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Geochronology of the Palaeoproterozoic Magondi Belt (Zimbabwe) and the Choma-Kalomo Block (Zambia), with regional implications

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The Palaeoproterozoic Magondi Belt (MB) is a deformed belt of metasedimentary rocks with minor volcanics, located on the western side of the Archaean Zimbabwe Craton (ZC), in W Zimbabwe and NE Botswana [1]. In the low to medium-grade (greenschist to amphibolite facies) part of the MB, there are three groups - the Deweras, Lomagundi and Piriwiri, while in the high-grade parts of the belt, there are intrusive granitoids dated at c. 2 Ga. The Lomagundi Group is the type locality for the "Lomagundi" global high-$\delta^{13}C$ excursion in marine carbonates [1], but its age was very poorly constrained, prior to this study. The Dete-Kamativi Inlier (DKI), which forms part of the MB, is situated in western Zimbabwe, in a window surrounded by Phanerozoic rocks. The Choma-Kalomo Block (CKB) is a NE-trending terrain located in SE Zambia. It is composed of a hitherto undated gneissic basement with a high-grade metamorphosed supracrustal meta-sedimentary sequence, which is intruded by hornblende granites and gneisses of the Choma-Kalomo (CK) Batholith, dated between c. 1.37 and 1.18 Ga [2], and younger, c. 1.03 Ga, tin pegmatites.

Our new geochronology results include U-Pb dating of zircons using the SHRIMP-RG at ANU, the CAMECA 1280HR ion probe at GFZ, and LA-ICP-MS at US; Pb-Pb dating of columbite-tantalite using ID-TIMS, and U-Pb dating of monazite by LA-ICP-MS at UT; in addition to ^{40}Ar-^{39}Ar dating using LA-ICP-MS at UJ. The results from the MB indicate that the basal Deweras Group volcanics are younger than 2.29 Ga, while the rest of the Deweras Group is younger than 2.17 Ga. Volcanic tuff units in the upper parts of the Lomagundi and Piriwiri Groups indicate maximum ages of 2.07 Ga and 2.16 Ga respectively. New age data from granitoids in the DKI and MB indicate the formation of an Andean-type magmatic arc on the western edge of the ZC at c. 2.08-2.02 Ga, some 80-20 Ma prior to the onset of the Magondi Orogeny. Granitic gneisses dated at c. 2.71 and 2.76 Ga indicate that the ZC extended under the Magondi Belt. In the CKB, a semi-pelitic muscovite-biotite schist has detrital zircons with ages ranging from c. 2.03-1.8 Ga, corresponding to the ages of granitic intrusion and metamorphism in the MB. A granulitic metabasite, which is intruded by 1.37 Ga aged granite of the CK Batholith, contains 2.04 Ga zircon cores with c. 1.37 Ga rims. A biotite-muscovite schist has detrital zircon ages falling into 4 separate clusters: c. 3.39 Ga, c. 2.7-2.6 Ga, c. 2.1-1.7 Ga and 1.55-1.28 Ga. The older zircons were derived from the ZC and MB, while the youngest zircons come from both phases of the CK Batholith.

A Pb-Pb isochron gives an age of 1.03 Ga for a tin pegmatite at Kamativi and 1.01 Ga for a pegmatite within the CKB, while metamorphic monazite grains from the country rock are 2.02-1.84 Ga. ^{40}Ar-^{39}Ar dating of biotite from gneisses, and muscovite from pegmatites, in the DKI give ages in the range 1.01-

0.98 Ma, showing that the tin pegmatites are similar in age, and coincide with a regional thermal event at ~1 Ga. Our data indicate that the CKB is not an exotic terrane [2], but was an integral part of the Zimbabwe Craton, becoming decratonised, probably through lithospheric delamination, during Palaeoproterozoic (Magondi) and Mesoproterozoic Andean-type arc formation and deformation events.

References:

[1] Master S et al. (2010) Precambrian Research 182:254-273

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