USING PETROLOGY AND MINERALOGY TO UNDERSTAND THE SURFACE OF VESTA: A COLLECTION OF FINE-GRAINED EUCRITES.

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Introduction: Recent work has suggested that fine-grained eucrites could be key to understanding the petrogenesis of Vesta [1]. These eucrites represent original surface or near-surface material that may give us information about Vesta's geologic past. It is unlikely that such units will be visible with the Dawn spacecraft, however, because of the brecciation on the surface of Vesta.

Previous studies, such as [1,2,3] indicate that individual fine-grained eucrites are not common; however, howardites are the most abundant member of the HED family and can contain unique eucrite clasts not found in eucrite-only samples. Therefore, the textural variety of eucrite clast types within howardites is far greater.

By studying these fine-grained eucrite clasts, we can better understand the different units found on the surface of Vesta, and what processes might have produced them.

Methodology: In this study, we have examined all howardites in the National Meteorite Collection at the Smithsonian for the presence of fine-grained eucrite clasts. These clasts were mapped using the FEI NovaSEM 600 scanning electron microscope in the Mineral Sciences Department at the Smithsonian. The resulting x-ray maps and BSE images have been used to analyze minerals present, modal abundances, and textures. The mineral chemistries of pyroxene and plagioclase within each of the clasts have been analyzed using the JEOL 9800R/5 electron microprobe, also at the Smithsonian. So far eight fine-grained eucrite clasts have been identified in five howardites.

Results and Discussion: After obtaining SEM and microprobe data we determined that there is a variety of textural and compositional features within the fine-grained eucrite clasts. Texurally, we found several clasts that exhibited ophitic textures and granular pyroxene and plagioclase. Some clasts were found to have a quenched, glassy texture and others contained skeletal grains. Compositionally, the fine-grained eucrites encompass both equilibrated and unequilibrated pyroxene compositions suggesting that they experienced a range of metamorphic conditions. Minor elements in pyroxene suggest that they formed from both early primitive and late stage, more evolved melts. There are also a large range of plagioclase compositions such as slilica-enriched plagioclase composition glass to crystalline plagioclase with a compositional range of An_{62-95}. Most samples have unequilibrated plagioclase of $An_{\sim 10}$.

SEM and electron microprobe data show a large variety of textures and compositions within the dataset. Such diversity has given us insight into the diverse geologic setting in which these eucrites were formed on Vesta.

References: [1] Mayne, R.G, Sunshine, J.M, McSween, H.Y, McCoy, T.J, Corrigan, C.M, & Gale, A. (2010). Meteoritics & Planetary Science, In press. [2] Stolper E. (1977) Geochimica Cosmochimica Acta, 41, 587-611. [3] Russell, C.T. et al. (2004) Planetary and Space Science, 52, 465-489.