U-Pb and Lu-Hf isotopie of zircon from (poly)metamorphic anorthosites and metabasites from the Central Zone of the Limpopo Belt

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U-Pb and Lu-Hf isotope – laser ablation ICP(MC)-MS - analyses of zircon grains/domains from two anorthosite samples of the Messina Layered Intrusion (eastern part of the Limpopo Belt) provide evidence for three zircon forming events: at 3.35 Ga, 2.65 Ga and 2.03 Ga. Zircon formation – rather than zircon alteration - during all three events is constrained by increasing $^{176}Hf/^{177}Hf$ from ˜0.2806 (at 3.35 Ga), to ˜0.2010 (at 2.65 Ga), and ˜0.2813 (at 2.0 Ga). This increase also indicates that a melt phase was present during zircon growth at all three times (see Gerdes & Zeh, 2008). Thus, the combined U-Pb and Lu-Hf datasets (in combination with CL images) provide evidence that the Messina layered intrusion emplaced at 3.35 Ga, and that their anorthositic differentiation products underwent re-melting during high-grade metamorphic events at 2.65 and 2.03 Ga. These conclusions well conform to those previously obtained from the nearby Sand River Gneiss TTG suite (Gerdes & Zeh, 2008). Epsilon Hf (3.35Ga) between +1.5 and -2.5 of the oldest zircon domains indicates that the Messina layered intrusion was derived from a Paleoarchean mantle source, which had a nearly chondritic composition. Notably, chondritic values were also obtained for the second zircon generation formed at 2.65 Ga. These values, however, can be explained by crustal fractionation during the re-melting process.
CL images and U-Pb ages of zircon grains of a metabasic rock from the Venetia area (central part of the Limpopo Belt) also provide evidence for Paleoarchean magmatic activities at 3.3 Ga, and for a metamorphic overprint at about 2.0 Ga. Textural relationships, furthermore, hint that at least some of the Paleoproterozoic zircon grains/domains were formed under amphibolite-facies conditions (650°C/6-7 kbar), perhaps as a result of the prograde mineral reaction: Hbl(Zr-rich) + Chl + Grt = Cummingtonit + Pl + Zrc. Presently, Lu-Hf analyses are under progress to test this hypothesis.

References

Gerdes A, Zeh, A (2008) Chemical Geology, doi: 10.1016/j.chemgeo.2008.03.005

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