**Introduction**

The CheMin instrument on NASA's Curiosity rover has detected the presence of jarosite at several locations. The occurrence of jarosite provides an opportunity to place constraints on the chemical environment at the time the minerals precipitated, which, in turn, can provide insight into fluid-rock interactions during diagenesis of the sediments that compose the lower slopes of Mount Sharp. In addition, jarosite and other members of the alunite group can have considerable compositional variability, including Al-for-Fe and Na- or H₂O-for-K substitutions which, if quantified, would provide additional insight into the processes involved in these sediment's formation. Accordingly, our study investigated how XRD patterns and spectral features change in response to these variations, and our results allow preliminary constraints to be placed on the chemical composition of the jarosite at Mount Sharp.

**Synthesis Experiments**

- **Temperature:** 155 ± 5 °C
- **Pressure:** ambient
- **Media:** H₂O or 0.1 M H₂SO₄
- **Substrates:** Al-Fe-and-NaSO₄ and KCl mixtures
- **Products:** rinsed with ethanol and dried at room temp.

**General formula for alunite-jarosite group:**

\[(Na,K,H₃O)(Al,Fe)₃(SO₄)₂(OH)₆\]  

**Fe # = [Fe/(Fe+Al)] x 100**

**Conclusions**

The noticeable shifts in XRD patterns and spectral features with varying composition suggest that using these indicators to infer chemical composition is feasible. With that said, our results indicate that the jarosite on the lower slopes of Mount Sharp has significant Al for Fe substitution and is dominated by K as opposed to Na or H₂O. Moreover, using our inferred composition and an estimated 3.1 wt% jarosite in the Mojave sample [2], we estimate that the jarosite can account for ~30 wt% K₂O, approximately half of the total amount of K₂O measured in the sample (0.72 wt%) [3]. Also, in many terrestrial settings, jarosite forms by oxidative weathering of Fe-sulfide minerals, and sulfides have been identified in small amounts in other samples within Gale crater [4]. However, it is not clear that this process could account for the inferred presence of substantial Al in the jarosite observed in the Murray formation samples, and may instead point to formation of the jarosite by interaction of acidic, sulfate-rich fluids with K-, Fe-, and Al-bearing silicate minerals.

**References:**