USEFULNESS OF LA-ICPMS SNGLE ZIRCON ANALYSIS: CRYSTALLIZATION AGE OF TRES PIEDRAS GRANITE—A CASE STUDY

R. Das (FSU, Geochemistry)

Introduction

Previous work shows, U-Pb zircon ages (by isotope dilution) for Tres Piedras Granite (a Precambrian granitic rock in north central New Mexico) delineate a chord that intersects concordia at 1654 +/- 16 Ma (Maxon, 1976). Rb - Sr whole rock data points obtained from the Tres Piedras Granite from Maxon, 1976 and this study yields a distinct isochron for each outcrop sampled: Tres Piedras Granite Type Locality: 1493 +/- 21 Ma and Tusas River Canyon: 1501 +/- 44 Ma. The Rb-Sr age matches with the metamorphic event that has been dated by many workers in that area. The Rb-Sr whole rock method is widely used as a dating tool for igneous crystallization but sometimes poses problem due to whole-rock open system behavior. If the daughter is completely homogenized, then the isochron age is reset to zero. When this happens, any later dating attempt will yield the age of that metamorphic event rather than the original time of crystallization. In case of Tres Piedras Granite the age discrepancy between the two systematics might arise due to two reasons: A. Zircon age is the crystallization age of the granite and the Rb-Sr age is the metamorphic homogenization age. B. Rb- Sr whole rock age is the crystallization age and the ID U-Pb data is biased (or older) due to incorporation of older xenocrystic zircons. To check for older xenocrystic zircon incorporation, single zircon analysis is required.

Experiment

Heavy mineral concentrates of the <350 microns fraction were separated magnetically. Inclusion-free zircons from the non-magnetic fraction were then handpicked under a binocular microscope at the Geochemistry facility of NHMFL. At least fifty zircons from each sample were mounted in epoxy and polished for laser ablation analyses at University of Arizona. Zircon crystals were analyzed in polished section with a Micromass Isoprobe multi-collector ICPMS equipped with nine Faraday collectors, an axial Daly detector, and four ion-counting channels. The Isoprobe is equipped with an ArF Excimer laser, which has an emission wavelength of 193 nm. Analyses were conducted on 50 micron spots with an output energy of ~32 mJ (at 22kV) and a repetition rate of 9 Hz. Each analysis consisted of one 20-second integration on peaks with no laser firing and twenty 1-second integrations on peaks with the laser firing. Hg contribution to the ^{204}Pb mass position is accordingly removed by subtracting the on-peak background values. The depth of each ablation pit was ~15-20 microns. Total measurement time was ~90 s per analysis. The collectors were configured for simultaneous measurement of ^{204}Pb in an ion-counting channel while ^{206}Pb, ^{207}Pb, ^{208}Pb, ^{232}Th, and ^{238}U are measured with Faraday detectors. All analyses were conducted in static mode. Inter-element fractionation was monitored by analyzing fragments of SL-1, a large concordant zircon crystal from Sri Lanka with a known (ID-TIMS) age of 564 ± 4 Ma (2σ) (Gehrels, unpublished data). This reference zircon was analyzed once for every three unknown samples.

Results and Discussion

30 zircons from each sample (Tres Piedras Type Locality and Tusas River Canyon) were analyses and plotted on a concordia diagram. For both the samples the upper intercept is at about 1730 +/- 30 m.y without any older xenocrystic zircon. Thus the Rb-Sr whole rock ages represents metamorphic ages due to complete homogenization of Sr isotope.

Acknowledgements

Mineral separation was done in the Geochemistry Department at NHMFL and the laser ablation was done at University of Arizona, Tucson.

References

[1] Maxon, J.R., *Abstracts with Programs - Geological Society of America,* **8,** 5, Rocky Mountain Section 29th annual meeting), 608 (1976).