

Multi-physics and Geological Analysis of the Katangan Copper Basin and Zambezi Orogen: Inter-cratonic Terranes, Transpressive Orogenesis and Granitic Invasion

Michael Daly¹, Max Moorkamp², Pascal Pare³, Chris Wijns⁴, Rita Kounoudis¹, Joseph Khaunga⁵, Bill Doerner⁶
¹Oxford University, Earth Sciences Department, Oxford, United Kingdom, ²Technical University, Berlin, Berlin, Germany, ³BHP, Toronto, Canada, ⁴FQM, Perth, Australia, ⁵GSSZ, Lusaka, Zambia, ⁶Zonge International, Tucson, USA

The development of inter-cratonic lithosphere records the break-up and accretion of relatively stable cratons and the associated resource endowment distribution. To understand these complex tectonic processes we acquired geophysical and geologic profiles along an ~800 km corridor across the central African copper basin between the Congo and Kalahari cratons. The integration of magneto-tellurics, seismology and geologic data reveals three lithospheric scale terranes and boundaries. The northerly Lunga terrane has a dominantly resistive lithosphere with shallow conductive anomalies related to Neoproterozoic rift basins. The terrane terminates at a north to ENE trending orogenic suture zone defined by a resistive/conductive crustal boundary, a ~10 km Moho step and a surface high grade metamorphic thrust belt. East of the suture, the Kaonde terrane comprises conductive crust with an anomalous conductive area down to ~80 km and extensive granites and metasomatic alteration. It terminates against the steep, NNW dipping Mwembeshi fault zone. South of the fault zone, the Zambezi terrane hosts a gabbroic eclogite, crystalline basement and metasediments that terminate at the highly resistive, northerly dipping, south thrusting mylonitic zone of the Zambezi frontal shear zone, adjacent to the conductive Kalahari craton. Regional vergence and kinematic indicators show the Lunga and Kaonde terranes experienced dominantly ~ENE-NNW thrust and strike slip displacement, fanning across the Zambian Copperbelt and creating the arcuate Lufilian fold belt. In stark contrast the Zambezi terrane is characterized by intense, southerly to SSE collisional displacement and metamorphism. Together, these coeval, high angle kinematics and extensive granitic magmatism and inferred metasomatism in the upper-plate Kaonde terrane, reveal a complex transpressive orogenic collision and magmatic history. They also define distinct copper mineral systems that may respond to distinct exploration strategies.