New insights on the thermal evolution of the Stolzburg Pluton, Barberton granitoid greenstone terrain, South Africa, by U-Pb apatite and zircon ages

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Two different models currently prevail to explain ca. 3.23 Ga garnet-amphibolite facies metamorphism to the south of the Barberton greenstone belt: A sagduction model involving ca. 3.23 Ga diapiric rise of partially molten tonalite-trondhjemite-granodiorite (TTG) plutons and sinking of more dense greenstone keels [1], and thickening of cool proto-continental crust due to lateral plate tectonics, followed by orogenic collapse and long-lived shortening to steepen fabrics [2]. We report new U-Pb apatite and zircon ages, as well as Lu-Hf zircon data for the Paleoarchean Stolzburg and Theespruit plutons which are proposed to represent the anatectic domes. Zircons from the Stolzburg and Theespruit plutons provide a crystallization age of ca. 3.45 Ga, confirming earlier studies, and εHf_t values of +1.2 to -3.3. Felsic dykes cross-cutting the 3.45 Ga plutons yielded a crystallization age of ca. 3.23 Ga and εHf_t values of +0.4 to -2.1. U-Pb apatite ages determined for both plutons and cross-cutting felsic dykes are ca. 3.45, 3.35, 3.21, 3.11 and 2.82 Ga. The preservation of the apatite ages indicates that no prolonged heating of the granitoids above ca. 550 °C has occurred after crystallization and cooling of the plutons. The Hf isotopic data show that the ca. 3.23 Ga dykes are less evolved than the host TTG plutons and are not produced by melt extraction following anatexis of the latter or their equivalents. This argues for metamorphism due to orogenic thickening of cool felsic crust at ca. 3.23 Ga.

[1] Van Kranendonk (2015) *Geol. Soc. London Spec. Pub.* **389**, 83-111. [2] Stevens & Moyen (2007) *Dev. Prec. Geol.* **15**, 669-698.