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Three natural reference materials for in situ andradite U–Pb geochronology

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Grandite garnets are a solid–solution series of andradite and grossular, and occur widely in a variety of alkaline magmatic rocks, carbonatites and skarn deposits typically associated with economic Fe, Cu, W, Sn and Mo mineralization. Andradite–rich garnet, a common mineral in various rocks such as alkaline and skarn rocks, could have high U/Pb ratios and is suitable and preferable for in situ U–Pb dating. Nevertheless, very limitedly available U–Pb andradite reference material hindered its widespread application for microanalysis. In this study, three new natural andradite (MKWB, DGS and Stanley) have been characterized and evaluated as potential reference material for in situ U–Pb geochronology. We performed U–Pb age measurement in four different laboratories using isotope dilution TIMS and laser ablation (SF, Q)–ICP–MS, to check the homogeneity of euhedral andradite crystals. The ID–TIMS results of MKWB, DGS and Stanley andradite are reported for the first time in this study. We presented ID–TIMS $^{206}Pb/^{238}U$ age of 264.9 ± 5.8 Ma (2s, n=6, MSWD=3.4), 139.42 ± 0.36 Ma (2s, n=5, MSWD=1.9) and 23.28 ± 0.38 Ma (2s, n=3, MSWD=1.9) for MKWB, DGS and Stanley, respectively. These three new natural secondary reference materials are to contribute significantly to rapidly developing in situ U–Pb andradite–rich garnet geochronology.