

Stabilising a craton: The 3.1 Ga Mpuluzi batholith (Swaziland / RSA)

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The Barberton Greenstone Belt and Ancient Gneiss Complex in Swaziland and adjacent South Africa are some of the most-studied Early- to Mid-Archean (3.6 to 3.2 Ga) crustal remnants. The granite-greenstone belt is surrounded and overlain by several large granitoid bodies (Mpuluzi, Piggs Peak, and Nelspruit batholiths), all emplaced ~3.1 Ga, and marking the end of TTG magmatism and regional metamorphism in the area.

The granitoids were emplaced as extensive, km-thick sheets and extend over more than 10,000 km². Zircon U-Pb ages range from ~3.08 to ~3.15 Ga; emplacement may have occurred over as much as 70 Ma. Some samples also have a minor inherited population at ~3.5 Ga, implying the involvement of older crustal material. Zircon Hf-isotope data show a range of up to 15 epsilon units within each sample, but little variation between samples. Average model ages of the 3.1-Ga zircons are ~3.5 Ga, corresponding to the age of the inherited population. These older grains commonly have model ages back to 4 Ga.

Whole-rock Sr and Nd isotopic data yield isochron ages of 3.022 Ga for both systems, and the initial ratios yield model age of 3.11 Ga for each system, perfectly consistent with the U-Pb data. The tight isochrons for both systems (r^2 for Sr = 0.9974, Nd = 0.9615) strongly suggest that the whole mass formed and cooled together, and the small time gap between the isochron and model ages suggests rapid cooling.

These 3.1 Ga granitoids therefore represent the final stage in the cratonisation of the region; this could represent the "draining" of fusible material from the lower crust, increasing its rigidity and limiting further tectonism. The unusual emplacement style, the large volume of magmas involved and the apparently short timescale of emplacement raise several important questions about the processes involved in the stabilisation of the eastern Kaapvaal Craton in particular and ancient crust in general: (1) What was the heat source for the magmas, and what was the source material? (2) How were these volumes of magma extracted from the deep crust? (3) What controlled the emplacement style as sheets rather than deep-rooted batholiths? These problems will now be addressed by dynamic and thermodynamic modeling.

Zinc Melanterite Formation from Acid Mine Drainage in Pan de Azúcar Mine (Zn-Pb-Ag), Northwest Argentina

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Melanterite formation in Pan de Azucar Mine: Evaporation of acid mine waters formed by oxidation of sulfide rich tailings in Pan de Azúcar Mine (Zn-Pb-Ag) favors the formation of soluble sulfates as Melanterite ($\text{Fe}^{2+}\text{SO}_4 \cdot 7\text{H}_2\text{O}$), which is one of the most common ferrous sulfates in nature and one of the first phases to precipitate from evaporation of acid mine drainage. One of the most important characteristic of these phases is their ability to store metals as Ni(II), Cu (II), Zn (II) [1] Zn-Melanterite: Acid mine drainage (139 g/L SO_4^{2-} ; 8960 mg/L Zn; 99,7 mg/L Cd; 47 mg/L Fe (total); 44 mg/L As; 10 mg/L Cu; 1,4 mg/L Pb) seeps from one of the tailings impoundments during dry season. High evaporation rates and high concentration of sulfate and iron favors the precipitation of melanterite at pH=2.1. Some preliminary SEM-EDS studies show high Zn concentrations in melanterite crystals, which indicates its ability to capture this metal in their structure instead of Cu or Ni, probably due to the Zn excess in the acid water. XRD and field observation suggests that during the dry season, melanterite dehydrates and changes to rozenite ($\text{Fe}^{2+}\text{SO}_4 \cdot 4\text{H}_2\text{O}$) as has been described by Nordstrom [1, 2]. In the following rainy season that phases dissolves and metals are again available to the hydrological cycle. This process has an important influence on temporal variation of metals in surface waters.

[1] Sulfate Minerals, Crystallography, Geochemistry and Environmental Significance (2000). Reviews in Mineralogy and Geochemistry, V 40. [2] Nordstrom (1982). Acid Sulfate Weathering: Soil Science Society of America Spec. 10, 37-56