SEDIMENTS INTERBEDDED WITH COLUMBIA RIVER BASALTS: A MARS ANALOG FOR WEATHERING, MASS WASTING, AND PRESERVATION OF BIOMOLECULES. K. F. Sprenke[1], L.L. Baker[1,2], J.R. Clevy[1], and W.C. Rember[1], [1]Dept. of Geological Sciences, University of Idaho, Moscow, ID 83844-3022, ksprenke@uidaho.edu, [2]Division of Soil and Land Resources, University of Idaho, Moscow, ID 83844-2339, lbaker@uidaho.edu.

Introduction: Geomorphological evidence suggests that in the ancient past, the planet Mars had (a) extensive surface volcanic activity, (b) an active surface hydrologic cycle with running water, and (c) active aqueous weathering and sedimentary processes. Thus, it is to be expected that volcanic eruption products such as layered basalt flows will be interbedded with sediments and weathering products indicative of interaction with surface water. Layered phyllosilicate deposits have been observed which are capped by basalt flows [1-5]. Surface water and near-surface sedimentary environments may have presented potentially habitable zones on ancient Mars. Ancient sedimentary units and surface weathering horizons, including those now buried under younger lava flows or sediment cover, could potentially preserve geochemical and mineralogical indicators of ancient Martian conditions as well as ancient biomarkers.

Latah Formation sediments: The distal margins of the Columbia River flood basalts (CRB) provide a terrestrial analog for this type of environment. The CRB flows in this area were emplaced between 18 and 12 m.y. before present [6]. Episodes of volcanic activity were punctuated by intervals of quiescence, during which sediments were deposited and soils formed on exposed basalt surfaces. In north Idaho, these materials are members of the Latah formation, and include fluvial and lacustrine sediments between and atop the basalt flows, as well as paleosols developed on basalt. These sedimentary interbeds are composed of a mixture of materials transported from surrounding highlands, airfall tephra from regional explosive volcanic activity, and of authigenic clay minerals formed from basalt.

Physical and hydrologic importance of the Latah Formation: Sediments of the Latah Formation are rich in clay minerals including kaolinite, halloysite, nontronite, and montmorillonite. This clay-rich mineralogy means the interbeds are important to groundwater hydrology, frequently functioning as aquitards in the CRB aquifer system. Sedimentary interbeds on Mars would also be expected to affect groundwater transport and storage.

As very weak, clay-rich layers sandwiched between massive basalt, Latah Formation interbeds also control topographic expression wherever they intersect the land surface. They have been documented to control landslide activity on hillslopes in north Idaho. Similarly, it has been suggested that failure of weak layers between basalts controls landslides on Mars [7]. We propose the Latah Formation's control of landslide activity in the Clearwater Basin is a direct analog for this process.

Biomarker preservation in the Latah Formation: In northeastern Idaho and western Washington, basalt flows of the CRB embayed older highlands and impounded the streams which drained them. Lakes rapidly formed behind the basalt dams in preexisting valleys. These lakes swiftly filled with sediment, resulting in exquisite preservation of buried organic debris such as plant material. Many of these lake sediments yield fossils of exceptional quality in which not only structures but original biomolecules, such as pigments and genetic material, are preserved [8-9].

Although no lake sediments have been identified as associated with branching valley networks, basalt flows embaying valley networks have been mapped [10], suggesting the possibility that sediment-filled basins of basalt-dammed lakes may be present on Mars. Such deposits on Mars, if identified, would present excellent candidate sites for biomarker preservation [11]. Rapid burial of organic material in basalt-dammed lakes would protect biological material from degradation by exposure to solar radiation and oxidizing surface sediments and should moderate the effects of wet-dry and freeze-thaw cycles caused by changing surface conditions. Thus, rapidly deposited lake sediments would make potentially promising exploration sites for preserved biomarkers from the ancient Martian past.

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