MIINERAL LIBERATION ANALYSIS OF STILLWATER NORITE FEEDSTOCK PILES. Courtney A. Young[1], Jackie N. Graham[1] and Paul J. Miranda[2]. [1]Metallurgical and Materials Engineering, Montana Tech of The University of Montana, Butte, Montana 59701, cyoung@mtech.edu (Dept Head and Prater Prof) and jngraham@mtech.edu (Student). [2]The Center for Advance Mineral and Metallurgical Processing, Butte, Montana 59701, pmiranda@mtech.edu (Process Engineer).

Introduction: The Center for Advanced Mineral and Metallurgical Processing (CAMP) has received a software add on to our current scanning electron microscope (SEM) located at Montana Tech. The Mineral Liberation Analyzer (MLA) technology was developed by Dr. Ying Gu of the JKTech Center of the University of Queensland. Since August 2006, CAMP has received and processed over 2,000 samples. The samples of interest were received from the Stillwater Mining Company norite feed stockpile. The samples are mainly silicates which could potentially represent and simulate lunar regolith for further technological experimental studies. During analysis of these received samples, the technology allows the samples to be identified and quantified mineralogically.

The MLA technology utilizes back scatter scanning electron microscopic techniques along with energy dispersive x-ray analysis (EDX). Secondly, the MLA uses brightness and contrast controls on the SEM. When properly used, elements located on the periodic table will have a defined brightness number. According to theory, lower atomic number elements such as carbon, oxygen, and silicon, as well as others, will tend to be less bright when compared to heavier atomic number elements, such as copper, gold, lead, and zinc. These elements tend to be brighter when these techniques are used. This technology allows the user to do a variety of mineral scans. These scans include an overall mineralogical search to determine and quantify silicate containing minerals and other potential phases.

Another advantage of the MLA technology is the ability to quantify the minerals within the samples. During analysis, the software takes into account particle size. The software then analyzes and records the particles within the sample, usually between 10,000 and 20,000 particles depending on initial mesh size. At the same time, an EDX pattern is collected and saved for future elemental quantitative analysis. After collection of the received sample, the minerals are micro-probed using the scanning electron microscope and analytical standard measurements are taken for mineral verification.

Samples are finally quantified mineralogically using the MLA software. This standard practice is done repeatedly until the overall unknown content is less 0.1%.

For the MLA data collection and analysis, backscatter images are initially collected. The magnification of the samples is dependant on the overall particle size. As particle size decreases, magnification increases. The MLA is set up to view approximately 200 to 300 particles per frame for analysis. Secondly, the software technology allows the operator to keep edge containing particles or discard them. In this case, since overall quantification was important, edge particles were utilized

After the initial backscatter image is collected, the background, carbon coating set at 8 to 12 on the gray scale, is removed by adjusting the gray scale above the carbon background at 20. From gray scale data, each particle is x-rayed and data stored. If the particle grayscale differs by one unit which includes inclusions, multiple minerals within a particle, or encapsulation of particles within larger particles, multiple x-rays are taken and stored. Finally, a false color image is captured for future mineral identification via x-ray analysis.

After the false color images are collected, minerals are identified by using x-ray analysis. The x-rays are identified until the percent unknown is less than 0.1%. Multiple minerals are identified and quantified. Final results are shown in figure 1.

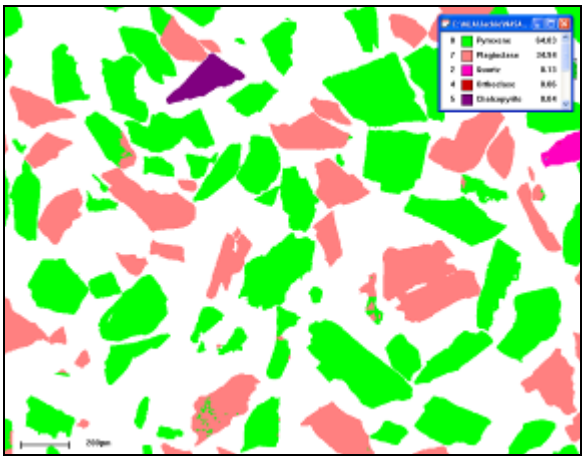

Figure 1. Overall Mineral Liberation Results.