Exploring the Neogene as a period for supergene ore formation and exposure in the Great Lakes Region (Western Great Rift Valley)

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The East African and Ethiopian plateaus form a superswell structure whose development dates back to the Miocene, with earlier evidences of increased geodynamic and magmatic activity in the Eocene. This mega-topographic high is still clearly visible today, albeit dissected by the Great African Rift. The exact reason for the development of this superswell structure is not precisely known, but it has been generally ascribed to the buoyancy and melt generation of an asthenospheric superplume beneath the East African plateaus (Wichura et al. 2010; Roberts et al. 2012; Adams et al., 2012).

The southeastern margins of the Congo River Basin, the so-called "Cuvette du Congo"– i.e. Kasai, Katanga and Kivu in the Democratic Republic of Congo (DRC); Burundi; Rwanda; Gabon – are part of this area that was uplifted throughout the Miocene. The uplift has been estimated to amount to 350-500 meters and is indirectly documented by the sharp increase of terrigenous Miocene sediment supply transported through the Congo River canyon on the Atlantic Ocean continental margin and slope (Lavier et al. 2001).

The central African plateau experienced incipient rifting at about 25 Myr, i.e. from the very beginning of the Miocene (Wichura et al. 2010; Roberts et al. 2012) implying that rifting was overall – if not everywhere, at any time and with similar intensity – synchronous with swell development and uplift. Reliable paleoaltimetry data and precisely dated sediments or paleosurface with associated weathering profiles are virtually nonexistent for the study area (Roberts et al. 2012). It makes it difficult to determine the kind of landscape and surface formations that developedand were affected by the swelling, rifting and denudation processes during the Oligocene, Miocene and Pliocene. This question has however critical economic interest since secondary oxidized manganese and cobalt ores in the Katanga (DRC) have been dated to the Upper Miocene and Mio-Pliocene (Decrée et al. 2010). These are regarded as lateral and contemporaneous equivalents of widespread (Fe-rich, Al-depleted) laterites from vast areas in Central Africa.

Laterite formation requires some basic conditions: (1) geodynamic stability over a sufficiently long period of time; (2) exposure of the protolith to the atmosphere, and (3) sufficient water availability and drainage, which is linked to climatic conditions prevailing at the time. In the study area, the rifting process favors climatic contrasts during the Miocene and Pliocene periods (Senut et al. 2009).

Furthermore, several other types of (undated) residual deposits of economic interest are known in the region:

- Sn-Ta-W-bearing laterites in the Northern part of Katanga and Kivu (DRC), Rwanda and Burundi;
- Au-bearing laterites in eastern DRC and Burundi;
- REE-bearing weathering profiles in western Burundi (see also the abstract by Decrée et al., this volume);
- Ni-bearing laterites in southeastern Burundi (Musongati area).

Compared to the southern part of the Katanga region (known as the "Copperbelt"), where imprint of the rifting on paleoweathering patterns is limited, most of the laterites and related residual depositsin the Great Lakes area are mechanically affected by rifting. The laterite formation and/or secondary ore formation did however proceed, as evidenced by Mio-Pliocene ages obtained on manganese and cobalt oxidized ore from Katanga (Decrée et al. 2010).

The objective of the present exercise is to relate absolute age information obtained by radiometric dating forMn-bearing ores to their climatic and tectonic context, in order to determine the time interval(s) when residual deposits could form, before or during rifting, and affect various types of exposed mineralized protoliths (Cu-Co rich sediments in Katanga; Sn-Ta-W pegmatites in the Great Lakes area; Ni-bearing ultramafic rocks in southern Burundi), to generate secondary ore deposits.

Reference

Adams et al. 2012, Geophys. J. Int., in press; Decrée et al. 2010, Miner. Depos. 45, 621-629; Lavier et al. 2001, Mar.Geol.178, 63-80; Roberts et al. 2012, Nature Geosci.5, 289-294; Senut et al. 2009, C.R. Geosci. 341, 591-602; Wichura et al. 2010, Geology 38, 543-546.