Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.36602

Distribution of U, Th and Pb in Ryugu Rocks

DR. KEEWOOK YI[1], YURI AMELIN[2], CHANGKUN PARK[3] AND HWAYOUNG KIM[4]

[1]Korea Basic Science Institute
[2]Guangzhou Institute of Geochemistry, CAS
[3]Korea Polar Research Institute (KOPRI)
[4]Korea Polar Research Institute

Uranium and thorium serve as the radioactive parent isotopes for U–Pb and Th–Pb chronometers, making their distribution within rocks essential for interpreting high-precision ID-TIMS Pb-isotopic ages. Mapping U and Th concentrations also helps identify minerals potentially suitable for in-situ geochronology. In this study, concentrations of U, Th, and Pb, along with Pb-isotope compositions, were measured in Ryugu samples using the KBSI SHRIMP IIe following established analytical protocols[1]. The samples, previously prepared as ~5 mm epoxy mounts containing 2–3 mm fragments, were first characterized using WDS and EDS to obtain elemental distribution maps for mineral identification and contextual interpretation of SIMS data.

For SIMS analysis, mounts were placed in custom brass adaptors compatible with standard 25 mm SHRIMP holders and analyzed without repolishing to avoid sample loss. Small shifts in primary beam position caused significant variations in secondary beam focusing, likely due to mount obliquity and the proximity of analytical spots to the metal frame. This problem is probably caused by mount obliquity and proximity of the sample spots to the metal frame, which can be efficiently avoided in analyses of samples in regular 25mm SIMS mounts. We are currently developing a method of data normalisation that would allow obtaining accurate element concentrations despite these problems.

A total of 40 spots in A0063 and 49 spots in C0046 were analyzed. Preliminary semi-quantitative concentrations averaged 7.3±5.3 ppb Th, 2.5±1.5 ppb U, and 467±241 ppb total Pb (1SD). Dolomite, sulfides, and magnetite showed concentrations similar to or lower than the phyllosilicate-rich matrix, which hosts most of these elements. Apatite grains contained slightly elevated U and Th but are too rare and small to influence bulk distributions.

Isotopic ratios were unaffected by focusing issues. The matrix yielded Th/U = 2.9±1.1 and $^{238}U/^{204}Pb$ = 0.14±0.11. Weighted mean $^{206}Pb/^{204}Pb$ (9.88±0.17) and $^{207}Pb/^{204}Pb$ (10.87±0.19) agree with previous TIMS results and are only slightly more radiogenic than primordial Solar System Pb. One apatite grain showed notably higher U (35 ppb) and $^{206}Pb/^{204}Pb$ (19.5), suggesting that further searches for apatite in other mounts may identify grains suitable for in-situ U–Pb dating.

[1] Yi and Amelin (2024) *JAST 15*