

## Testing the response of $x\text{s}^{230}\text{Th}$ and extraterrestrial $^3\text{He}$ to sediment redistribution at the Blake Ridge, western North Atlantic

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The constant flux proxies  $x\text{s}^{230}\text{Th}$  and extraterrestrial  $^3\text{He}$  ( $^3\text{He}_{\text{ET}}$ ) have the potential to provide unique insights in paleoceanographic studies by allowing estimates of vertical rain rates and rates of lateral sediment redistribution. Fractionation associated with redistribution may separate  $x\text{s}^{230}\text{Th}$  from  $^3\text{He}_{\text{ET}}$ , however, biasing accumulation rate data; it has been suggested that  $x\text{s}^{230}\text{Th}$  may be enriched in clay-sized particles [1], while  $^3\text{He}_{\text{ET}}$  is thought to reside primarily in larger grains [2]. In this study, we evaluate the fractionation between  $x\text{s}^{230}\text{Th}$  and  $^3\text{He}_{\text{ET}}$  in Holocene and last glacial samples from two cores from the Blake Ridge, a drift deposit in the western North Atlantic. At the end of the last glacial period, both cores received large amounts of advected sediment, enriching the cores in fine material. We find no evidence for fractionation between  $^{230}\text{Th}$  and  $^3\text{He}$  related to sediment focusing. We also find that despite large temporal and spatial differences in sediment redistribution, normalization to  $^{230}\text{Th}$  and  $^3\text{He}$  produces mass accumulation rates that are generally internally consistent. High terrigenous contributions to glacial samples require a correction for terrigenous He for some samples. We discuss new data constraining the terrigenous endmember as well as  $x\text{s}^{230}\text{Th}$  and  $^3\text{He}_{\text{ET}}$  distributions in different grain size fractions.

[1] Lyle *et al.* (2005) *Paleoceanography* **20**, PA1005.

[2] Farley *et al.* (1997) *GCA* **61**, 2309-2316.

## Double dating of zircon via SHRIMP U/Pb and (U-Th)/He methods

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Combined zircon (U-Th)/He and U/Pb dating methods have previously been applied to provenance and sediment recycling studies [eg. 1, 2] where the U/Pb analysis was performed by LA-ICPMS. In this work we have combined SHRIMP U/Pb analysis with traditional (U-Th)/He analysis to obtain double dates on zircon from a kimberlite pipe.

Zircon grains were abraded to remove the outer 20 $\mu\text{m}$  and eliminate the need for an alpha-ejection correction. Abraded grains were mounted in epoxy and lightly polished to expose a flat surface, then analysed by SHRIMP. Grains were then extracted from the epoxy and analysed by standard (U-Th)/He methods. A test using in-house zircon standards was made to determine whether the ion microprobe sputtering process affected He diffusion from the sample. Virtually identical ages (ex-SHRIMP (U-Th)/He age =  $10.8 \pm 0.3$  Ma vs Standard (U-Th)/He age =  $10.3 \pm 0.2$  Ma) and Th/U ratios were obtained to within error.

We applied the double dating technique to a zircon mineral separate obtained from a bulk sample from the Sacamore pipe located in the Merlin kimberlite field in the Northern Territory of Australia. The zircon U/Pb ages for the Merlin kimberlite (n=14) clustered around the mean of 1694 ( $\pm 156$ ) Ma while the zircon (U-Th)/He thermochronometry (n=33) yielded a mean age of 376 ( $\pm 62$ ) Ma, within error of previously determined emplacement ages for the Merlin pipe (380 Ma[3]).

The double dating method indicates that all of the zircon grains in the Merlin kimberlite were xenocrysts that originated from lower- to mid-crustal regions (>6 km).

[1] Campbell *et al.* (2005) *EPSL* **237**, 402-32. [2] Rahl *et al.* (2003) *Geology* **31**, 761-764 [3] Hell *et al.* (2003) 8th International Kimberlite Conference, Victoria, Canada.