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HEMATITE & SULFATE MINERALS IN LAVA TUBES: POTENTIAL MARS ANALOGUES

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Lava tubes occur on Mars and Earth, and are good candidates for preservation of biosignatures and mineralization. Secondary mineral assemblages seen on Mars also occur in basaltic lava tubes on Earth. The Holocene basalt flows of Craters of the Moon National Monument and Preserve (CRMO) have Fe₂O₃ contents (~18%) that closely resemble Martian basaltic compositions. Studying the silica, sulfate, and hematite alteration and precipitation products present in lava tubes in these flows can provide context for sedimentary processes and minerals formed through alteration of basalt and precipitation of leached ions.

Mineral samples were collected from lava tubes and included floor mounds, ceiling and wall coatings (specifically white and orange encrustations, and alteration surfaces with metallic luster), the basaltic substrate beneath each deposit, and unaltered basalt. These samples were analyzed using X-Ray Diffraction and X-Ray Fluorescence to determine mineralogy and geochemistry. The white and orange ceiling coatings are mostly calcite, while the main constituents of the metallic coatings are hematite and silica. The floor mounds are composed of sulfate, carbonate, and bicarbonate minerals including thenardite, burkeite, mirabilite, and trona. The calcite coatings are precipitates, products of groundwater interaction with basalt. Olivine is abundant in the unaltered basalt but absent in the metallic luster alteration surface, where it has been replaced by hematite and silica. This process likely occurred under hydrothermal conditions as the lava tube cooled. The mounds are probably biological in origin, created by microbial processes. These results help refine the complex sedimentary processes that occur in lava tubes during and after cooling.

The hematite occurrence is similar to assemblages seen at Meridiani Planum, interpreted as products of low T hydrothermal alteration or ambient groundwater interaction. Sulfate minerals differ from those on Mars because they are Na-rich, which may be caused by differing conditions and higher Na in CRMO basalts.

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Session No. 93

[Filling the Hole: Sedimentary Geology and Paleontology of Caves and Karst](#)

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