

Bassanite could instead have formed via dehydration from gypsum under a warmer paleoclimate (Vaniman et al., 2009). Other alternatives proposed by Vaniman et al. (2008) include bassanite formation under hydrothermal conditions, via burial diagenesis of gypsum, or from acid-sulfate alteration of preexisting calcium carbonates. The range of hydration states observed across the planet may therefore reflect differences in precursor mineralogy and/or conditions of sulfate formation or diagenetic history. For example, Ca-sulfates were likely buried to hundreds of meters depth at Meridiani Planum (Hynek et al., 2002) and Mawrth Vallis (Loizeau et al., 2007, 2010; Noe Dobrea et al., 2010), which may not have occurred in Columbus crater or the polar sand sea. *In situ* study of the minerals accompanying bassanite at Mawrth Vallis would help to distinguish between the diagenetic, hydrothermal, and acid alteration hypotheses for its origin. Once formed, bassanite may persist longer at the surface of Mars than it does on Earth because of the colder, more arid martian conditions (Vaniman et al., 2009).

Together with the jarosite identified by Farrand et al. (2009), our detection of bassanite adds to the already considerable mineralogic diversity of the Mawrth Vallis region (Loizeau et al., 2007; Wray et al., 2008; Bishop et al., 2008; McKeown et al., 2009; Noe Dobrea et al., 2010). Mawrth Vallis is one of the final candidate landing sites for the Mars Science Laboratory mission, for which it has been argued that an ideal site would provide access to both phyllosilicates and sulfates (Grotzinger, 2009). Relative to the currently favored landing ellipse, Farrand et al.'s (2009) jarosite lies ~95 km from its northwest edge, whereas our site 3 discussed above is ~30 km to the northeast (Fig. 1). Additional CRISM coverage of the channel floor should be acquired to search for other sulfate exposures even nearer the ellipse. If the way is trafficable, driving eastward and down into Mawrth Vallis would also enable a direct test of whether some or all of the region's phyllosilicates and layered deposits predate the outflow channel (Poulet et al., 2005; Loizeau et al., 2007, 2010; Michalski and Noe Dobrea, 2007) or constitute a younger drape deposit (Howard and Moore, 2007; Wray et al., 2008), with significant implications for when and how these deposits formed. Mawrth Vallis remains an intriguing and geologically diverse region for future surface exploration.

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