



V11D-0120 - U-Pb dating of accessory minerals by LA-ICP-MS/MS



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Moscone South - Poster Hall

Swirl Topics

Data & Rising Technologies - SWIRL

Abstract

Titanite and apatite can incorporate significant amounts of common Pb (^{204}Pb) into their mineral structures, which leads to uncertainty when applying the U-Pb decay series for geochronology. The isobaric interference between ^{204}Pb and ^{204}Hg creates an additional complexity when calculating common lead corrections. Here we investigate the removal of ^{204}Hg interferences during titanite U-Pb dating using reaction cell gas chemistry via triple quadrupole mass spectrometry compared with traditional methods that calculate U-Pb ages using a common lead correction. U-Pb dates for titanite natural reference materials MKED-1 and BLR-1 were determined using an ESI NWR193^{UC} excimer laser coupled with an Agilent 8900 'triple quadrupole' mass spectrometer. The 8900 is equipped with an octopole collision/reaction cell, which enables online interference removal. In order to compare traditional methods for U-Pb dating with interference removal methods, two experiments were run, one in which data was collected in NoGas mode, and one in which the 8900 was run in MS/MS mode, in order to assess the feasibility of determining U/Pb ratios with mass shifted isotopes.

In MS/MS mode, NH_3 was flowed through the reaction cell in order to enable a charge transfer reaction between NH_3 and Hg^+ , effectively neutralizing Hg. During spot analyses in NoGas mode, masses ^{202}Hg , ^{204}Hg , ^{204}Pb , ^{206}Pb , ^{207}Pb , ^{208}Pb , ^{232}Th , ^{235}U , and ^{238}U were monitored. For spot analyses in MS/MS mode, Th and U isotopes were measured on-mass at ^{232}Th , ^{235}U , ^{238}U and mass-shifted to ^{247}Th , ^{250}U , and ^{253}U . Pb isotopes were measured on-mass since Pb does not react with NH_3 . Ratios for $^{207}\text{Pb}/^{235}\text{U}$, $^{206}\text{Pb}/^{238}\text{U}$, and $^{207}\text{Pb}/^{206}\text{Pb}$ were calculated in Lolite (v.3.7.1) using the Geochron4 DRS using MKED-1 as the primary reference material and BLR-1 as a secondary reference material. Dates were calculated using IsoplotR. Weighted mean ages for titanite BLR-1 in MS/MS mode are 1043.8 ± 10.5 Ma (2σ , MSWD=1.08) for U isotopes measured on mass, and 1039.7 ± 8.3 Ma (2σ , MSWD=1.08) for mass-shifted U isotopes. These dates are both in agreement with the TIMS $^{206}\text{Pb}/^{238}\text{U}$ date for the BLR-1 titanite of 1047.1 ± 0.4 Ma. The use of NH_3 for reaction cell chemistry has the potential to enable measurement of ^{204}Pb without needing to correct for Hg interferences.

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