



Zircon formation during hornblende-breakdown at 600-650°C – an example from Archean tholeiites of the Limpopo Belt

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Detailed petrological observation of rock forming and accessory minerals provide evidence that zircon in tholeiitic metabasites from the central part of the Limpopo Belt were formed during two distinct processes: during magma crystallisation at ca. 3.3 Ga, and a metamorphic overprint at about 2.0 Ga. This is well supported by zircon textures (CL images), as well as by U-Th-Pb and Lu-Hf isotope analyses of zircon obtained by laser-ablation-ICP-MS in thin sections and zircon mounts. Textural observation, thermodynamic calculations and trace element analyses furthermore constrain that the metamorphic zircon overgrowths formed under amphibolite-facies conditions at ca. 600-650°C / 5-7 kbar, and result from the prograde mineral reaction: hornblende (Zr-rich = 30ppm) + chlorite + garnet = cummingtonit (Zr poor = 3 ppm) + plagioclase + zircon. The results also show that the primary magmatic zircon cores – even such affected by multiple Pb-loss - still preserve their original $^{176}\text{Hf}/^{177}\text{Hf}$ of ca. 0.28065, whereas the metamorphic overgrowths have higher $^{176}\text{Hf}/^{177}\text{Hf}$ of 0.28090-0.28115. This indicates that the metamorphic zircon overgrowths incorporated additional radiogenic hafnium, perhaps formed by ^{176}Lu decay in the matrix between 3.3 and 2.0 Ga. Furthermore, our results show that zirconium and hafnium are mobile in the environment of hornblende-breakdown.