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Lacustrine Mineral Deposits and their Geologic Context at Bradbury Crater on Mars

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The 60-km Bradbury Crater (85.8˚E; 2.7˚N) is located at the Libya Montes region at the southern rim of the Isidis impact basin on Mars. This area is predominantly characterized by Noachian-aged highland massifs that were heavily modified by fluvial, lacustrine, aeolian, volcanic, and impact processes occurring in multiple recurring events. Bradbury Crater stands out for its abundance of fluvial and lacustrine landforms, which reflect a varied history of aqueous-related geological processes. A 2.8 by 5 km-sized fan-shaped deposit has been interpreted to have played a significant role in the hydrologic evolution of landforms at Bradbury Crater. This deposit is partly composed of Al-rich phyllosilicates, indicating aqueous alteration processes. The current work is directed towards shedding light on the origin and timing of these aqueous alteration processes. HRSC digital terrain models give conclusive insight into the stratigraphic relationships of those sediments to each other. Geological analyses have been performed on the basis of HRSC, CTX and HiRISE image data in combination with HRSC and HiRISE digital elevation models. Mineral detection has been performed by spectral analyses of targeted CRISM images.

Fe/Mg-smectites are detected along the walls of the ancient Libya Montes bedrocks and could be a result of Isidis impact-related hydrothermal alteration. Carbonates intermixed with Fe/Mg-smectites occur at the base of the bedrock unit. Carbonate formation may have been driven by the interaction of hydrous CO_2rich fluids with olivine at the paleolake site. An Al-smectite, consistent with beidellite, is exposed within several layers of the deltaic deposit. Because beidellite forms at elevated temperatures, its presence might either result from alteration in a warm paleolake at this site or it could be an allochtonous sediment deposited here subsequently. Since the strongest beidellite signatures are detected within the foreset and the bottomset layer of the delta, *in situ* alteration in a warm standing body of water is likely, but not certain. Alternatively they might be remnants of former Fe-rich highland clays, which were leached into Al-smectites, transported and deposited here.

Fe/Mg-smectites present in the ancient bedrock are exposed at higher elevations but are stratigraphically lower and older than the lower lying Al-smectites. In either alteration scenario for the Al-smectites, allochtonous or *in situ*, they are significantly younger than the Fe-clays, a stratigraphic situation often observed on Mars.