U/Pb dating of CA and non-CA treated zircons obtained by LA-ICP-MS and TIMS techniques: impact for their geological interpretation

A. VON QUADT[1], D. GALLHOFER[1], M. GUILLONG[1], I. PEYTCHEVA[1,2] AND M. WAELLE[1]

[1]Department of Earth Sciences, Institute of Geochemistry and Petrology, ETH Zurich, Switzerland, e-mail: vonquadt@erdw.ethz.ch

[2]Bulgarian Academy of Science, Geological Institute, Sofia, Bulgaria

The Chemical Abrasion-Isotope Dilution-Thermal Ionization Mass Spectrometry (CA-ID-TIMS) is known as a high precision technique for resolving lead loss and improving the interpretation of U/Pb zircon age data. Here we present the results using a combination of CA with widely applied Laser Ablation – Inductively Coupled Plasma – Mass Spectrometry (LA-ICP-MS) and argue that this combination improves the precision and accuracy of zircon dates, while reducing data scatter, providing meaningful geological interpretations. The samples for dating are magmatic rocks chosen from different time periods (Paleozoic, Mesozoic, Cenozoic). All zircon separates are measured with LA-ICP-MS before and after CA and compared with the CA-ID-TIMS $^{206}Pb/^{238}U$ dates. All CA-treated zircon crystals show up to 50% less data scatter compared to the non-CA treated zircon grains and thus a reduction of the calculated errors is apparent. The obtained mean $^{206}Pb/^{238}U$ ages of the CA-treated zircon grains are up to 6 % higher than those for the non-CA treated crystals, exceeding the usual analytical errors associated with the LA-ICP-MS dating technique of 1-2 % or less. The interpretation of the age data is easier, as U-(and Th)-decay damaged parts with lead loss are removed, so we can exclude younging from the possible geological scenarios. CA-LA-ICP-MS age data are in good agreement with the CA-ID-TIMS dating and suggest the use of the CA-LA-ICP-MS as an independent technique that should be “obligatory” in cases of short-lived systems, in order to define life-times of magmatic systems or ore formation and P-T-t paths.