

Comparing primitive EETA79001 melts with those from other SNC meteorites. C. Calvin^{1*}, M. Rutherford¹, and N. Sullivan¹, ¹Brown University 324 Brook Street, Box 1846, Providence, RI 02912. *Christina_Calvin@brown.edu.

Introduction: The shergottite meteorites have been subdivided into three groups based on texture and mineralogy [1]. EETA79001 is a shergottite that contains examples of all three lithologies: lherzolitic (lithology X), olivine-phyric (lithology A), and basaltic (lithology B). Therefore, studying the magmas involved in the petrogenesis of EETA79001 may provide information not only on its own petrogenesis but of the petrogenetic links between the shergottites.

This preliminary study involves the rehomogenization of the ground mass and interstitial melts in chips of EETA79001's lithology A in order to constrain the composition of the parental magma. These melt compositions are then compared to melt compositions determined for ALH 77005, a lherzolitic shergottite [2,3].

Experiments: Experiments were performed in argon-pressurized, TZM pressure vessels. Samples were surrounded with graphite, which reacts with ferric iron to fix the oxidation state of the experiment at QFM-2.0. The graphite also prevents sample tube reaction (Fe-loss to Pt tubing). The tubes were pressurized to 800 bars. The temperature of the samples was raised

to 1150, 1155, 1160, and 1165°C. Samples were run for durations ranging from 48 to 72 hours. After a rapid quench, polished sections were made for analysis by electron microprobe.

Results: The fused ground mass and interstitial melt for lithology A of EETA79001 is plotted (Figure 1) along with the liquid line of descent determined for ALH 77005 from rehomogenized, olivine-hosted melt inclusions. For the major elements SiO₂, FeO, and Al₂O₃, the interstitial melt falls near the liquid line of descent defined by ALH 77005 (Figure 1). In addition, K₂O and Na₂O (not pictured) also fell near the liquid line of descent defined by ALH 77005. However, the CaO, P₂O₅, and TiO₂ contents of the ground mass are lower for comparable MgO contents (Figure 1). The chlorine content of the fused ground mass is considerably lower than that of the rehomogenized melt inclusions from ALH 77005 (Figure 2). In addition, the interstitial melt that was homogenized during experiments on ALH 77005 is plotted for comparison. Although more scatter exists in ALH 77005's interstitial melts, EETA79001's ground mass still has significantly lower chlorine content than ALH 77005.

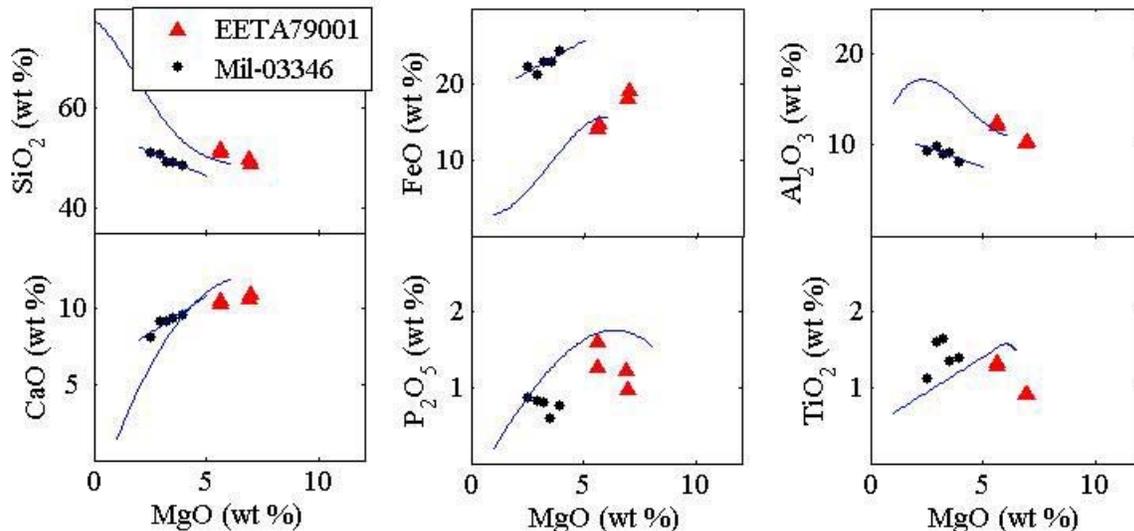


Figure 1. Fused ground mass of EETA's lithology A (red triangles) compared with the liquid line of descent outlined from rehomogenized, olivine-hosted melt inclusions in ALH 77005 and fused ground mass from Nahklite Mil-03346 (black circles).

