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**TITLE:** Characterizing the Phyllosilicates and Amorphous Phases Found by MSL Using Laboratory XRD and EGA Measurements of Natural and Synthetic Materials (*Invited*)

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**ABSTRACT BODY:** The Curiosity Rover landed on the Peace Vallis alluvial fan in Gale crater on August 5, 2012. A primary mission science objective is to search for past habitable environments, and, in particular, to assess the role of past water. Identifying the minerals and mineraloids that result from aqueous alteration at Gale crater is essential for understanding past aqueous processes at the MSL landing site and hence for interpreting the site's potential habitability. X-ray diffraction (XRD) data from the CheMin instrument and evolved gas analyses (EGA) from the SAM instrument have helped the MSL science team identify phases that resulted from aqueous processes: phyllosilicates and amorphous phases were measured in two drill samples (John Klein and Cumberland) obtained from the Sheepbed Member, Yellowknife Bay Fm., which is believed to represent a fluvial-lacustrine environment. A third set of analyses was obtained from scoop samples from the Rocknest sand shadow. Chemical data from the APXS instrument have helped constrain the chemical compositions of these secondary phases and suggest that the phyllosilicate component is Mg-enriched and the amorphous component is Fe-enriched, relatively Si-poor, and S- and H-bearing. To refine the phyllosilicate and amorphous components in the samples measured by MSL, we measured XRD and EGA data for a variety of relevant natural terrestrial phyllosilicates and synthetic mineraloids in laboratory testbeds of the CheMin and SAM instruments. Specifically, Mg-saturated smectites and vermiculites were measured with XRD at low relative humidity to understand the behavior of the 001 reflections under Mars-like conditions. Our laboratory XRD measurements suggest that interlayer cation composition affects the hydration state of swelling clays at low RH and, thus, the 001 peak positions. XRD patterns of synthetic amorphous materials, including allophane, ferrihydrite, and hisingerite were used in full-pattern fitting (FULLPAT) models to help determine the types and abundances of amorphous phases in the martian rocks and sand shadow. These models suggest that the rocks and sand shadow are composed of ~30% amorphous phases. Sulfate-adsorbed allophane and ferrihydrite were measured by EGA to further understand the speciation of the sulfur present in the amorphous component. These data indicate that sulfate adsorbed onto the surfaces of amorphous phases could explain a portion of the SO<sub>2</sub> evolution in the Rocknest SAM data. The additional constraints placed on the mineralogy and chemistry of the aqueous alteration

phases through our laboratory measurements can help us better understand the nature of the fluids that affected the different samples and devise a history of aqueous alteration for the Sheepbed Member of the Yellowknife Bay Fm. at Gale crater.

**KEYWORDS:** 5410 PLANETARY SCIENCES: SOLID SURFACE PLANETS Composition, 1039 GEOCHEMISTRY Alteration and weathering processes, 3617 MINERALOGY AND PETROLOGY Alteration and weathering processes, 5494 PLANETARY SCIENCES: SOLID SURFACE PLANETS Instruments and techniques.

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### **Additional Details**

**Previously Presented Material:** ~20% of this material was presented at the Fall AGU Meeting in 2012 (i.e., the XRD and EGA of ion-adsorbed allophane and ferrihydrite), but we have expanded upon these experiments and will also present XRD and EGA data of clay minerals and synthetic hisingerite.

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