Visualizing He distribution in zircon by laser ablation noble gas mass-spectrometry: Implications for (U-Th)/He geochronology and thermochronology

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Conventional (U-Th)/He dating of zircon is traditionally established by measuring bulk He, U and Th abundances in single zircon crystals, and by applying an alpha ejection correction [1]. The homogeneity of U-Th in dated crystals is commonly assumed but is clearly not always valid. The consequences of ignoring parent element heterogenity on He distribution has not been directly addressed before.

In this paper we use the RESOchron™ instrument, which integrates laser ablation micro-sampling and noble-gas mass-spectrometry, to reconstruct high-resolution (~10 μm scale) two-dimensional (2D) images of He distribution in zircon crystals. We construct He maps for a set of zircon crystals in order to investigate the impact of U-Th zoning, radiation damage and inclusions on He distribution. He maps, in combination with characterisation information from imaging techniques (cathodoluminescence, confocal Raman microscopy and LA-ICPMS elemental maps) allow us to visualize the impact of these commonly undetected grain features to the fundamental principles and assumptions of (U-Th)/He geochronology. They also allow us to suggest refinements to analytical protocols currently used for conventional as well as *in-situ* (U-Th)/He dating. Finally, we will illustrate how He mapping may potentially provide a new means for thermal history reconstructions by allowing direct measurement of He diffusional profiles.

[1] Farley *et al*. (1996) *GCA* **60**, 4223-4229.