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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 [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 20µm to eliminate the need for an alpha-ejection correction. Abraded grains were mounted in epoxy and lightly polished to expose a flat surface for analysis by SHRIMP. Grains were then removed from the epoxy using 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 ± 0.3 Ma vs Standard (U-Th)/He age = 10.3 ± 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 Sacramore 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 (± 156) Ma while the zircon (U-Th)/He thermochronometry (n=33) yielded a mean age of 376 (± 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, I.H. et al., 2005. *EPSL* 237, 402-32; [2] Rahl, J.M. et al., 2003, *Geology* 31, 761-764 [3]Hell, A. et al, 2003. 8th International Kimberlite Conference, Victoria, Canada.