Bracketing the archean: Zircon from the Lacorne Pluton (Abitibi, Québec) to improve LA-ICP-MS geochronology

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U-Pb geochronology applied to zircon mineral is one of the main tool to produce reliable ages of geological systems. Classical thermal ionisation mass spectrometry technique relies on isotope dilution and rigorous chemical procedures to separate, purify and quantify precisely and accurately the contents of Pb and U isotopes in this mineral. This will most probably remain the benchmark to produce high precision and accurate ages.

However, in some geological contexts a quicker procedure is needed to produce high volume of geochronological data that would not be feasible by TIMS (e.g. detrital provenance study, requiring more than 100 zircon grains to be measured from one single sample). Laser ablation ICP-MS is then the technique of choice, with a throughput of several hundred measurements per day achievable. One of the caveat of this technique is a matrix match bias between standard and sample responses, which was shown to be linked to the differential coupling between laser beam and crystal structure; the ablation rate being different from one zircon type to the other (Marillo-Sialer et al. 2014 JAAS, 29, p.981). Focusing of the laser beam, which also has a strong effect on this coupling, can be monitored to minimize its effect, but the crystaline structure cannot be known for all samples (nor changed). When present, such bias (of a few percents) may be magnified if the samples are very different in ages from the calibrator. For exemple, Archean samples standardized using 91500 (1065 Ma) can be shifted by up to 20 Ma, breaking down accuracy, even though internal precision on sample remains an order of magnitude better.

Here we present a new natural zircon of 2680 Ma (TIMS age) from Lacorne, Québec, (post-tectonic calco-alcaline pluton) which seems to behaves very similarly to the 91500 standard in laser ablation ICP. We believe this could fill in the gap of calibrators at the older end of geological ages. Standardizing Lacorne zircon using 91500 gave back its TIMS age. When using Lacorne as the standard, we obtain correct 207/206 ages (within uncertainty) for both 91500 and for several samples of known TIMS ages, indicative of the accuracy of the measurements.