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Effective LA-ICP-MS dating of common-Pb bearing accessory minerals with new data reduction schemes in Iolite

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Compared to non-destructive geochemical analyses, LA-ICP-MS consumes ca. 0.1 μm of material per ablation pulse. It is therefore to be expected that the combined analyses of ca. 200 pulses will encounter geochemical and isotopic complexities in all but the most perfect minerals. Experienced LA-ICP-MS analysts spot down-hole complexities and choose signal integration areas accordingly. In U-Pb geochronology, the task of signal integration choice is complex as the analyst wants to avoid areas of common Pb and Pb-loss and separate true (concordant) age complexity.

Petrus and Kamber (2012) developed VizualAge as a tool for reducing and visualising, in real time, U-Pb geochronology data obtained by LA-ICP-MS as an add-on for the freely available U-Pb geochronology data reduction scheme of Paton et al. (2010) in Iolite. The most important feature of VizualAge is its ability to display a live concordia diagram, allowing users to inspect the data of a signal on a concordia diagram as the integration area it is being adjusted, thus providing immediate visual feedback regarding discordance, uncertainty, and common lead for different regions of the signal. It can also be used to construct histograms and probability distributions, standard and Tera-Wasserburg style concordia diagrams, as well as 3D U-Th-Pb and total U-Pb concordia diagrams.

More recently, Chew et al. (2014) presented a new data reduction scheme (VizualAge_UcomPbine) with much improved common Pb correction functionality. Common Pb is a problem for many U-bearing accessory minerals and an under-appreciated difficulty is the potential presence of (possibly unevenly distributed) common Pb in calibration standards, introducing systematic inaccuracy into entire datasets. One key feature of the new method is that it can correct for variable amounts of common Pb in any U–Pb accessory mineral standard as long as the standard is concordant in the U/Pb (and Th/Pb) systems after common Pb correction. Common Pb correction can be undertaken using either the ^{204}Pb, ^{207}Pb or ^{208}Pb(no Th) methods. After common Pb correction to the user-selected age standard integrations, the scheme fits session-wide model U–Pb fractionation curves to the time-resolved U–Pb standard data. This down hole fractionation model is next applied to the unknowns and sample-standard bracketing (using a user specified interpolation method) is used to calculate final isotopic ratios and ages. ^{204}Pb- and ^{208}Pb(no Th)-corrected concordia diagrams and ^{204}Pb-, ^{207}Pb- and ^{208}Pb(no Th)-corrected age channels can be calculated for user-specified initial Pb ratio(s). All other conventional common Pb correction methods (e.g. intercept or isochron methods on co-genetic analyses) can be performed offline.

Apatite, titanite, rutile and very young zircon data will be presented, obtained using a Thermo Scientific iCAP-Qc (Q–ICP–MS) coupled to a Photon Machines Analyte Excite 193 nm ArF Excimer laser with a novel signal smoothing device

Chew, D.M., Petrus, J.A., and Kamber, B.S. (2014); Chemical Geology, 363, 185-199.

Paton C., Woodhead J.D., Hellstrom J.C., Hergt J.M., Greig A. and Maas R. (2010); Geochemistry Geophysics Geosystems, 11, 1-36.

Petrus, J.A. and Kamber, B.S. (2012): Geostandards and Geoanalytical Research, 36, 247-270.