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Carbon and U–Pb evidence for a Palaeoproterozoic crustal component in the Central Zone of the Limpopo Belt, South Africa

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Abstract: Supposedly mid-Archaean (*c*. 3.3 Ga) granulite-grade marbles from the Gumbu Group, Central Zone, Limpopo Belt (South Africa) have anomalously high $\delta^{13}C$ values (+4.6 to +7‰) interpreted as minimum values for their limestone protoliths. Such elevated $\delta^{13}C$ values are unknown in any Archaean carbonate worldwide, but occur in Palaeoproterozoic (*c*. 2.4–2.1 Ga) carbonates; for example, on the adjacent Zimbabwe and Kaapvaal cratons. This suggests that the Central Zone contains a previously unrecognized Palaeoproterozoic cover sequence, contrary to the prevailing view. This conclusion is supported by zircon U–Pb sensitive high-resolution ion microprobe ages from two metasediments, which, in addition to *c*. 2.02 Ga metamorphic zircon overgrowths, contain detrital zircons no older than *c*. 2.68 Ga, and some possibly as young as *c*. 2.2 Ga. The recognition of post-3.3 Ga metasediments in the Central Zone requires a major revision of models of the tectonic evolution of the Limpopo Belt.

Keywords: Precambrian, Limpopo Belt, carbon isotopes, age.

The Limpopo Belt is a *c*. 750 km long east–west zone of predominantly granulite-facies rocks between the Archaean Kaapvaal and Zimbabwe cratons of southern Africa (Fig. 1). In the east, the belt comprises three well-defined domains, the Central Zone and the flanking Southern and Northern Marginal Zones, that are separated by major ductile shear zones. To the west, amphibolite-facies Central Zone rocks lie in direct contact with the adjacent cratons. Both the Northern and Southern Marginal Zones contain tonalite–trondhjemite–granodiorite intrusive suites and subordinate metasedimentary rocks thought to be the granulite-facies equivalents of Archaean granite–greenstone sequences of adjacent cratons (Robinson & Du Toit 1981; Du Toit *et al*. 1983). In contrast, the origin of the Central Zone, which is dominated by granodioritic and granitic gneisses interlayered with metapelites, quartzites and marbles, is unclear. It has been variously interpreted as a giant nappe (McCourt & Vearncombe 1987) or thrust sheet (McCourt & Vearncombe 1992), or as a distinct crustal block wedged in from the NE in a Himalayan-type orogeny (Treloar *et al*. 1992). Although there is uncertainty regarding its tectonic evolution, there is now general agreement that Central Zone sedimentary protoliths were deposited at *c*. 3.3 Ga (Barton 1983; Kröner *et al*. 1999).

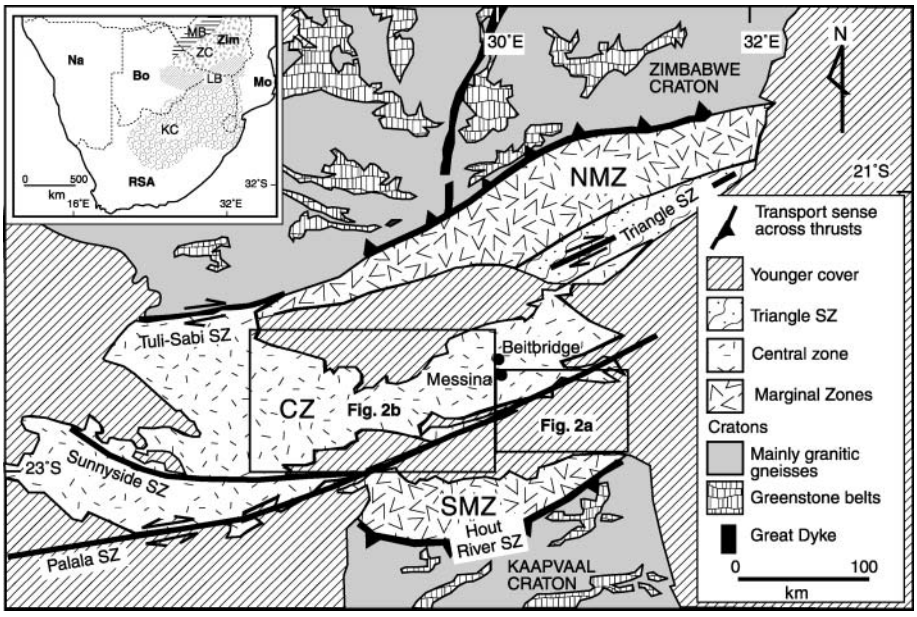

Fig. 1. Simplified geological map of the Limpopo Belt and adjacent Kaapvaal and Zimbabwe cratons. Modified after Rollinson & Blenkinsop (1995). Bo, Botswana; CZ, Central Zone; KC, Kaapvaal Craton; LB, Limpopo Belt; MB, Magondi Belt; Na, Namibia; NMZ, Northern Marginal Zone; RSA, Republic of South Africa; SMZ, Southern Marginal Zone; Zim, Zimbabwe; ZC, Zimbabwe Craton.