



# Emplacement and preservation of mineralized *écaille* within Roan Breccia of the Lufilian Arc, Central African Copperbelt: the Thrust Belt Boudinage model

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## Abstract

Localized zones of Roan Breccia with very large clasts, termed *écaille*, occur throughout the arcuate Lufilian Arc of Central Africa. The breccia zones consist of mineralized *Mines* Subgroup rocks with *Roches Argilo-Talcqueuses* (R.A.T.) at their base. Several of these areas, such as Mashitu/Tenke-Fungurume, Kamoya-Kambove and Shinkolobwe, contain significant Cu and Co resources. A new model, termed the Thrust Belt Boudinage model, ascribes their formation and mineralization to localized lateral extension of the fold-and-thrust belt as the arc flexed during its development. *Roan Breccia*-rich areas, termed Double Cuspate Zones (DCZs), initiated from early, major, strike-perpendicular fractures. These progressively dilating areas became sumps for detritus shed from — and pushed ahead of — advancing thrust units. Detritus entrained into the base of advancing thrust units, which adopted a pseudo-lamination, was incorporated into R.A.T. Over-riding thrust units were locally unsupported by these dilating *Roan Breccia*-filled DCZs, resulting in delamination of the highly fractured, pervasively veined and mineralized lower portions of the *Mines* Subgroup, which slumped into DCZs at various attitudes. These *écaille* preserve disharmonic folding, with respect to longer-wavelength Kundelungu Group folds that are evident on Lufilian Arc maps. DCZs bear a remarkable resemblance to zones of foliation boudinage, suggesting that they were low-pressure depositional sites for metal- and brine-rich fluids. The process is encapsulated in a physically-and geologically-accurate animation video. While the new model does not replace the role of halite-rich fluids transporting mineralization, it obviates the requirement for very large volumes of salt transporting *écaille* physically and *en masse*.

**Keywords** Lufilian Arc · Base metals · *Écaille* · Dilation · Foliation boudinage

## General geology

The Lufilian Belt or Arc, encompassing the Central African Copperbelt, comprises a portion of the Pan-African orogenic system that hosts the world's largest known endowment of stratiform Cu-Co ( $\pm$  Ni,  $\pm$  U,  $\pm$  Pb,  $\pm$  Zn) deposits (François 1973, 1974; Cailteux 1994; Cailteux et al. 1994; 2005a;

Selley et al. 2005; Muchez et al. 2015). The Lufilian Arc is a 900-km-long, northward-convex feature, straddling the border between the southernmost Katanga (now Lualaba) Province of the Democratic Republic of the Congo and the northwestern provinces of Zambia. It resulted from the amalgamation of Archaean to Mesoproterozoic blocks and terranes, including the Kasai Block, the Kibaran Belt, the Bangweulu Block and the Irumide Belt (e.g. Kipata 2013; Kipata et al. 2013; De Waele and Fitzsimons 2007; Williams and Nisbet 2017) (Fig. 1).

The arc is subdivided into five regional tectono-metamorphic domains, from hinterland to foreland, that preserve a broad, south-to-north decrease in metamorphic grade, from upper amphibolite to lower greenschist facies (Selley et al. 2005). These domains, from south to north, are as follows: (1) Katanga High, (2) Synclinal Belt, (3) Domes Region or Middle Lufilian, (4) External Fold-and-Thrust Belt or Outer Lufilian and (5) Lufilian Foreland (Porada 1989;

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