the Lufilian orogenic event.
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Keywords: Copperbelt; Mwashya; Lithostratigraphy; Cu–Co; Magmatism

1. Introduction

The Neoproterozoic Katangan sedimentary rock succession hosts the rich copper–cobalt deposits of the central African Copperbelt in both Democratic Republic of Congo (Congo hereafter) and Zambia, which represent the most economically important Pan-African belt of the continent. The central African Copperbelt forms a northward convex structure, straddling the Congo–Zambia border and called "Lufilian Arc". It was formed during the Lufillian orogeny (ca. 620–570 Ma), stretching over a 700-km-long and 50-km-wide region from the Mwinilunga district in northwestern Zambia (Brock, 1961; Steven, 2000), east-northeastwards through Kolwezi and Likasi (Congo), and southeastwards to Bwana Mkubwa (Zambia) and Lonshi (Fig. 1). The Katangan sedimentary rock succession totals 5–10 km in thickness and is divided into three major lithostratigraphical units (François, 1974, 1995). From bottom to top, these units are the Roan (code R), Nguba (code Ng, formerly Lower Kundelungu) and Kundelungu (code Ku, formerly Upper Kundelungu) Groups (Table 1).

The uppermost sedimentary sequence of the Roan Group is called the "Mwashya Subgroup" or "R 4" in Congo (formerly "Système Schisto-Dolomitique" of Van den Brande, 1935; "Série de Mwashya" of Oosterbosch, 1962; "Faisceau de Mwashya" of François, 1974). It has been documented in several areas that

* Corresponding author. EGMF, Av. Pasteur, 9, B-1300 Wavre, Belgium.
E-mail address: jyc.egmf@forrestrdc.com (J.L.H. Cailteux).
✠ Deceased.

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doi:10.1016/j.gr.2006.04.016

