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Lu-Hf isotopes and U-Pb ages of detrital zircons from Saldania Belt, South Africa: Stratigraphic and Tectonic Implications

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The Saldania Belt along the southwestern margin of South Africa shows three major tectonostratigraphic zones. The Tygerberg Zone (Tygerberg Formation) consists of a rhythmic turbiditic alternation of greywacke, silty, argillite and arenite. The Swartland Zone (Swartland Subgroup) is composed by phyllite, sericite-chlorite schist and biotite-albite schist. The Boland Zone consists of low-grade metamorphic siliciclastic rocks. The Klipheuwel Group, unconformably overlies all these tectonostratigraphic zones. In order to better assess the relationships between these tectonostratigraphic units a provenance study, using LAICPMS U-Pb age data and Lu-Hf isotopes obtained on the same detrital zircon grain was conducted.

The similarity in the youngest detrital zircon ages obtained across the three tectonostratigraphic units of the western Saldania Belt points to a similar age of deposition of all these units. The maximum age (564 ± 3 Ma) of the Tygerberg Formation (Tygerberg Zone) is within error identical to obtained (557 ± 6 Ma and 554 ± 3 Ma) in the Swartland Zone. Considering that the minimum age for both units is given by the oldest intrusive body of the Cape Granite Suite, i.e. 552 ± 4 Ma only a very short time span of a few million years remains for the deposition of these formations.

As is the case with the Nama sediments, the source of the Boland sediments was mainly from the Namaqua-Natal metamorphic belt, which forms the immediate border of the Kalahari. The youngest zircon grains with ages around 0.6 Ga cannot be sourced on the palaeocontinental margin but must come from the Pan-African orogenic belts to the west. The new zircon data for Klipheuwel Group that rests unconformably above the Malmesbury and Boland Groups indicate that the Magrug Formation must be younger than 551 Ma.

Hf data in the same zircons, show that zircons in the 0.7 - 1.0 Ga interval are responsible for the main concentration of positive eHf (0 to +5), suggesting an important mantle contribution at this time. These two age peaks show a main Hf(t) model age close to 1.5Ga suggesting that the main accretion of juvenile material to the crust occurred during the Mesoproterozoic, reinforcing the interpretation of a small Kalahari Craton contribution in the generation of Saldania Belt rocks.