BENEFICATION OF TERRISTRIAL RESOURCES FOR THE PRODUCTION OF LUNAR SIMULANT SEPARATES. J. N. Graham, R. S. Lambson, S. M. Nordwick, E. J. Dahlgren, and C. A. Young, Montana Tech of The University of Montana, 1300 West Park Street, Butte, MT 59701, CYoung@mtech.edu.

Introduction: Lunar regolith contains over 95% silicates composed of high calcium plagioclases, orthopyroxenes, clinopyroxenes and olivines. In order to develop and test processes and equipment for lunar space missions, it is necessary to have actual lunar regolith or a simulated lunar regolith with properties as close to actual regolith as possible. This study was conducted to develop and characterize a process for producing a simulated lunar regolith using terrestrial resources. Mineral separation techniques including magnetic, electrostatic and flotation were examined as possible methods for concentrating minerals for producing simulated lunar regolith from igneous minerals collected from the Stillwater Mineral Complex. Tailings from the mining operation and rocks collected from a norite outcrop adjacent to a road above the Stillwater Mining Companies' Nye portal were the two primary sources of materials used in this study. Mineral samples obtained from the separation experiments were analyzed utilizing x-ray diffraction, x-ray fluorescence, scanning electron microscopy, energy dispersive x-ray spectroscopy, and utilizing a mineral liberation analyzer.

Separation Techniques: Several magnetic separation methods were examined for separating the diamagnetic, paramagnetic, and ferromagnetic components of the feed materials. The type of magnetic separation method was chosen based on the particle size of the feed materials, magnetic susceptibility and whether the feed material was dry or slurried. The equipment utilized to separate dry feed materials included a hand magnet, multiple element dry drum separator and rare earth magnetic belt separator. For processing slurried feed materials, an electromagnetic drum separator and a wet high intensity magnetic separator were used.

In addition to magnetic separations, electrostatic and flotation separation techniques were examined for effecting separations based on the electrostatic affinity of the feed material grains and the hydrophobic characteristics of the feed material.

Results: Plagioclase and pyroxene concentrates were produced utilizing both dry and slurry-based magnetic separation methods. Interlocking of pyroxene and plagioclase mineralization on a single particle was identified in the concentrates produced utilizing dry separation methods. An example of a particle containing both plagioclase and pyroxene mineralization is shown in Figure 1. The particle was classified as a paramagnetic material by the magnetic separator and was part of the pyroxene concentrate.

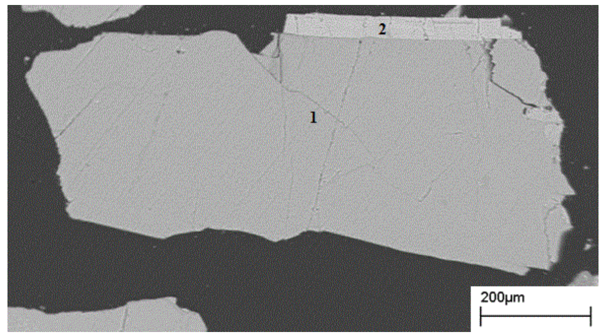

Figure 1. Scanning electron microscope image of a particle containing a paramagnetic and diamagnetic component. Region 1 is composed of plagioclase and Region 2 is composed of a pyroxene.

Grinding to finer particles sizes was explored as a method for further liberating the two types of mineralization. However, it was found dry magnetic separations were not effective when particle sizes were less than 150 µm due adherence of the particles to the separation equipment and the formation of dust. As a result, further separations were performed using separation techniques that could handle slurries.

Magnetic separations and flotation separation experiments were conducted utilizing slurries prepared from the norite rocks and slurry obtained from the Stillwater Mining Company. Initial flotation separations indicated hydrated silicate minerals such as talc could be removed from the plagioclase concentrate. Successful flotation of hydrated silicate minerals is of interest in order to produce simulated lunar regoliths from mixed origin feedstocks that are not carefully screened prior to processing such as tailings from the Stillwater Mining Company.

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