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Compositional Models of Hematite-Rich Spherules (Blueberries) at Meridiani Planum, Mars and Constraints on Their Formation A. SCHNEIDER, Ohio Wesleyan University, D MITTLEFEHLDT, NASA Johnson Space Center — The Mars Exploration Rover Opportunity discovered hematite-rich spherules ("blueberries") believed to be diagenetic concretions formed in the bedrock in stagnant or slow-moving groundwater. These spherules likely precipitated from solution, but their origins are poorly understood. Three formation mechanisms are possible: inclusive, replacive and displacive. The first would result in a distinct spherule composition compared to the other two. We propose that chemical clues may help to constrain the nature of blueberry formation. We used Alpha Particle X-ray Spectrometer data for undisturbed soils that were blueberry-free and with visible blueberries at the surface in Microscopic Imager images. We made plots of the elements versus iron for the spherule-rich soils and compared them to a mixing line representative of a pure hematite end member spherule (called "the zero model"). This modeled the replacive formation mechanism, in which pure hematite would replace all of the original material. If the spherules grew inclusively, chemical data should reflect a compositional component of the rock grains included during formation. Four models were developed to test for possible compositions of a rock component. These models could not easily explain the APXS data and thus demonstrate that the most plausible rock compositions are not components of blueberries.

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