In-situ isobaric interference removal for geochronology applications with LA-ICP-MS using triple quadrupole technology

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Laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) enables the direct determination of various isotope systems in accessory minerals without the need of prior digestion; however, for systems such as Sr-Rb and K-Ca, isobaric overlaps present challenges to accurate ratio determinations.

To be able to resolve isobaric overlaps, high resolution mass spectrometers could be used; however, the K-Ca system requires a minimum mass resolution of 190,300 ($m/\Delta m$) to resolve ^{40}K and ^{40}Ca from both each other and ^{40}Ar. Similarly, to resolve ^{87}Rb from ^{87}Sr, a mass resolution of 300,000 is required.

Traditional analyses use pre-analysis chemical separation using wet chemical methods, but LA-ICP-MS prohibits such interference removal techniques due to it's inherent *in-situ* sampling characteristic, so another interference removal strategy has to be employed.

Collision/Reaction cells (CRCs) have been used in quadrupole mass spectrometers to remove polyatomic interferences by pressurizing the CRC with an inert gas to reject the (larger) polyatomic interferences. CRCs can also be pressurized with reactive gases to allow chemical reactions to occur within the ion beam. In this way, it is possible to use reactive gases, such as oxygen, ammonia and others to specifically react with certain elements to effect chemical separation from isobaric interferences.

Mass shift alone may shift the analyte mass to a region where another isobaric interference exists, for example $^{87}Sr^+$ can be shifted to $^{103}SrO^+$, but ^{103}Rh will now be an interference. For this reason, triple quadrupole (TQ) technology is required to filter out any existing 'mass shift interferences' and provide a clean background for analysis.

In this work, chemical separation of Sr from Rb and Ca from K was effected using SF_6 gas in a TQ-ICP-MS system for the LA-ICP-MS analysis of micas. Accurate age determinations were made possible due to the interference removal power of the TQ-ICP-MS system.