URANIUM-LEAD SYSTEMATICS OF LUNAR BASALTIC METEORITE NORTHWEST AFRICA 2977

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Introduction: Northwest Africa 2977 (NWA 2977) is a lunar basaltic meteorite found in 2005 [1], which mainly consists of olivine, pigeonite, augite, and plagioclase with accessory minerals including K-feldspar, chromite, ilmenite, phosphate, baddeleyite, troilite and Fe-Ni metal [2]. From this mineral composition, NWA 2977 is classified as an olivine cumulate gabbro, and its origin is a Mare area of the Moon. As a remarkable texture, there is a shock-induced melt vein structure in the investigated sample. For a better understanding of the thermal history recorded in NWA 2977, we have conducted *in-situ* U-Pb isotopic measurement of phosphate grains using an ion microprobe.

Analytical Methods: Initially, in order to identify the location and mineralogy of the phosphate phases from a polished thin section of NWA 2977, the elemental composition measurement was conducted using SEM-EDS. Then, the isotope analysis was carried out with the NanoSIMS at the Atmosphere and Ocean Research Institute (AORI), The University of Tokyo [3]. The primary ion beam (O^-) of 0.3 nA was focused to sputter an area 4 μm in diameter on the phosphates, and the positive secondary ions, $^{238}UO^+$, $^{238}UO_2^+$, $^{206}Pb^+$, $^{204}Pb^+$ and $^{207}Pb^+$, were collected from 15 phosphates found in the shock melt vein (SMV) and host-rock of NWA 2977. From the empirical relationship of the standard apatite, PRAP [4], the isotope ratios, $^{238}U/^{206}Pb$, $^{207}Pb/^{206}Pb$, $^{204}Pb/^{206}Pb$, were obtained.

Results and Discussion: The data from 15 phosphate grains in NWA 2977 are well expressed by linear regression and are not scattered on the plane in the $^{238}U/^{206}Pb$, $^{207}Pb/^{206}Pb$, $^{204}Pb/^{206}Pb$ three-dimensional space, which means that the disturbance of the U-Pb systems did not occur in this meteorite. The resultant concordia age was 3.13 ± 0.10 Ga, which is consistent with the previous studies obtained from the whole-rocks and minerals (Nd-Sm age of 3.10 ± 0.05 Ga, Rb-Sr age of 3.10 ± 0.05 Ga, and Pb-Pb baddeleyite isochron age of 3.12 ± 0.01 Ga) [5,6]. There is no clear difference in the isotopic compositions between the phosphates found in the SMV and host-rock, while the shape and size of the grains and the Raman spectra show the evidence of intense shock metamorphism. Based on this finding, the cooling rate of phosphate was calculated to be very fast, constrained to be larger than 140 K/s.

The U-Pb systematics of NWA 2977, shows an extremely low μ-value ($^{238}U/^{204}Pb$ ratio) compared with those of Apollo samples ranging from several hundreds to several thousands [7]. The extremely low μ-value and the young crystallization age of 3.10 Ga of NWA 2977 suggest that the origin of magma source of this meteorite might be different from those of the explored region of the Moon surface.

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