

EPISODIC CRUSTAL RECYCLING IN THE METACRATONIC IRUMIDE BELT: GEOCHEMICAL AND ISOTOPIC EVIDENCE.

De Waele, B¹, Liégeois, J-P.

¹Tectonics SRC, The University of Western Australia, Crawley WA 6009. bdewaele@tsrc.uwa.edu.au

³ Département de Géologie, Musée Royal de l'Afrique Centrale, B-3080 Tervuren, Belgium

The Irumide Belt (IB) occurs along the southern margin of the Bangweulu Block (BB), and comprises the following units: (a) a complex of Palaeoproterozoic crystalline basement dated between 2.05 and 1.93 Ga (G_{1a}), with a minor Archaean component dated at 2.73 Ga (G_0); (b) the Muva Supergroup psammo-pelites, unconformably /structurally overlying the basement, and including rare thin mafic and felsic volcanic units dated between 1.88 and 1.85 Ga (G_{1b}); (c) a volumetrically small suite of anorogenic plutons dated between 1.66 and 1.55 Ga (G_2); and (d) voluminous K-feldspar porphyritic granitoids intruded between 1.05 and 0.95 Ga (G_4), coincident with the climax of Irumide tectonism dated at 1.02 Ga (MP-HT metamorphism).

The most voluminous groups (G_{1a} and G_4) despite their significant age difference, share the same whole-rock geochemistry (high-K calc-alkaline) and the same Nd T_{DM} model ages (3.1-3.3 Ga), indicating the same Archaean source at depth. G_{1b} dacites-rhyolites in the IB have very similar geochemistry to contemporaneous granites and dacites present in the BB. The G_{1b} Group, both on the BB and in the IB, display a range of Nd T_{DM} between 2.9 and 2.3 Ga, indicating a mixing between Archaean crust and a mantle component. The anorogenic G_2 plutons are more enriched in most of the incompatible elements than the former groups and geochemically correspond to A-type granitoids. Their Nd T_{DM} model ages range from 3.2 to 2.8 Ga indicating a preponderant crustal source; their particular composition could be ascribed to a mantle component but more probably to a lower degree of partial melting of the Archaean crust.

Rb-Sr isotopic data for all the magmatic units in the IB record significant disturbance, ascribed to mobility during Irumide and possibly Pan-African tectonism. This effect renders previously reported whole rock Rb-Sr dates on deformed lithologies within the IB suspect.

Nd T_{DM} model ages clearly indicate that an Archaean crust is present under the IB. The major Usagaran (~2 Ga) and Irumide (~1 Ga) events do not appear to have added new material to the crust in the region. The volumetrically small G_{1b} (Ubendian – ~1.85 Ga) and G_2

magmatic pulses added little new material, being also mainly crustal in origin. The geochemical characteristics of all groups are dominated by the nature of the Archaean crust, rendering deductions on geotectonic environments tenuous.

We consider the IB as the southern boundary of the BB, reworked during Usagaran (2 Ga) and Irumide (1 Ga) orogenesis. At 1 Ga, this reworking generated amphibolite to granulite facies rocks but also preserved 1.88-1.85 Ga supracrustal and volcanic rocks. This suggests important vertical tectonism. No active margin rocks have been observed while just to the south, on the other side of the Mwembeshi mega-shear zone, ca. 1 Ga juvenile terranes are known. Irumide reactivation could have consisted in the continental subduction of the southern margin of the BB, inducing mainly fracturing of the cratonic boundary and intrusion of crustal granitoids in response to asthenospheric upwelling along subvertical shear zones, and leaving intact the global structure of the cratonic boundary. A similar scenario can be ascribed to the Usagaran (G_{1a}) phase along the same margin, while G_{1b} and G_2 magmatism would have occurred in response to more distant collisions, exploiting the rheologically weakened structure of the proto-Irumide Belt. A far-field setting would favour the limited mantle contribution seen in these magmas.

The IB shows all the hallmarks of a cratonic continental passive margin, subjected through time to several convergent periods. These events were able to transform this margin of the BB into a metacratonic margin, susceptible to reactivation.