SHORELINES IN THE WESTERN UNITED STATES AS ANALOGS FOR HYPOTHESIZED SHORELINE FEATURES ON MARS. J. R. Zimbelman[1], S. H. Williams[2], R. P. Irwin[1], E. J. Rivera[3], L. Graves[4] and G. Ghatan[1], [1]Center for Earth and Planetary Studies, National Air & Space Museum, Smithsonian Institution, Washington, D.C. 20013-7012, zimbelmanj@si.edu, [2]Education Division, National Air & Space Museum, Smithsonian Institution, Washington, D.C. 20013-7012, [3]Earth Science Education, University of Delaware, Newark, DE 19717, [4]Thomas Jefferson High School for Science and Technology, Arlington, VA 22312.

Introduction: Shoreline features have been interpreted to be present around former standing bodies of water on Mars, inferred from both imaging [1] and topographic [2, 3] data analysis. However, the hypothesized shoreline landforms remain rather controversial in interpretation, and they have proved difficult to identify at MOC resolution [4]. As part of a project funded by the Mars Fundamental Research Program, we are collecting detailed topographic data and associated field observations for well-preserved shorelines around glacial paleolakes from several locations in the western United States. These data will subsequently be used to help in evaluating some of the proposed shoreline features on Mars. Here we focus on newly acquired topographic data and on candidate sites for future topographic measurements.

Background: Considerable literature exists both supporting and contesting the pluvial interpretation of features in the northern lowlands of Mars; see [1-4, and references therein] for detailed information. Precision topography holds good potential for documenting distinctive attributes of well-preserved shorelines on Earth, as illustrated in a preliminary study from Lake Winnemucca, Nevada [5]. We are now collecting Differential Global Positioning System (DGPS) surveys across a suite of shorelines from glacial-age lakes in enclosed basins in Nevada, Oregon, and eastern California. The DGPS data have a horizontal precision of ~2 cm and a vertical precision of ~4 cm [6]; these data have proved very useful in documenting distinctive topographic attributes of landforms such as lava flows [6, 7]. These new data can later be used to compare to MOLA data across hypothesized Martian shorelines.

Spring Valley, Nevada: The northern end of Spring Valley, near the eastern border of Nevada and NE of the town of Ely, has a remarkable array of shoreline features clearly visible from space (Fig. 1). In April of 2004 we obtained a DGPS surveys across several of the uppermost shorelines in Spring Valley Fig. 2). Precision topography across these shorelines reveals distinctive shapes for the shoreline ridges, as well as the presence of numerous small playa-like flat areas upslope of the larger ridges. These playa-like features should be observable wherever overland flow brings silt and clay into standing bodies of water ponded on the up-slope side of shoreline ridges. Similar flat areas potentially might be associated with shoreline ridges on Mars if sufficient overland flow occurred after emplacement of the shorelines [8].

Figure 1. Portion of Landsat TM image of the north end of Spring Valley, Nevada. North at top; scene is ~15.3 km wide. Shorelines show up as grey arcs. Diagonal black line indicates location of survey line shown in Fig. 2.

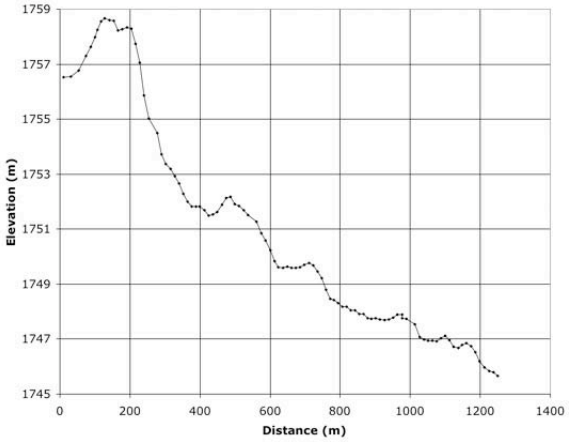

Figure 2. DGPS transect across the northern-most shorelines in Spring Valley, Nevada; north is to the left. Precision of each point is ~2 cm horizontal and ~4 cm vertical [6]. Vertical exaggeration, 78X.

Additional sites for DGPS surveys: During our April 2004 fieldwork, we also acquired DGPS

surveys of wave-cut benches around Black Rock Desert north of Gerlach, Nevada. The erosional benches are distinctly different in origin from the depositional environment represented by shoreline ridges, and they will not be considered further here. Following our Spring Valley work, we also made a brief visit to Long Valley, Nevada, northwest of Ely, where beautiful shoreline ridges are preserved on the southern end of the valley [9]. Subsequent analysis and interpretation of aerial photographs of Long Valley resulted in a map (see Fig. 3) that will provide

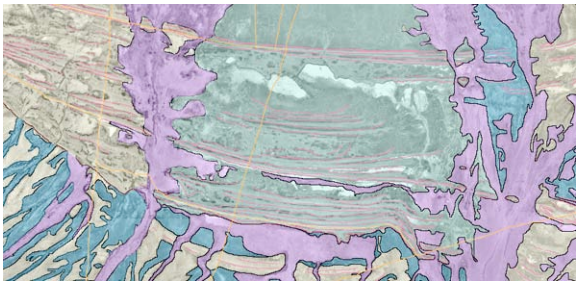

Figure 3. Portion of photo-interpretation map of well-preserved shoreline ridges along the southern margin of Long Valley, Nevada. North at top; scene is ~5.6 km wide.

an excellent basis for planning our next DGPS survey effort, tentatively planned for May of 2005 (along with additional surveys in Spring Valley). We have mapped the shoreline features visible in aerial photomosaics of Lower Alkali Lake, on the border between northern California and northern Nevada, and the southwestern margin of Summer Lake in south-central Oregon, where brief visits during 2004 revealed the presence of numerous shoreline ridges and wave-cut benches. These two additional locations will hopefully be sites for future DGPS survey work.

Re-examination of Martian shorelines: We have just started a systematic comparison of some hypothesized shoreline locations in and around the Chryse basin using data from MOLA, MOC, and THEMIS, along with other Martian databases, all within a GIS configuration. To date, we have not been successful in uniquely identifying shoreline features in the new imaging data, nor do we detect consistent variations in physical properties across the elevations identified for possible past ocean levels. We are hopeful that the new DGPS data will provide additional topographic signatures (like the flat playas up-slope of large ridges when overland flow occurs) that we can use for testing against candidate shoreline features on Mars using MOLA data.

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