Rb-Sr AND Sm-Nd AGES OF ZAGAMI DML AND Sr ISOTOPIC HETEROGENEITY IN ZAGAMI.

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Introduction: Zagami contains lithologic heterogeneity suggesting that it did not form in a homogeneous, thick lava flow [1]. We have previously investigated the Sr and Nd isotopic systematics of Coarse-Grained (CG) and Fine-Grained (FG) lithologies described by [2]. Both appear to belong to Normal Zagami (NZ) [1,3], but their initial Sr-isotopic compositions differ [4,5]. Here we report new analyses of the Dark Mottled Lithology (DML, [3]) that show its age and initial Sr and Nd isotopic compositions to be identical within error limits with those of CG, but Sr initial isotopic compositions differ from those of FG.

Rb-Sr Isochron Results: Eleven new Rb-Sr analyses of DML give an isochron age of 167±18 Ma (2σ) for $\lambda(^{87}Rb)$ = 0.01402 Ga^{-1} [6] and initial $^{87}Sr/^{86}Sr$ = 0.72172±9 (uncertainty refers to last digit). The corresponding Rb-Sr ages for CG (11 analyses) and FG (12 analyses) are 167±12 Ma and 179±18 Ma, resp. The corresponding initial $^{87}Sr/^{86}Sr$ ratios are 0.72170±8 and 0.72221±11, resp. On a (T,I_{Sr})-diagram, DML and CG plot at identical positions, but (T,I_{Sr}) for FG is clearly resolved.

Sm-Nd Isochron Results: New Sm-Nd analyses of 9 samples of DML give an isochron age of 166±29 Ma (2σ) and initial ε_{Nd} = -5.8±0.5. The corresponding Sm-Nd ages for CG (9 analyses) and FG (8 analyses) are 177±18 Ma and 151±34 Ma, resp., and the corresponding initial ε_{Nd} values are = -6.3±0.2 and -6.1±0.3.

Rb, Sr, Nd, Sm, Abundances: Chondrite-normalized Rb, Sr, Nd, and Sm abundances of two analyses of bulk CG and one analysis of FG vary from ~2.5 x CI to ~10 x CI. One FG analysis is enriched in Sr and depleted in Nd and Sm, indicating non-representative plagioclase abundance. DML is 15-30% enriched in Rb relative to Sr and abundance patterns of the other lithologies, suggesting trace element evolution during crystallization.

Possible Interpretations: Two alternatives seem possible:

Magma mixing. McCoy et al. [1] suggested that lithologic heterogeneity could result if pulses of new magma were injected into a partially-crystallized near-surface magma body. Preservation of Sr isotopic heterogeneity would require rapid cooling, probably on the Martian surface, suggesting wallrock assimilation. Also, FG may have inherited more pyroxene cores from an earlier magma chamber than CG [3], but preservation of the Sr-isotope heterogeneity is difficult to envision in this case.

Brecciation? The easiest way to preserve the Sr isotopic difference between FG and CG would be if different lithologies were brought together via brecciation. This possibility should be examined using the largest available samples.

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References: [1] McCoy T. M. et al. 1995. 26th Lunar and Planetary Science Conference. pp. 925-926. [2] McCoy T. M. et al. 1992. *Geochim. Cosmochim. Acta* 56:3571-3582. [3] McCoy T. J. et al. (1999). *Geochim. Cosmochim. Acta* 63: 1249-1262. [4] Nyquist L. E. et al. 1995. 26th Lunar and Planetary Science Conference. pp. 1065-1066. [5] Nyquist L. E. et al. 2006. *Meteoritics & Planetary Science* 41:A135. [6] Begemann F. et al. 2001 *Geochim. Cosmochim. Acta* 65: 111-121.