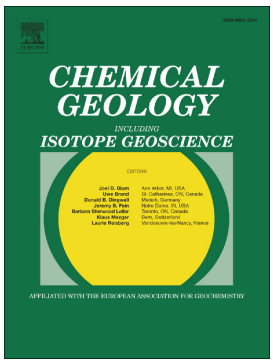

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Isotope-dilution anchoring of zircon reference materials for accurate Ti-in-zircon thermometry

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ABSTRACT

The temperature-dependence of Ti incorporation into zircon can be used to estimate crystallisation conditions and to make inferences about the petrogenesis of host rocks or parental melts. However, the foundation for such temperature estimates – Ti concentration in zircon – is currently determined by a variety of techniques with no common reference. Analyses of Ti in zircon commonly utilise *in situ* microbeam techniques such as secondary ion mass spectrometry (SIMS), laser ablation–inductively coupled plasma mass spectrometry (LA-ICP-MS), and electron probe microanalysis (EPMA). These techniques require external calibrations that are prone to matrix effects, potentially imposing significant errors on Ti concentrations and the derived model temperatures. To improve the accuracy of these determinations, we present a new framework of zircon reference materials for Ti built around two thoroughly characterised zircons, the widely distributed zircon 91500 and the new reference zircon GZ7. Laser ablation ICP-MS and SIMS analyses reveal that the homogeneity with respect to Ti/Si is on the order of 4.1–8.2% (relative standard deviation, RSD) for zircon 91500 and 1.1% for zircon GZ7, which is considered sufficient for their use as primary calibration materials. We present independent determinations of Ti concentration in multiple fragments of these two zircon crystals using isotope dilution (ID)-ICP-MS employing a precisely calibrated ^{47}Ti–^{49}Ti double spike. The recommended ID Ti concentration values are 4.73 ± 0.15 µg g^{-1} for zircon 91500 and 25.08 ± 0.18 µg g^{-1} for zircon GZ7 (95% confidence level). A set of complementary secondary reference