Laser-ablation U-Pb geochronology in common-Pb rich minerals

C. PATON[1]*, B. PAUL[2], J.D. WOODHEAD[2], J.M. HERGT[2] AND M. BIZZARRO[1]

[1]Centre for Star and Planet Formation, University of Copenhagen, Copenhagen DK-1350 Denmark (*correspondence: chadpaton@gmail.com)

[2]School of Earth Sciences, The University of Melbourne, Parkville, Vic 3010, Australia

Laser ablation U-Pb geochronology has become extremely popular in recent years, largely because of a favourable combination of relatively high sample throughput, affordability, and spatial resolution relative to alternative methods such as TIMS and SHRIMP. However, despite a concerted effort by the geochemical community to advance the technique, laser ablation U-Pb geochronology is still largely limited to zircon, because of its extremely low common-Pb content.

A correction for common-Pb using the invariant ^{204}Pb isotope is typically impractical during laser ablation due to a combination of low ^{204}Pb counts and high ^{204}Hg backgrounds. Alternative methods of correction are compromised by the interplay between laser-induced elemental fractionation (LIEF) and within-grain variability in common-Pb content. Thus, although efforts have been made to extend the technique to common-Pb rich phases, these typically try to minimise LIEF, as well as favouring reference materials with homogeneous common-Pb content [1]. We present a new method that expands on the approach of Paton *et al*. (2010) [2] by deconvolving the effects of LIEF and common-Pb in reference materials. This allows for the accurate correction of LIEF using matrix-matched reference materials with variable common-Pb contents.

Unlike all previous methods that consider the composition of the reference material as a single bulk composition, our approach instead employs a compositional trend that defines varying fractions of common-Pb in the mineral (i.e., a straight line on a Tera-Wasserburg plot between the common-Pb composition and the age intercept of the reference material). Modelling and correction of LIEF is then done in 2-dimensional space relative to this line, and not to a single reference value. In this way it is possible to accurately model and correct for LIEF without correcting for common-Pb in the reference material, and to thereby generate accurate ages using analyses with varying common-Pb content.

[1] Chew *et al* (2013), Chem. Geol. **363**, 185–199. [2] Paton *et al* (2010), G-cubed **11**, Q0AA06.