Composition of micrometre-scale zircon grains from the Bunburra meteorite

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The Bunburra Rockhole meteorite is a brecciated basaltic achondrite that comprises three distinct lithologies defined by the grain size: coarse-grained, medium-grained, and fine-grained [1,2]. The mineralogy in each of these is similar and comprises anorthitic plagioclase and pyroxene as the major minerals, with minor amounts of silica glass, sulfides, ilmenite, chromite, phosphates and zircon [2-4]. The zircon grains have not been previously studied in detail because of their small size, with the biggest grain being ≤ 15 μm in the long axis.

Atom probe tomography is capable of analysing the isotopic and trace element composition of sub-μm domains and thus is one of few techniques capable of characterising the Bunburra zircons. Five zircon grains from the different lithologies were analysed to investigate their trace element composition in order to better understand their origin and formation. Li, Y, Ca and P were measured with concentrations between 100 and 400 ppma, while Al, Mg, Ce and Fe were detected with concentrations below 50 ppma. Comparison between the grains from different lithologies indicated similar trace element composition, pointing to crystallisation from a similar source melt or to different melts with very similar composition. What's more, the presence of micrometre-scale zircon grains, indicates that they crystallized from a source melt saturated in silica.

[1] Bland *et al*. (2009) *Science* **325**, 1525-1527. [2] Spivak-Birndorf *et al*. (2015) *Meteorit. Planet. Sci.* **50**, 958-975. [3] Jourdan *et al*. (2014) *Geochim. Cosmochim. Acta* **140**, 391-409 [4] Benedix *et al*. (2017) *Geochim. Cosmochim. Acta* **208**, 145-159.