Characterization of clay and associated minerals at the Northstar mine, Main Tintic district, Juab County, Utah*

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Northstar Clay Mines LLC currently operates the Northstar Mine, located near Mammoth, Utah in the Main Tintic District of Juab County. The mine supplies a local cement plant with clay and iron-oxide, however the company is interested in marketing the specialty clay, halloysite. The clay deposits from this district have previously been documented to contain halloysite and kaolinite, however little is known about their purity and associated minerals. This study uses crystal imaging and X-ray diffraction to determine abundance and mineralogy of clays and other minerals in the Northstar clay deposit.

Samples pertaining to the Northstar clay deposit were collected from pits, adits, and the surface along a cross-section that reflects a horizontal and vertical extent of the deposit. The Cameca SX-100 microprobe and scanning electron microscope (SEM) produced high-resolution secondary electron images from chip-samples of the clays. Random powder mounts of the clays were made by wet-crushing with acetone. The Panalytical X’pert Pro X-Ray Diffraction (XRD) unit analyzed the random powder mounts to determine mineral identification. Samples provided a distribution of halloysite and kaolinite, with some mixing of illite. Much of the clay deposit is dominated by iron (Fe)- and manganese (Mn)-enrichment, respectively through goethite and lithiophorite. Aluminum (Al)-enrichment occurs selectively as gibbsite and alunite.

The pure white halloysite clay can be confirmed by SEM imaging and XRD peak identification. SEM imaging also displays halloysite in the Fe- and Mn-enriched samples, however the XRD Fe-background is too high to display clay peaks for identification. Future work will include back-scattered electron imaging and spectroscopy chemical mapping with the SEM. Additionally, the Fe-enriched clay samples will be further processed to reduce iron so that clay identification can be possible through X-ray diffraction.