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THE PARENT MAGMA OF XENOLITHS IN SHERGOTTITE EETA79001: BULK AND TRACE ELEMENT COMPOSITION INFERRED FROM MAGMATIC INCLUSIONS. Allan H. Treiman[1], David J. Lindstrom[2] and Rene R. Martinez[3]. [1]Lunar and Planetary Institute, 3600 Bay Area Blvd. Houston TX 77058 [2]SN4, Johnson Space Center, Houston TX 77058 [3]Lockheed E.S.Co. 2400 NASA Rd. 1, Houston TX 77258.

The SNC meteorites are samples of the Martian crust, so inferences about their origins and parent magmas are of wide planetologic significance. The EETA79001 shergottite (S of SNC), a basalt, contains xenoliths of pyroxene-olivine cumulate rock which are possibly related to the ALHA77005 and LEW88516 SNC lherzolites [1]. Olivines in the xenoliths contain magmatic inclusions, relics of magma trapped within the growing crystals. The magmatic inclusions allow a parent magma composition to be retrieved; it is similar to the composition reconstructed from xenolith pyroxenes by element distribution coefficients. The xenolith parent magma (assuming a single magma) is similar but not identical to parent magmas for the shergottite lherzolites.

Magmatic Inclusions. Magmatic inclusions in xenolithic olivine in the A lithology of EETA79001 were identified optically in thin sections: ...,367; ...,68; and ...,18. The inclusions, up to 150 μm diameter, consist of high-Ca pyroxene, glasses of feldspar and silica composition, and troilite, chromite, and apatite. They are petrographically similar to magmatic inclusions in olivines in other SNCs and other basaltic rocks [2-5]. Some inclusions are adjacent to or include chromite grains 30-50 μm across, which are not interpreted as having crystallized from trapped magma.

Analytical Method. Chemical analyses of the inclusions were obtained by electron microprobe [5]. Rastered area analyses covering each inclusion were averaged; sums are low because of abundant cracks. Olivine adjacent to each inclusion was analyzed. The proportion of olivine in each analyzed area (18-65%) was determined planimetrically from BSE images; and that proportion of olivine was subtracted from rastered area analyses to yield bulk inclusion analyses and their average (e.g., Table 1). A few inclusions with Cr_2O_3>2%, caused by large chromite crystals in and adjacent to the inclusions, were excluded from further interpretation. To reconstruct the parent magma from the average inclusion analyses, we correct for chemical effects after the inclusions were entrapped: crystallization of olivine from the inclusion onto the host olivine, and Fe/Mg/Mn exchange with and through the host olivine [5]. The parent magma composition was reconstructed by simultaneously: adding to the inclusion composition olivine composition that would have been in Fe/Mg equilibrium (Mg*=0.84) with the most magnesian pyroxenes in the xenoliths (Mg*=0.86); and adjusting the Mg/Fe ratio of the inclusion composition, holding molar Mg+Fe constant. These corrections were iterated until the magma composition: had the correct Mg*=0.61 for equilibrium with the xenoliths' most magnesian pyroxenes; and was co-saturated in olivine and low-Ca pyroxene [6]. The correction involved adding 13.1% mass of olivine and adjusting MgO/FeO from 1.1 to 0.51.

Discussion. The reconstructed parent magma for the EETA79001 xenoliths in Table 1 is provisional, as it is derived from an average of only 9 inclusions (more are being analyzed). Standard deviations of the average are high because the mineral grains in the inclusions are not much smaller than the inclusions themselves; thus, placement of individual mineral grains has a strong effect on an inclusion analysis.

Given these uncertainties, the xenolith parent magma estimated here is quite similar to that estimated by [6] for the xenoliths from pyroxene analyses and mineral/melt partition coefficients

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(Table 1). The parent estimated here has higher Mg* than the parent estimated by [6] because we have used a slightly more magnesian pyroxene to fix Mg*. The similarity of these results is gratifying, as they rest on totally independent assumptions and methods [5]. Both estimates of the xenolith parent magma are slightly more siliceous, aluminous, chromian, and magnesian (Mg*) than the host basalt (Eg [6], Table 1). This mix of primitive (high Cr, Mg*) and evolved (high Si, Al) characteristics suggests that the xenolith parent magma is not directly related to the host basalt. The xenoliths are similar in petrography and mineral chemistry to the ALHA77005 and LEW88516 SNC lherzolites, and the xenolith parent magma is in the range of possible parent magmas for the latter ([3] Table 1). However, minor and trace element chemistry and isotopic ratios appear to preclude a comagmatic origin for xenoliths and the SNC lherzolites [7,8].

Trace Element Analyses. Trace element analyses for these inclusions are being measured by micro-INAA [9], following [10] where it was shown that useful trace element data could be derived from magmatic inclusions. Inclusions from ...,367 (including some contained entirely within the section) have been removed from the section by drilling and have been irradiated. Analytical results from these irradiations will be presented at the conference.

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[1] McSween and Jarosewich (1983) *Geochim. Cosmochim. Acta 47*, 1501. Treiman A.H. (1993) Meteoritics 28, 451. [2] Jagoutz E. (1989) *Geochim. Cosmochim. Acta 53*, 2429. [3] Harvey R.P. et al. (1993) *Geochim. Cosmochim. Acta 57*, 4769. [4] Roeder E. (1979) *Bull. Mineral. 102*, 487-510. [5] Treiman A.H. (1993) *Geochim. Cosmochim. Acta 57*, 4753. [6] Longhi and Pan (1989) *Proc. 19th LPSC*, 451. [7] Wadhwa M. et al. (1994) *Geochim. Cosmochim. Acta*, submitted. [8] Wooden et al. (1982) *LPS XIII*, 879. [9] Lindstrom D. (1990) *Nucl. Instr. Meth. Phys. Res. A299*, 548-588. [10] Lindstrom D. et al. (1993) *Meteoritics 28*, 386-387.

Table 1.Magmatic Inclusion Analyses and Estimated Magma Compositions.

	Representative Anal's. Inclusion EETA 79001 ,367i1	Inclusion EETA 79001 ,367i14	Average 9 Inclusions Mean	Std. Dev.	Derived EETA Xenolith Parent Magma	EETA Xenolith Parent Magma Ex [6]	EETA 79001A Host Basalt Eg [6]	LEW 88516 Parent Basalt [3]*
SiO_2	63.61	47.10	56.5	± 2.4	53.3	51.47	50.67	54.5
TiO_2	0.70	0.76	0.69	± 0.09	0.6	0.62	0.86	0.7
Al_2O_3	12.45	9.30	12.0	± 1.0	10.2	12.21	7.10	7.1
Cr_2O_3	0.20	1.52	0.7	± 0.2	0.6	0.50	0.12	--
FeO	1.24	7.48	7.7	± 1.9	12.7	13.77	18.67	14.2
MnO	0.10	0.26	0.25	± 0.03	0.2	0.50	0.52	--
MgO	1.94	7.75	8.4	± 1.8	11.1	10.32	12.22	10.9
CaO	9.21	10.70	10.4	± 1.1	8.9	9.56	8.74	9.5
Na_2O	2.40	1.31	1.9	± 0.3	1.6	0.93	1.07	1.2
K_2O	0.03	0.02	0.13	± 0.04	0.1	0.08	0.07	0.07
P_2O_5	1.95	1.30	1.4	± 0.2	1.2	--	--	--
Total	93.83	87.50	=100.		=100.	99.96	100.04	99.68

* Average of olivine-pigeonite-cosaturated compositions, Table 3 of [3]