

Strontium and Hydrogen Isotopes of Apatite Inclusion in Archaean Zircon

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Geochemical records of Archaean era are significantly sparse because they were possibly altered by later metamorphic activities. For example, isotopic composition of carbon in graphite included in apatite from the 3.83 Ga Akilia sedimentary rocks suggested that it has a biogenic origin. However SHRIMP U-Pb dating of the apatite showed younger age of 1.5 Ga and indicated a metamorphic event of 600 C, which may have altered the carbon isotopes. Zircon is the best candidate because it is resistant against heat and corrosion and ubiquitous in the Earth's crust. It is also the "perfect" mineral for U-Pb dating because it contains enough amount of U and excludes Pb from the lattice when it formed. We performed U-Pb dating of zircons from Eoarchaeon rocks using NanoSIMS. Then we selected zircons with apatite inclusions and conducted *in situ* isotopic analysis of strontium and hydrogen of the apatite with NanoSIMS.

We collected samples from the tonalitic unit of the Nuvvuagittuq Supracrustal belt in Quebec, Canada. Extracted zircon grains from the tonalite were mounted in epoxy resin disk together with QNG standard and polished until the mid-section was exposed. Both ²³⁸U-²⁰⁶Pb and ²⁰⁷Pb-²⁰⁶Pb dating was conducted by a conventional method using the NanoSIMS. For ⁸⁷Sr/⁸⁶Sr measurements of apatite, we focused the primary beam of 0.5 nA to 5-micron diameter. Observed data were calibrated against our standard. For D/H measurements, Cs⁺ ion was used as a primary beam with intensity of 200pA and a crater size of 1-micron diameter. Primary beam was rastered in a region of 10x10-micron and secondary ions from the inner part of 2.5x2.5-micron were detected. Observed D/H ratios were calibrated against our standard apatite.

Average of U-Pb and Pb-Pb ages of zircon samples are 3537±76 Ma and 3624±7 Ma, respectively, showing slightly discordant signature. For apatite inclusions in zircon, ⁸⁷Sr/⁸⁶Sr ratios vary from 0.7095 to 0.7153. There is a positive correlation between ⁸⁷Rb/⁸⁶Sr and ⁸⁷Sr/⁸⁶Sr ratios, suggesting either an isochron or two component mixing. D/H ratios and water contents of apatite are ranging from -210permil to 65permil and 0.15% to 1.32%, respectively. There is a positive correlation between the ratio and content, suggesting a mixing trend.

Keywords: Archaean, Strontium isotopes, Hydrogen isotopes, U-Pb dating, NanoSIMS