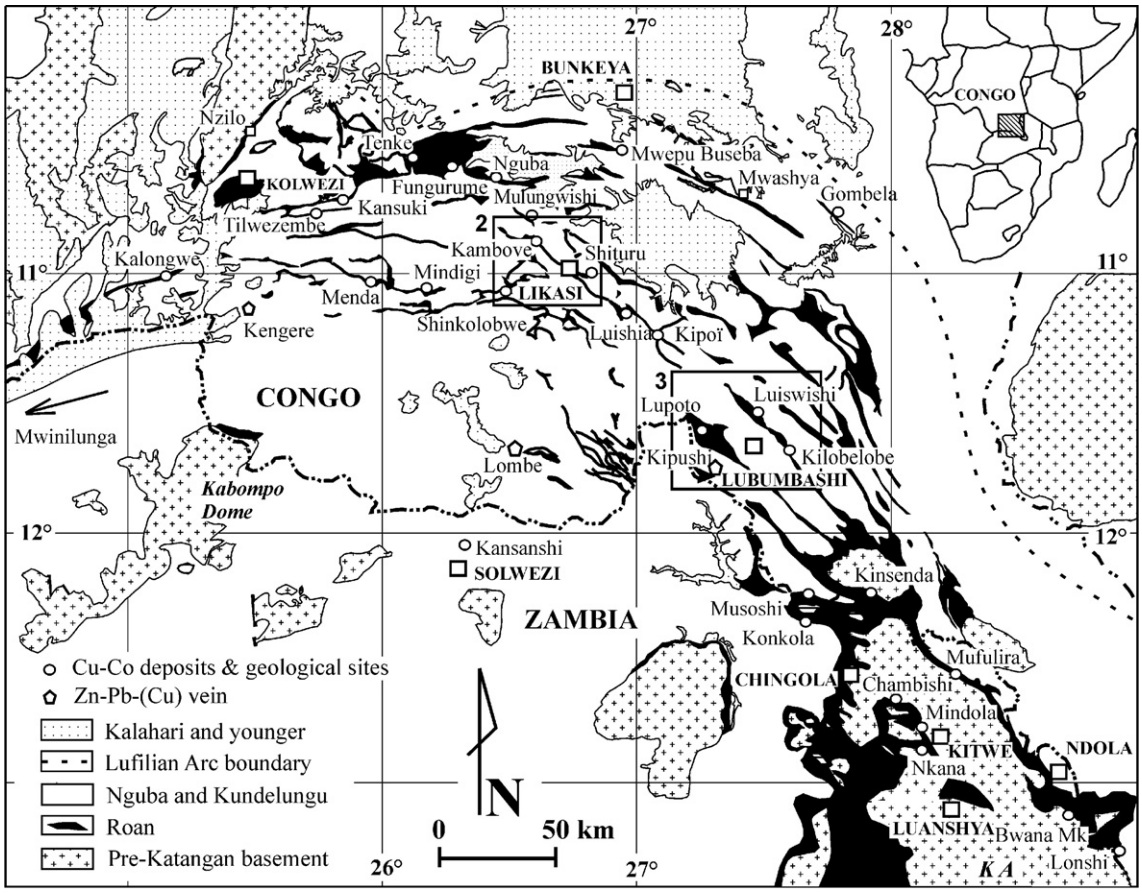

Fig. 1. Location of the main ore deposits and geological sites in the central African Copperbelt (modified from Mendelsohn, 1961; François, 1974; Cailteux et al., 1994). Areas labeled "2" and "3" are the sites of Figs. 2 and 3, respectively.

include Mwashya, Mulungwishi, Shituru, and Kambove (Fig. 1; Van den Brande, 1932, 1935; Francotte, 1959; Lefebvre, 1973, 1974, 1976, 1979; Cailteux, 1983, 1994). It is commonly divided into a predominantly dolomitic Lower Mwashya (R 4.1) and a predominantly pelitic Upper Mwashya (R 4.2) Formations, but there is no well-documented regional lithostratigraphic description of the transition and boundary between these two formations (François, 1974). In Zambia, only a dominantly argillaceous unit, called "Mwashia", is identified as Mwashya Subgroup (Mendelsohn, 1961; Cailteux et al., 1994) and is noted in stratigraphic position above the "Upper Roan" dolomite (or Bancroft Dolomite, Carbonate Unit of Binda, 1994, Kanwangungu Formation of Tshiauka et al., 1995; Table 1).

Previous authors linked the Upper Mwashya Formation and the Grand Conglomérat to form the "Système du Grand Conglomérat et du Mwashya" (e.g., Cahen and Mortelmans, 1948; Cahen, 1954; Lepersonne and Trottereau, 1974; Table 2). This interpretation was based on the hypothesis that both lithological units represent glacial to periglacial deposits, and a conglomerate near the base of the Upper Mwashya Formation (called "Conglomérat de Mwashya"; Van den Brande, 1932) was inferred to be a glacial deposit. In this alternative model, the Lower Mwashya Formation has been incorporated in pre-Mwashya units to create the "Faisceau de Mofya" of Lepersonne and Trottereau (1974), also called the "Kansuki Group" by Cahen (1974; Table 2).

The aim of this study is: (1) to improve the lithostratigraphy of the Mwashya Subgroup, i.e., to document the transition from Lower to Upper Mwashya Formations and their relationships with underlying (Dipeta Subgroup) and overlying (Grand Conglomérat tillite/diamictite) units by examining/re-examining new and old lithostratigraphic data; and (2) to better constrain the evolution of the Katangan basin during the deposition of rocks of the Mwashya Subgroup. There is a considerable interest in the Mwashya succession because of the occurrence of mafic volcanism and Cu–Co mineralisations.

2. Geological setting

Deposition of rocks of the Roan Group corresponds to the opening of a continental rift basin (fluvial clastics and lacustrine-type sediments; Buffard, 1988), which evolved into a proto-oceanic rift stage (Kampunzu et al., 1991, 1993). Sedimentary characteristics of the youngest Roan Group and of the Nguba and Kundelungu Groups rocks, indicate a widening of the basin due to extensional tectonics. Inversion from extensional to compressional tectonics, related to a convergence between the Congo and Kalahari cratons, generated the detachment of the Katangan sedimentary rock succession from the basement, and caused a north-directed folding and thrusting that led to the formation of the Lufilian Arc (Kampunzu and Cailteux, 1999). Other detachments occurred in the Congo-type Roan Group

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