Nagihara [2], M.B. Milam and Yosio Nakamura [3] (Goddard Space Flight Center, Greenbelt, MD 20771, patrick.taylor@nasa.gov, [2] Texas Tech, Lubbock, TX and [3] Univ of Texas, Austin, TX)

Introduction: A study of future lunar seismology and heat flow is being carried out as part of the NASA Lunar Sortie Science Program [1].This study will include new lunar drilling techniques,using a regolith simulant, for emplacement of instruments. Previous lunar simulants, such as JSC-1 and MLS-1, were not available when the study began, so a local simulant source was required. Diabase from a quarry at Leesburg, Virginia, was obtained from the Luck Stone Corporation. We report here initial results of a petrographic examination of this rock, GSC-1 henceforth.

Geologic Setting: The Luck Stone quarry is in a Jurassic diabase sill in the Culpeper basin, a Triassic half-graben similar to others in the eastern U.S., and bounded on the west by a normal fault separating the basin from the Proterozoic core of the Blue Ridge anticlinorium. The sill has been deformed by transverse folding and has been cut by several faults, which have been intruded by quartz veins and bordered by kaolinization zones in the diabase.

Petrographic Characteristics: Diabase for simulant preparation was selected from fresh, unaltered exposures. Thin sections show GSC-1 to be a holocrystalline diabase with ophitic texture. Estimated modal compositions are: plagioclase (An50), 45%; clinopyroxene (augite), 45%; opaques (probably magnetite, 5%; quartz, 3%; biotite, 2%. Pyroxenes commonly show diallage structure, parallel layers of orthopyroxene and clinopyroxene.

Comparison with Lunar Basalts: The bulk mineralogy and texture of GSC-1 are similar to that of most mare basalts. GSC-1 plagioclase and pyroxene are notably sharp and unaltered. These characteristics in lunar basalts result from the complete lack of water in lunar mare magmas. The GSC-1 diabase exposures have fault-controlled zones of serpentinitzation and kaolinization, and the magma as a whole clearly had a normal water content. However, diabase selected in this study had only a small amount of biotite, and no amphibole or other OH-bearing minerals. The pervasive diallage of GSC-1 clinopyroxenes resembles that found in many lunar basalts starting with those from the Apollo 11 mission. Diallage is well-proven to result from subsolidus exsolution [2], and the GSC-1 diallage is understandable as demonstrating the slow post-intrusion cooling of the Leesburg sill. In summary, GSC-1 resembles most mare basalts in texture, bulk mineralogy, lack of hydrated minerals, and in pyroxene structure. Planned experiments will concentrate on fine-grained crushed diabase, so the absence of unique lunar basalt regolith features such as agglutinates is not considered critical. This work was done under NASA 06-LSSO-0011.

References: [1] Taylor, P.T., et al.(2006) – Seismology and heat flow instrument package for lunar science and hazards, Lunar Sortie Science Proposal. [2] Papike, J.J., et al.,(1998), Planetary Materials, Ch. 5.

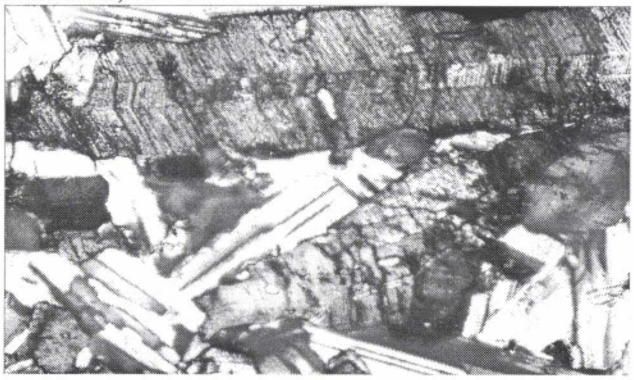


Figure 1. Photomicrograph of thin section of GSC-1 cross polarized light.

Figure 2. Lunar thin section 40X, cross polarized light (Apollo 17)-from Dr. Kurt Hollecher (Union College).

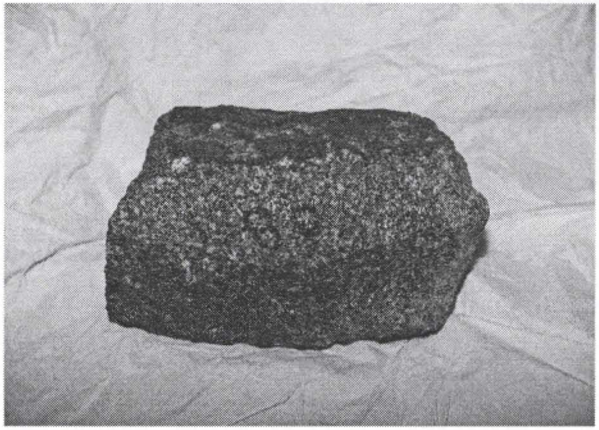
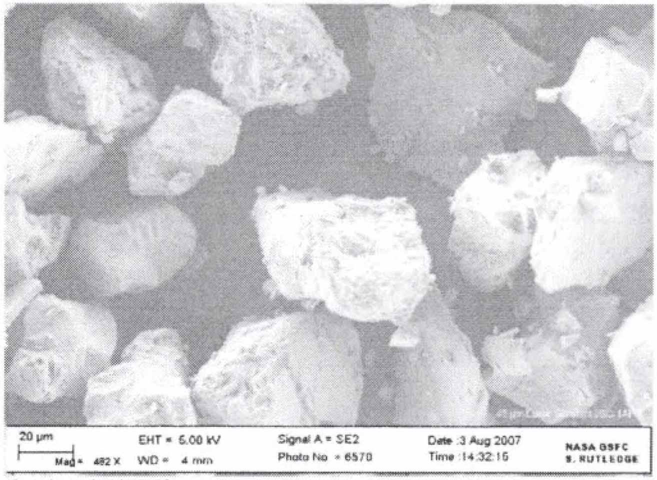


Figure 3. Hand sample of GSC-1, length 10cm



45 um lunar sim pic 1.JPG

Figure 5. SEM image of JSC-1, scale bar 20 um

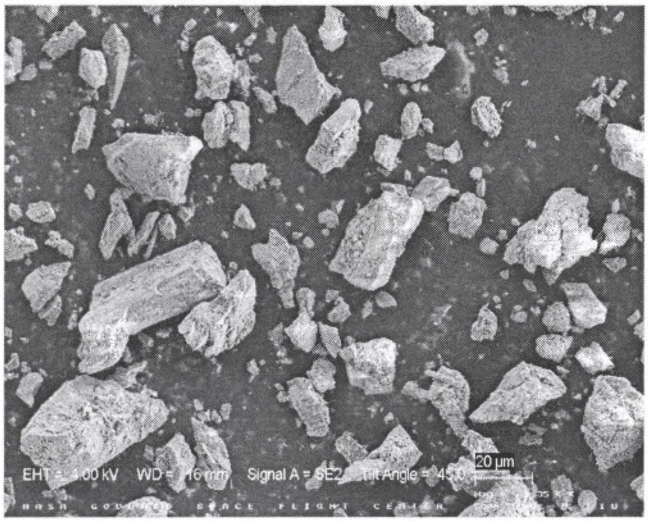


Figure 4. SEM image of GSC-1, scale bar 20 um