Simultaneous in-situ U–Pb dating and Hf-isotope ratio determination of zircons with laser ablation ICP-MS

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Laser ablation inductively coupled plasma-mass spectrometry (ICP-MS) has become a common method for U–Pb dating of zircon, especially when large numbers of grains have to be analyzed. The same is valid for laser ablation multi collector ICP-MS Hf isotope determination in zircons. These two measurements are commonly done independently, leading to a potential mismatch of ages and Hf isotope ratios in heterogeneous grains. Recently, some laser ablation ICP-MS laboratories introduced a split stream approach, where the laser ablation aerosol is split into two parts. One part is used for U–Pb dating, commonly on a single collector ICP-MS, the other part is used for Hf isotope determination on a multi-collector ICP-MS. This method allows a simultaneous in-situ determination of both, the U–Pb dating and the Hf isotope determination. This split stream approach has been implemented at Memorial University and the performance of the setting is presented here.

The 91500 zircon is commonly used as primary standard for dating; however, over the past few months, secondary zircon standards (Plesovice, 02123, Temroa-2) were also analyzed. These yielded average $^{206}Pb/^{238}U$ ages of 336.5 ± 0.7 Ma for Plesovice (comparably, data obtained using isotope dilution-thermal ionization mass spectrometry (ID-TIMS) yielded 337.13 ± 0.37 Ma); 291 ± 1 Ma for 02123 (ID-TIMS: 295 ± 1 Ma); and 412.9 ± 2.1 Ma for Temora-2 (ID-TIMS: 416.78 +/- 0.33 Ma). The accuracy of mass interference and mass bias corrections applied to $^{176}Hf/^{177}Hf$ are validated by analyzing synthetic zircons doped with Lu and Yb, along with natural zircon standards. Recent results include $^{176}Hf/^{177}Hf$ = 0.282302 ± 38 for 91500 (solution ICP-MS: 0.282308 ± 6) and $^{176}Hf/^{177}Hf$ = 0.282757 ± 45 for R33 (solution ICP-MS: 0.282764 ± 14).

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