

## Tourmaline boron isotope evidence for multiple fluid sources in silicified oceanic crust of the Barberton greenstone belt, South Africa

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The Palaeo- to Mesoarchaeon Barberton greenstone belt, South Africa, contains strongly silicified volcano-sedimentary sequences. Silicification is regarded as a result of seawater circulation in shallow subsurface convection cells [1], but other (hydrothermal) fluid sources are also discussed. To provide constraints on the fluid source and conditions of the alteration, fluid inclusion analyses in quartz veins and boron isotope analyses in tourmaline were carried out on chert and komatiite samples from the 3.3 Ga Mendon Formation.

Fluid inclusion analyses reveal that the fluid preserved in vein quartz is of metamorphic origin and cannot be used to constrain the conditions of chert formation [2]. In contrast,  $\delta^{11}\text{B}$  values in tourmaline appear to be unaffected by later alteration. In-situ SIMS analyses reveal an extreme range of  $\delta^{11}\text{B}$  values from -22 to +10 ‰. Positive  $\delta^{11}\text{B}$  values (+6 to 10 ‰) are interpreted as representing boron derived from seawater-altered oceanic crust. The more common  $\delta^{11}\text{B}$  values (-8 to -6 ‰) overlap with MORB and may represent a B-source from the Archaean oceanic crust. The most negative  $\delta^{11}\text{B}$  values (-10 to -22 ‰) are restricted to the rims of tourmaline hosted by syn-diagenetic hydraulic breccias. Although the source of fluid with light  $\delta^{11}\text{B}$  values has yet to be identified, these results show that the boron preserved in tourmaline of these early hydrothermal systems was derived from more than one source. We identify Archaean seawater, mantle-derived oceanic crust, and a third source with isotopically light boron that may be mature continental crust or non-marine evaporites. This latter source must have been available during seafloor hydrothermal alteration and the deposition of the Mendon Formation at ca. 3.3 Ga.

[1] Hofmann & Harris (2008), *Chemical Geology* **257**, 224-242 [2] Farber et al., in revision, *Precambrian Research*.