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Identifying the tectono-metamorphic overprints of a Gondwana forming collision: a structural and thermobarometric transect of the Southern Irumide and Zambezi belts, Zambia

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The Southern Irumide Belt (SIB) of southern Zambia is an orogenic belt consisting of structurally stacked, predominantly Mesoproterozoic terranes. Located on the southern margin of the Congo–Tanzania–Bangweulu (CTB) continent, it bears a Neoproterozoic overprint relating to the collision between the CTB and Kalahari cratons during Gondwana amalgamation. Similar overprints are also recorded in the adjacent Kafue region that comprises part of the Zambezi Belt, which together with the Lufilian Arc and Damara Belt marks the suture zone between the Congo and Kalahari continents. A common feature to both the Southern Irumide and Zambezi belts are largely variable metamorphic overprints, ranging from high-pressure 'whiteschist' mineral assemblages to more amphibolite assemblages that appear to reflect more Barrovian thermal gradients. These contrasting tectono-metamorphic overprints along the southern Congo–Tanzania–Bangweulu margin provide evidence for the plate margin evolution of the region, and are a unique opportunity to better constrain and understand the evolution of central Gondwana.

This study provides pressure–temperature constraints for a whiteschist from the Southern Irumide Belt and metapelite from the Zambezi Belt that are obtained via phase equilibria modelling. These data serve to supplement existing thermobarometric data that are combined with new and existing structural data in order to understand the relationship between structural and metamorphic overprints in southern Zambia. Additionally, samples of supracrustal units from the Zambezi Belt were analysed for their U–Pb and Lu–Hf isotopes, which are used to better constrain their timing and relationship to similar units in the Southern Irumide Belt. Calculated thermal gradients of 30–55 °C/kbar and 70–165 °C/kbar were obtained for the modelled whiteschist and metapelite, respectively. Both samples are interpreted to have formed during Congo–Kalahari collision, being coeval with N–S compressional structures that are prominent in the SIB. The discrepancy between obtained thermal gradients is interpreted to relate to different aspects of this collision, where the amphibolite facies rocks formed in a compressional setting proximal to the southern Congo–Tanzania–Bangweulu margin. The whiteschists instead formed directly at the site of continental collision, marking the suture zone between the Congo and Kalahari continents.