DIRECT U-Pb MEASUREMENTS OF REIDITE FROM ROCHECHOUART IMPACT STRUCTURE

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Introduction: Shocked zircon has the potential to yield much information about impact cratering events, and has been widely studied in both lunar and terrestrial impactites. However, zircon’s high pressure polymorph reidite, which is now considered a diagnostic indicator of shock metamorphism, has not been studied in as much detail as zircon’s typically larger and more commonly found shock microstructures. Understanding the effects of reidite’s formation and existence on the ZrSiO₄ U-Pb system could prove useful for the terrestrial dating effort and potentially yield age information about events experienced on other planetary bodies targeted for sample return if reidite is discovered there in the future. Massive occurrence of reidite in relatively large quantity has recently been discovered by Plan et al. [1] at Rochechouart impact structure (~207-204Ma, target ages ~550-300Ma), allowing for direct U-Pb investigation.

Samples and Methods: Thin sections of the Rochechouart impact structure Chassenon suevitic breccia from Grosse Piece quarry were made and polished for 3 hours each with 60 nm colloidal silica. Large-area wavelength dispersive and energy dispersive spectrometry maps of the thin sections were made on a JEOL JXA-8530F electron microprobe at Arizona State University (ASU) Each high-Zr grain larger than 10 µm was imaged at high magnification with backscattered electrons. Grains suspected of containing reidite were confirmed using Raman spectroscopy and electron backscatter diffraction (EBSD) analysis on a Zeiss Auriga FIB/SEM at ASU. EBSD analysis followed established protocol for shocked zircon (ex:[2]). EBSD data processing was limited to the removal of wild spikes. Four grains containing sections of massive reidite (at least 10µm in size) were cut from thin sections using a wire saw, then mounted together with AS3 age standards in epoxy. The Cameca ims-1290 SIMS instrument at UCLA was used to obtain U-Pb isotopic information by measuring ²³⁵U, ²³⁴U, ²⁰⁶Pb, and ²⁰⁷Pb in eleven spots. To monitor common Pb, ²⁰⁶Pb was measured, and a correction using San Diego sewage common Pb composition was applied. In situ AS3 age standards were analyzed throughout the session, then used to calibrate the dataset.

Results: The locations and phases of all SIMS spots are shown as ellipses in A-C, with the number next to each ellipse referring to the calculated common ²⁰⁶Pb percentage. Shown in D is a Tera-Wasserburg diagram of isotopic results for all spots, and shown in E are the results for the two spots with the highest calculated radiogenic ²⁰⁶Pb, which are the yellow ellipses in A and B. The spots shown in E yield concordant ages.

Discussion: The highest precision ages obtained show no evidence for age resetting of reidite as a result of the Rochechouart impact. The high common Pb in these grains is hypothesized to have been taken in post-impact due to hydrothermal alteration [3]. While reidite as a precise recorder of impact ages would help the terrestrial impact dating effort, reidite as a preserver of target ages may instead assist in the characterization of other rocky bodies from which sample return missions and meteorites will provide samples. With reidite being found at increasingly more terrestrial impact structures, further work on its’ U-Pb systematics is both necessary and possible.

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