

Baddeleyite SKL01—A New Natural Reference Material for Microbeam U-Pb Geochronology and Hf isotope ratio

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A new natural baddeleyite reference material SKL01 is presented for U-Pb geochronology and Hf isotope ratio by microbeam techniques such as secondary ion mass spectrometry (SIMS) and laser ablation-(multiple collector)-inductively coupled plasma-mass spectrometry (LA-MC-ICP-MS). BSE images illustrate that no zircon overgrowth or other minerals at the edge or inside of grains. Baddeleyite SKL01 is homogeneous with respect to U-Pb age and Hf isotope ratio based on a large number of measurements by LA-ICP-MS (n=254), SIMS (n=30) and LA-MC-ICP-MS (n=210). We further demonstrated that the shallow laser ablation (crater depth: $\sim 2 \mu\text{m}$) can significantly improve the U-Pb accuracy by LA-ICP-MS due to the mitigation of downhole fractionation, which is normally more than four times larger than that of zircon. Isotope dilution thermal ionisation mass spectrometry (ID-TIMS) U-Pb isotopic analyses from two independent laboratories produced a mean $^{206}\text{Pb}/^{238}\text{U}$ age of $532.92 \pm 0.39 \text{ Ma}$ (2s, n = 15). Five aliquots MC-ICP-MS analyses yield a mean $^{176}\text{Hf}/^{177}\text{Hf}$ ratio of 0.282002 ± 0.000015 . Baddeleyite SKL01 contains $536 \pm 172 \mu\text{g g}^{-1} \text{ U}$ with a value of ~ 0.012 for Th/U. These results illustrate that SKL01 is practical as primary or quality control reference materials for LA-ICP-MS and SIMS baddeleyite U-Pb dating.