In-situ Uranium-Lead dating of Zagami and RBT 04261 phosphates by NanoSIMS

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Introduction

Zagami is a basaltic shergottite, which fell in Nigeria. There are many reports on radiometric ages of Zagami. The ^{238}U-^{206}Pb age obtained by TIMS was 230±5 Ma [1]. Recent study [2] reported ^{238}U-^{206}Pb age of phosphates 153±81 Ma.

In this study, we conducted ^{238}U-^{206}Pb and ^{207}Pb-^{206}Pb isotopic analysis on apatite [$Ca_5(PO_4)_3Cl_2$] and merrillite [$Ca_9NaMg(PO_4)_7$] grains of Zagami and RBT 04261 using NanoSIMS. We also calculated "U-Pb 3D ages" in order to obtain crystallization ages of the meteorites.

Results and discussion

The 3D ages of Zagami and RBT 04261 were obtained as 245±80 Ma and 248±41 Ma, respectively. The initial lead isotopic ratio of Zagami was calculated as $^{206}Pb/^{204}Pb$=14.5±0.8 and $^{207}Pb/^{204}Pb$=15.5±0.7, and that of RBT 04261 was estimated as $^{206}Pb/^{204}Pb$=10.1±2.2 and $^{207}Pb/^{204}Pb$ =12.7±1.1. Concordant ages were obtained for both shergottites, and those ages are consistent with other isotopic systems [3, 4], therefore U-Pb system of phosphates in our samples was not disturbed by secondary metamorphism or aqueous alteration.

Difference in initial lead ratio among two shergottites may indicate two possibility; (1) each shergottite originated from different magma which have different common lead and crystallized in 250 Ma independently, or (2) two shergotteites originated from same magma, while crustal component with more radiogenic lead was mixed only into Zagami in the shallow part of Mars.

The almost identical ejection age of the two meteorites (approx. 2.9 Ma [3, 5]) may support the latter interpretation.

[1] Chen and Wasserburg (1986) *GCA* **50**, 955. [2] Zhou et al. (2013) *EPSL* **374**, 156. [3] Nyquist et al. (2001) *CEM* **96**, 105-164. [4] Niihara (2011) *JGR* **116**, E12008. [5] Nishiizumi and Caffee (2010) *LPSC* 2276.