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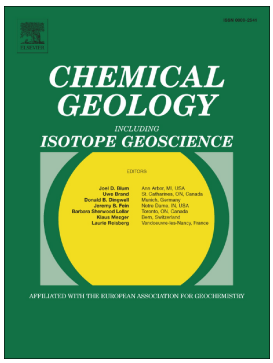

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Leonid A. Neymark, Christopher S. Holm-Denoma, Richard J. Moscati

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In situ LA-ICPMS U–Pb dating of cassiterite without a known-age matrix-matched reference material: Examples from worldwide tin deposits spanning the Proterozoic to the Tertiary

Leonid A. Neymark[1], Christopher S. Holm-Denoma[1], Richard J. Moscati[1]

[1]U.S. Geological Survey, Southwest Isotope Research Laboratory, Denver, CO

Abstract. Cassiterite (SnO_2), a main ore mineral in tin deposits, is suitable for U–Pb isotopic dating because of its relatively high U/Pb ratios and typically low common Pb. We report a LA-ICPMS analytical procedure for U–Pb dating of this mineral with no need for an independently dated matrix-matched cassiterite standard. LA-ICPMS U-Th-Pb data were aquired while using NIST 612 glass as a primary non-matrix-matched standard. Raw data are reduced using a combination of Iolite™ and other off-line data reduction methods. Cassiterite is extremely difficult to digest, so traditional approaches in LA-ICPMS U-Pb geochronology that utilize well-characterized matrix-matched reference materials (e.g., age values determined by ID-TIMS) cannot be easily implemented. We propose a new approach for *in situ* LA-ICPMS dating of cassiterite, which benefits from the unique chemistry of cassiterite with extremely low Th concentrations (Th/U ratio of 10^{-4} or lower) in some cassiterite samples. Accordingly, it is assumed that ^{208}Pb measured in cassiterite is mostly of non-radiogenic origin—it was initially incorporated in cassiterite during mineral formation, and can be used as a proxy for common Pb. Using ^{208}Pb as a common Pb proxy instead of ^{204}Pb is preferred as ^{204}Pb is much less abundant and is also compromised by ^{204}Hg interference during the LA-ICPMS analyses.

Our procedure relies on $^{208}Pb/^{206}Pb$ vs $^{207}Pb/^{206}Pb$ (Pb-Pb) and Tera-Wasserburg $^{207}Pb/^{206}Pb$ vs $^{238}U/^{206}Pb$ (U-Pb) isochron dates that are calculated for a ~1.54 Ga low-Th cassiterite reference material with varying amounts of common Pb that we assume remained a closed U-Pb system. The difference between the NIST 612 glass normalized biased U-Pb date and the Pb-Pb age of the reference material is used to calculate a correction factor (F) for instrumental U-Pb fractionation. The correction factor (F) is