

New approaches to U-Th-Pb zircon dating using the Cameca ims-1270

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For many years ion microprobe zircon U/Pb dating has used UO/U ratios to correct for changes in the ionisation of Pb relative to U between standards and unknowns. An alternative method has been suggested [1,2] using Pb/UO₂ vs UO₂/U. The Pb/UO₂ ratio appears much less sensitive to changes in secondary ion energy reducing one potential source of change. Measurements have been made on the Edinburgh ims-1270 exploring the use of three peaks U, UO and UO₂ and a new correction method is suggested: Pb/U vs UO₂/UO. Although increasing the number of peaks measured it eliminates common denominators and, for the ims-1270 at least, gives significantly greater reproducibility than the conventional method.

Conventionally standard material has always been added to each mount. This results in a significant loss of standard material. The use of separate mounts for standards and unknowns has been explored. One surprising result from these studies is that (uncorrectable) differences in the U/Pb ratios are observed if the sample and unknowns are at a different temperature. Measurements made by heating and cooling zircon and a glass standards demonstrates that Pb ionisation decreases when the sample is heated and increases when cooled. U, and its oxides, are virtually unaffected. The increase in Pb ionisation on cooling can be as much as 50% but is significantly less than that created by simply flooding the surface with oxygen. Clearly if both standard and unknown are on the same mount then they should be at the same temperature. However, after a sample change even a 5°C change may create a 1% difference in the U/Pb ratio.

References

- [1] Schuhmacher et al. SIMS IX 919-922
- [2] Whitehouse et al. Geochim. Comochim. Acta 61, 4429-4438