Low Temperature Anhydrite Formation in Flowing Systems: Implications for Near Surface Diagenesis on Mars

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ABSTRACT

Ca-sulfate minerals anhydrite and gypsum have been historically used to interpret temperature and salinity conditions experienced during diagenesis, as anhydrite commonly forms at temperatures > 50° C in high salinity waters, while gypsum commonly forms in closed systems at lower temperatures. However, previous experiments comparing jarosite dissolution in semi-open and closed system experiments with high salinity CaCl2 brine observed anhydrite forming at <25° C in semi-open flow-through experiments [Dixon et al., 2015], while gypsum formed in batch reactors with otherwise identical conditions. While previous studies have interpreted anhydrite veins at Gale Crater, Mars as forming at depth indicating significant burial had occurred prior to diagenesis, our experimental results Our work seeks to link Ca-sulfate phase nucleation to specific hydrodynamic conditions via XRD, Raman spectroscopy, VNIR, and TEM work demonstrate that anhydrite may also form at lower temperatures if there is significant groundwater flow. Linking Ca-sulfate phase nucleation to specific hydrodynamic conditions gives us information about the open or closed nature of the aqueous system in which the observed Ca-sulfate minerals may have formed. Our work seeks to link Ca-sulfate phase nucleation to specific hydrodynamic conditions and mineralogical substrates.