Magmatic to hydrothermal zircons: Textural and chemical evolution

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Zircon is undoubtedly the most sought-after mineral for geochemical studies, for its ability to provide information on its host rock, spanning from geochronology, tracing of source and processes, geothermometry, and, recently, redox conditions [1]. However, it is crucial to ascertain its primary origin, and in the past two decades there has been increasing evidence of its crystallization from hydrothermal fluids [2]. Two of the main characteristics that are widely used to ascertain the magmatic or hydrothermal origin of zircon are texture and trace-element chemistry. However, most of these data are contradictory and can be similarly attributed to a primary and secondary origin [3], resulting in a poor understanding of hydrothermal zircon characteristics.

We present data on a suite of zircons from the Ambohimirahavavy alkaline complex, Madagascar, that display impressive textural, morphological and compositional variations, strongly suggesting a span in origin from magmatic to hydrothermal (Fig. 1). Clearly magmatic zircons yield ages of 20.40 ± 0.16 and 21.21 ± 0.44 Ma. Hydrothermal zircon yields a similar age of 20.64 ± 0.48 Ma. Evidence for hydrothermal origin includes its occurrence with quartz in pseudomorphs after primary minerals, as botryoidal crystals filling cavities, and precipitation in exoskarn [4]. Strong variations in the amounts and distribution of trace element also occur among different sectors in zoned crystals.

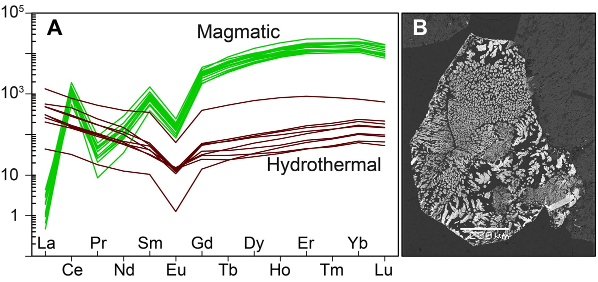

Figure 1: A) Chondrite-normalized REE patterns for magmatic and hydrothermal zircons. B) Pseudomorph of fibrous zircon plus quartz after eudialyte; scale bar 200 μm.

[1] Trail *et al* (2011) *Nature* **480**, 79-83. [2] Schategger (2007) *Elements* **3**, 51-79. [3] Hoskin & Schaltegger (2003) *RIMG* **53**, 27-62. [4] Estrade *et al* (2015) EconGeol, in press.