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Further Advances in U-Th-Pb LA-PIMMS

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Laser ablation (LA) U-Th-Pb geochronology now provides a viable alternative to the more costly and labour intensive high-resolution ion-microprobe and ID-TIMS techniques. Coupled to plasma-ionisation multi-collector mass spectrometers (PIMMS) this high spatial resolution technique can produce U-Th-Pb results from separated samples within a few hours rather than *c.* 1-5 days.

Research at NIGL, employing a raster ablation protocol, indicates that U-Pb fractionation can be eliminated and errors of *c.* 5% (2σ; or 1.1% (95% conf.) on wtd mean, (see Figure 1) can be achieved for U-Pb data on accessory minerals such as xenotime, monazite and zircon over a 5-20 hour ablation session (Horstwood et al (submitted)). This has been achieved without using a matrix-matched standard or an empirically derived correction factor for U-Pb fractionation (*c.f.* Horn et al 2000).

Precision of 38-15 Ma (2σ) has been achieved for U-Pb zircon data for crystals with ages of 570-2263 Ma (Horstwood et al., (submitted)). These data were obtained using a static faraday collection procedure on the VG Elemental P54.

We have estimated realistic uncertainties for samples by including information on the reproducibility of a standard of comparable Pb content. In this way, a single data point 'stands alone' as representative of the age of the sample.

Alternatives to the raster approach are to scan the beam back and forth along a line profile to excavate a 'trench' of material or to use a single spot analysis. Whichever protocol is employed, the smaller the area of ablation and the lower the aspect ratio (length/breadth) of the pit, the sooner U-Pb fractionation within the run is induced. The aspect ratio of the ablation pit, and *not* the wavelength of the laser, therefore appears to control the degree of U-Pb fractionation (*c.f.* Horn et al 2000).

For reference to a standard, it is therefore crucial to ablate the 'unknown' sample in the same way as the standard. In this way sensible statistics (particularly MSWD values) can be achieved.

Current technique improvements are focussing on increasing the overall precision by improving instrument sensitivity and adding multiple ion-counting capability. Combined with rapid peak switching using electro-static (flight-tube) scanning on a VG Elemental Axiom PIMMS instrument, these systems will: 1) improve the measurement of ^{204}Pb and ^{207}Pb and hence the internal precision of the analyses; 2) allow accurate common-Pb corrections to be made; 3) increase the overall reproducibility of the standard particularly for low ^{207}Pb/^{206}Pb ratios, and; 4) reduce the amount of ablated material required thereby reducing the U-Pb fractionation within each individual run and improving the U-Pb reproducibility.

Horn I, Rudnick RL & McDonough WF, *Chemical Geology*, **164**, 281-301, (2000).

Horstwood MSA, Parrish RR, Nowell GM & Noble SR, *(**submitted** to Geochim. Cosmochim. Acta)*, (2000).

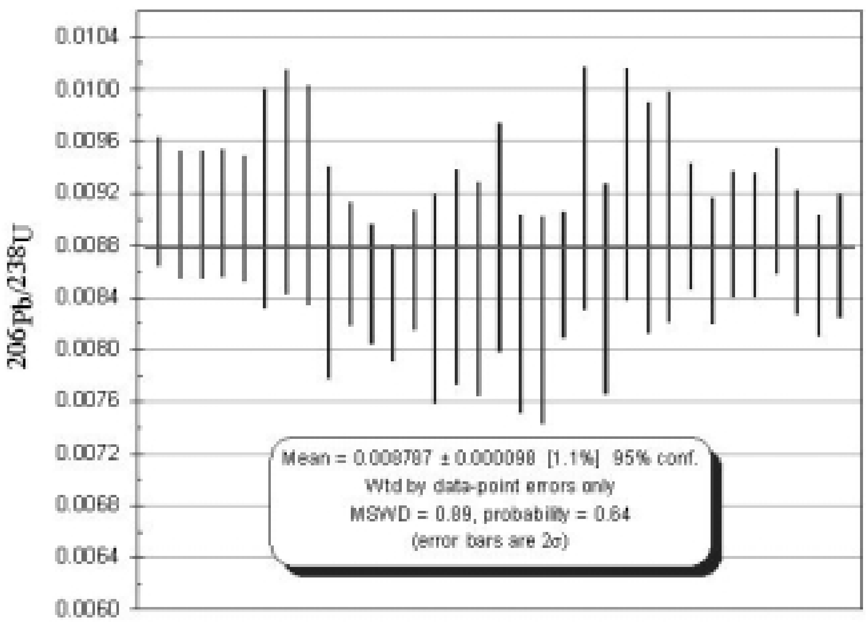

Figure 1 - ^{206}Pb/^{238}U monazite data over 14 hours