

Late- to post-orogenic extension and inversion in the Lufilian Arc, RDCongo

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The late and post-orogenic evolution of the of the Lufilian Arc and Kundelungu foreland in the Katanga region of the Democratic Republic of Congo between the paroxysm of the Lufilian orogeny at ~ 550 Ma and the late Neogene to Quaternary development of the south-western branch of the East African rift system remains poorly unknown although it caused important Cu-dominated mineral remobilizations leading to world-class ore deposits. This long period is essentially characterized by brittle tectonic deformations that have been investigated by field studies in open mines spread over the entire arc and foreland. Paleostress tensors were computed from 23 sites totaling 1900 fault-slip data by interactive stress tensor inversion and data subset separation, and the relative succession of 8 brittle deformation events established. They evidence the brittle evolution of the Lufilian Arc and foreland from orogenic compression, orogenic bending and to orogenic collapse, an early Mesozoic transpressional inversion and late Mesozoic – Recent rifting. The results are interpreted with reference to major collisional and extensional events that affected the Congo cratonic plate during his Phanerozoic history.

The first brittle structures observed were formed during the Lufilian compressional climax, after the transition from ductile to brittle deformation (stage 1). They have been re-oriented during the orogenic bending that led to the arcuate shape of the belt (stage 2). Unfolding the stress directions allows to reconstruct a well-defined N-S to NNE-SSW direction of compression, consistent with the stress directions recorded outside the belt. Constrictional deformation occurred in the central part of the arc, probably during orogenic bending. After the bending, the Lufilian arc was affected by a NE-SW transpression of regional significance (stage 3), inducing strike-slip reactivations dominantly sinistral in the Lufilian arc and dextral in the Kundelungu foreland. The next two stages were recorded only in the Lufilian arc. Late-orogenic extension was induced by σ_1 – σ_3 stress axis permutation in a more trans-tensional regime (stages 4). Arc-parallel extension (stage 5) marks the final extensional collapse of the Lufilian orogeny. In early Mesozoic, NW-SE transpressional inversion felt regionally (stage 6) was induced by far-field stresses generated at the southern active margin of Gondwana. Since then, this region was affected by rift-related extension, successively in a NE-SW direction (stage 7, Tanganyika trend) and NW-SE direction (stage 8, Moero-Upemba trend).