Removal of Hg interferences for common Pb correction when dating minerals by LA-ICP-MS/MS

SARAH GILBERT[1] BEN WADE[1] STIJN GLORIE[2] MITCHELL BOCKMANN[2]

[1]Adelaide Microscopy, University of Adelaide, Australia sarah.gilbert@adelaide.edu.au

[2]School of Physical Sciences, University of Adelaide, Australia

LA-ICP-MS is a commonly used technique for U-Pb dating of zircons and other accessory minerals such as apatites, monazite and rutiles. The dating of these minerals is often complicated by the presence of non-radiogenic Pb. This common Pb can be corrected using the non-radiogenic ^{204}Pb iostope, where the isobaric overlap of ^{204}Hg must be corrected via the analysis of ^{202}Hg. However, Hg is a common contaminant in many LA-ICP-MS systems where the measured 204 amu signal is predominently ^{204}Hg. This can limit the aplicability of the ^{204}Pb corrections. The recent development of ICP-MS/MS instruments provides a means of interference free measurement of ^{204}Pb and subsequently more accurate common Pb corrections.

A RESOlution 193nm excimer laser ablation system was coupled with an Agilent 8900 ICP-MS/MS, with NH_3 in the collision/reaction cell. Hg is highly reactive with HN_3 via the charge transfer reaction: $Hg^+ + NH_3 \rightarrow Hg^0 + (NH_3)^+$, whereas Pb does not react [1]. This method removes more than 99.98% of the Hg signal, enabling interference free common Pb correction with the equivalent of 10,000 cps ^{202}Hg as measured by conventional single quadrupole ICP-MS. The sensitivity of all Pb isotopes significantly increased in NH_3 mode which improved the precision for ^{204}Pb, whereas the U sensitivity was reduced due to multiple reaction products (predominently U-NH and U-$NH(NH)_3$). In most minerals where the sensitivity of the Pb isotopes is significantly lower than for U, additional Pb sensitivity at the expense of U is desirable for improved precision.

This method was tested with a range of common Pb bearing apatite and titanite. Correction was achievable using ^{204}Pb at much lower levels than previously possible with a single quadrupole ICP-MS.

[1] Glenn Woods (2014), Agilent Techniologies Application Note 5991-5270EN