UNDERSTANDING AND IDENTIFYING SPACE WEATHERING PRODUCTS IN REGOLITH BRECCIAS. S. K. Noble[1], L. P. Keller[2] and C.M. Pieters[1], Brown University, Providence RI 02912, [2]JSC SR Houston TX 77058. noble@porter.geo.brown.edu

Introduction: Remote-sensing data provide several lines of evidence that asteroids are affected by space weathering. Spectra from Galileo [1] and NEAR [2], and telescopic evidence from near Earth asteroids [3] indicate that the optical properties of ordinary chondrite (OC) material can be altered to resemble S-type asteroids. Recent work has demonstrated that the spectral properties of S-type asteroids directly mimic the effects predicted for small amounts of nanophase iron ($npFe^0$) on surfaces of OC regolith particles [4,5,6]. We have begun an electron microscope study of lunar and meteorite breccias to determine if $npFe^0$-rich weathered rims (similar to those observed in lunar samples) form in asteroid regoliths as well.

Unlike the Moon, we have no direct samples of asteroidal regolith to study, we do however, have a number of regolith breccia meteorites, rocks composed of lithified asteroid regolith, that may contain direct evidence of space weathering.

Lunar Regolith Breccias: Recent SEM and TEM studies of lunar regolith breccias indicate that the lithification process does not significantly alter the $npFe^0$-rich rims produced in lunar soil (fig. 1) [7]. Therefore, if such weathering products are produced in asteroid regolith, they should be preserved in regolith breccia meteorites.

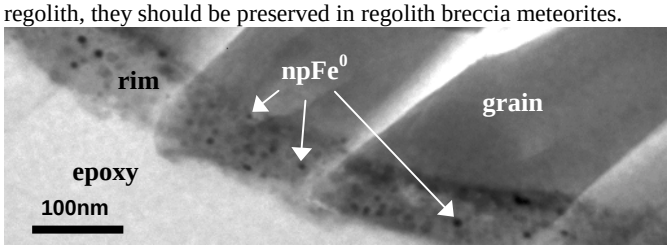

Figure 1. TEM image of weathered rim on grain of lunar breccia 10068.

Meteorite Regolith Breccias: Initial results are presented for two regolith breccias: Fayetteville (H4) and Kapoeta (How). These breccias are both rich in noble gases and have high particle track densities. These and other indicators suggest that they are composed of regolith which was exposed at the surface.

Fayetteville: The Fayetteville sample has been investigated via both SEM and electron microprobe. Some preliminary TEM analysis has begun as well. Like most regolith breccias, Fayetteville is composed of light and dark regions. The dark regions, where the noble gasses are concentrated, contain numerous µm-scale Fe-metal and FeS particles, consistent with earlier findings [8]. TEM analysis reveals that within these dark areas are many small regions of melt glass which contain abundant nm-scale Fe-metal and FeS particles. The glassy material is largely located along cracks and between grain boundaries and therefore is likely to be formed in the breccia as a result of friction melting [9], rather than by sputtering and/or micrometeorite impact-induced vaporization/melting in the regolith. Weathered rims are difficult to distinguish, but we will continue to look for evidence of space weathering in this meteorite.

Kapoeta: As a howardite, Kapoeta represents a distinct type of regolith breccia and similar analyses are being initiated.

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