YOUNG U-Pb AGE OF BADDELEYITE IN ENRICHED SHERGOTTITE RBT 04261

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Introduction: Crystallization ages of shergottites have come under great debate recently. Bouvier et al. [1] reported a ~4.0 Ga Pb-Pb age of Zagami and argued that the lithosphere of Mars is extremely old. Herd et al. [2, 3] and Misawa and Yamaguchi [4] conducted in situ U-Pb isotopic analyses of baddeleyite and obtained young ages of <200 Ma. Bouvier et al. [5] reported additional Pb-Pb ages of ~4.1 Ga for Shergotty and Los Angeles and suggested that the young ages obtained from baddeleyite were disturbed by shock metamorphism, and that the old ages of ~4.1 Ga represent crystallization of shergottites. The U-Pb systems of baddeleyite could not be easily reset by experimental shock conditions [6-8]. To determine robust crystallization ages of shergotties, we have undertaken U-Pb isotopic analyses of baddeleyites (~10 μm in size) in RBT 04261, enriched lherzolitic shergottite.

Experimental: We used polished sections of RBT 04261 for analyses. Texture was observed using a SEM-CL-EDS (JEOL JSM-5900LV). U-Pb isotopic analyses were performed with SHRIMP II at NIPR [9].

Results and Discussion: RBT 04261 is composed of poikilitic and non-poikilitic areas. Numbers of baddeleyite grains are found in non-poikilitic lithologies. Most baddeleyite grains have unhedral in shape (~10 μm in size) and associated with ilmenite. High-pressure and -temperature polymorph or silica glass was not observed. A few baddeleyite grains showed euhedral in shape and occurred with maskelynite. These occurrences did not result from the decomposition of zircon ($ZrSiO_4$) into baddeleyite and silica glass (ZrO_2+SiO_2). Baddeleyite surrounded by impact melt was rarely observed.

A concordant U-Pb age of 203±30 Ma (2σ errors) was obtained for relatively large baddeleyite grains without shock-melting features. This U-Pb age is consistent with the Rb-Sr and Sm-Nd ages (~170 Ma) reported for the paired shergottite, RBT 04262 [10]. The baddeleyite grain with shock melt experienced minor isotopic disturbance, but the loss of U or gain of Pb has been small. These results indicate that shock metamorphism cannot completely reset the U-Pb systems, and that the young U-Pb age of baddeleyite represents a crystallization age of the enriched shergottite.

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