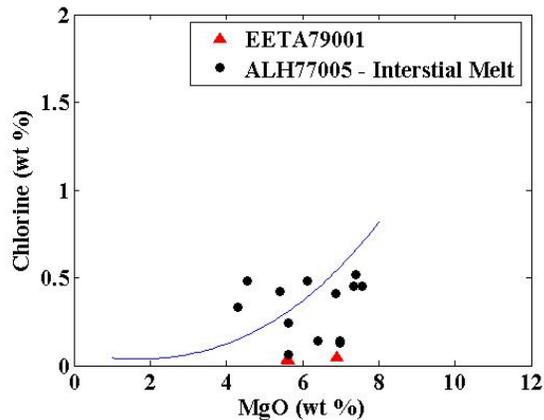


Figure 2: Fused ground mass of EETA79001, compared with fused interstitial melt and the liquid line of descent determined for rehomogenized, olivine-hosted melt inclusions in ALH 77005.

The sulfur concentration of EETA's lithology A fused glass is plotted versus FeO (Figure 3). The sulfur concentration of the rehomogenized melt inclusions and interstitial melts in ALH 77005 is plotted for comparison. The sulfur content of all three glasses increases with increasing FeO.

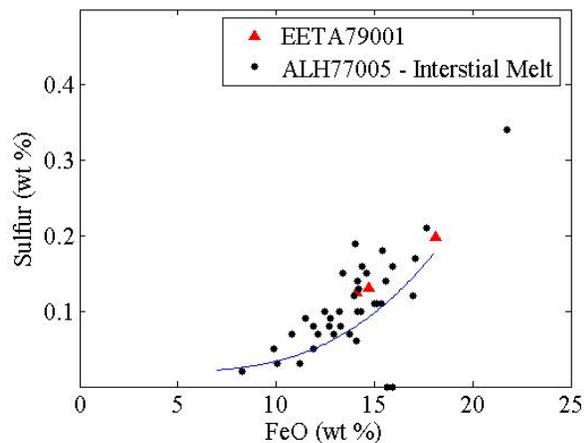


Figure 3. Sulfur vs. FeO for fused ground matrix from lithology A of EETA79001 (red triangles) is plotted with fused interstitial melt (black circles) and rehomogenized, olivine-hosted melt inclusions for ALH 77005.

Discussion: EETA79001 is composed of 3 distinct lithologies. Lithology A, a fine-grained igneous texture with a groundmass composed of pigeonite and plagioclase, contains megacrysts of olivine, low-Ca pyroxene and chromite. These megacrysts (lithology X) are similar to the lherzolithic shergottites. In a previous study, the parental magmas and liquid line of descent have been outlined for ALH

77005 based on experimental data from rehomogenized olivine-hosted melt inclusions [1]. This research suggests that the parental magmas of ALH 77005 olivines and chromites are best represented by a magma with ~6 wt% MgO. We have undertaken similar experiments with lithology A and X of EETA79001, in an effort to compare the parental magmas that formed these lithologies with the magmas that crystallized to form ALH 77005.

Our preliminary results show that the ground mass of EETA79001 falls along the liquid line of descent defined by ALH 77005 for major elements. However, for minor elements such as P_2O_5 , TiO_2 , and to a lesser extent CaO, the ground mass of EETA79001 is depleted relative to ALH 77005. The ALH 77005 experiments were run between 1150 and 1165°C whereas the experiments performed on EETA79001 were only run to 1155°C. In ALH 77005 experiments, Ca-phosphates such as whitlockite and apatite were slow to rehomogenize and completely rehomogenized only at high temperatures. Therefore, it will take more experiments at higher temperatures to determine if the CaO and P_2O_5 are truly depleted in EETA79001 melts relative to ALH 77005, or if this depletion is a kinetic artifact of the experiment.

Chlorine concentration for EETA79001's ground mass is significantly lower than for ALH 77005. There are four possible explanations for this. First, the chlorine could reflect differences in the parental magmas. Second, chlorine can be incorporated into Ca-phosphates as chloroapatite which may not have completely rehomogenized into the melt. Third, chlorine could have been lost from EETA79001 during degassing. Finally, chlorine could have been added to ALH 77005 through secondary processes. This is the least likely of the options as chlorine is not uniform throughout ALH 77005 but is concentrated in later crystallizing phases.

The sulfur concentration of EETA79001's fused ground mass and of ALH 77005's fused ground mass and rehomogenized melt inclusions increase with increasing Fe. They are at or near the sulfur saturation for magmas with their respective Fe contents [4]. This suggests that either the magmas were sulfur saturated at the time of crystallization or, more likely, they have had sulfur added to them through secondary processes.

References: [1] Goodrich, C. A. (2003) *GCA*, 67, 3735–3771. [2] Calvin, C. and Rutherford, M. (2005) *LPSC XXXVI*, Abstract #1895. [3] Calvin, C. and Rutherford, M. (2004) *LPSC XXXV*, Abstract #1371. [4] Mathez, E (1976) *JGR*, 81, 4269–4276.