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OXYGEN ISOTOPES IN MAFIC AND FELDSPATHIC CLASTS FROM POLYMICT UREILITES

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Introduction: Polymict ureilites DaG 165 and DaG 319 contain a wide variety of igneous clasts that might be derived from basaltic complements to the ultramafic monomict ureilites [1–2]. In a previous ion microprobe oxygen isotopic study of clasts from DaG 319, most plagioclase bearing clasts were found to plot along the CCAM-line and thus their origin from the ureilite parent body (UPB) was confirmed [1]. However, because of the small number of samples and limited precision of the analyses (⊗^{17}O ~1‰), oxygen isotopic systematics among these clasts is not well understood. In this study, the new ion microprobe IMS-1280 [3] was used to perform a systematic survey of 28 new clasts (described by [2, 4]) in DaG 165 and 319, including 20 plagioclase bearing clasts similar to those studied by [1]. In addition, two unusual mafic clasts (olivine with chromite exsolution, and Ferich pigeonite containing a melt inclusion) described by [4] and several of the olivine-augite feldspathic clasts described by [2] were studied to clarify their origin.

Ion Microprobe Analyses: The sample was sputtered with focused Cs+ primary ions (2–7 nA, 10–15 ⌠m diameter) and oxygen three isotopes were analyzed by 3 Faraday Cup detectors combining mono and multicollection systems [3]. At least 4–6 repeated analyses were made for each clast in order to obtain <0.3‰ precisions in ™^{18}O, ™^{17}O, and ⊗^{17}O. Olivine, pyroxene, and plagioclase standards with matching chemical compositions were used for correction of instrumental mass fractionation.

Results and Discussion: All but one of the feldspathic clasts plot along the CCAM line in the same region as ferroan monomict ureilites (⊗^{17}O = □0.5 to □1.4‰). One albitic plagioclase fragment plots on the TF line at ™^{18}O ~6‰, similar to enstatite meteorites. The two unusual mafic clasts plot on or slightly above the TF line at ™^{18}O~3‰, indicating a possible link to primitive achondrites or ordinary chondrites. Four olivine-augite bearing feldspathic clasts plot along CCAM, confirming their UPB origin. None of the samples plot in the range of magnesian ureilites (⊗^{17}O~ □2‰ on CCAM), consistent with the previous study [1]. If smelting determined mg#s of monomict ureilites and the UPB had a correlation of ⊗^{17}O with depth [4], our results indicate a bias toward materials from the deeper source regions (in contrast to the interpretation of [4] that the dominant feldspathic clasts were derived from the shallowest depths). This is likely due to mingling of melts during fractional melt extraction [6], a process that was not recognized in the modeling of [4]. Calcic clasts (An >30) show slightly higher ⊗^{17}O than albitic clasts (An <30) by 0.3‰. Low degree melts enriched in alkali and other trace elements generated at depth might migrate into shallower region where isotopic mixing with lower ⊗^{17}O could occur. This is consistent with recent UPB models suggesting that Al-rich melt containing live ^{26}Al concentrated at shallower depths on the UPB [5, 6].

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