GEOLOGIC MAPPING INVESTIGATON OF THE ARGYRE AND SURROUNDING REGIONS OF MARS. J.M. Dohm[1] and J.S. Kargel[1], [1] Department of Hydrology and Water Resources, University of Arizona, Tucson, AZ (dohm@hwr.arizona.edu, kargel@hwr.arizona.edu).

Introduction: Argyre is the best preserved of the large multi-ringed impact basins on Mars, comparable to the Orientale Basin of the Moon when viewed at resolutions less than a kilometer per pixel. However, even at Viking Orbiter image resolutions the basin has been distinctly modified by erosional and depositional processes. The Argyre impact was one of several large impact events (including Hellas and Isidis) that occurred relatively early in the geologic history of Mars; based on a new global crater data base [1,2], [3] indicates that the Argyre impact event took place 3.93±0.02 Ga based on fitting the Hartmann isochrons [4] or 3.94±0.03 Ga based on fitting Neukum isochrons [5]. Though it is difficult to establish whether Argyre formed prior to or concurrent with the incipient development of Tharsis, the multi-ringed impact structure appears to have influenced the geophysical and geological development of a large part of Mars, including the southeast part of the Thaumasia plateau (i.e., impact-induced basement structures partly controlled plateau development [6]) and the Uzboi drainage system and other systems of surface and subsurface movement of liquid water and water-ice [7,8].

A post-Viking-era geologic mapping investigation of the Argyre impact basin and surroundings at 1:5,000,000 scale is ongoing to address important questions concerning the impact event and its subsequent influence on the geology and hydrology of the region (**Fig. 1**). Questions include: What was the extent of flooding and glaciation in and surrounding the ancient impact basin [7,8]? Was the basin occupied by a large lake, and did this hypothesized lake source the Uzboi Vallis drainage system during the Noachian Period, as hypothesized during Viking-era investigation [9]? What was the extent of Argyre-related tectonism and its influence on the surrounding regions [e.g., 6,10]? How did the narrow lowland ridges in the southeastern part of the basin form [e.g., 11]?

Mapping highlights: The initial stage of the Argyre mapping investigation includes compiling the stratigraphic relations among rock materials and tectonic and erosional structures (**Fig. 2**). This information has been incorporated into the global geologic mapping effort of Mars led by Ken Tanaka [12]. In addition, detailed mapping has revealed Argyre-induced basins, which appear to have been occupied by lakes, and glacially, periglacially, and fluvially etched landscapes [13] (**Figs. 3-4**). Major stratigraphic sequences indicate resurfacing during the Late Noachian-Amazonian, possibly related in part to Tharsis growth.

Map completion: Completion of the geologic map of the Argyre region of Mars will include finalizing the stratigraphic map, compiling crater statistics, and completing structural mapping, which will include Argyre- and Tharsis-related faults, channels and valley networks, many of which are controlled by the growth of Tharsis and landscape deformation through the Argyre impact event, wrinkle ridges, and a diverse assemblage of glacial and peri-glacial features. This investigation will also include spectroscopic/stratigraphic investigation, which includes construction of cross sections [e.g., 14], and GIS-based statistical analysis of the rock stratigraphic units and structures.

A new regional geologic map of the Argyre region of Mars will result in spatial and temporal information from which we can (1) better assess whether the Argyre basin contained lakes [9], (2) draw insights

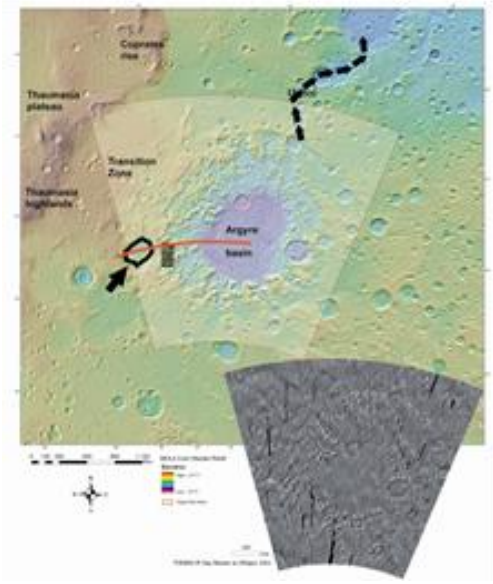

Fig. 1. *MOLA color shaded relief map centered on the Argyre region (transparent outline). The image on the bottom right shows a 256 pixels/degree THEMIS IR day mosaic. The regional 1:5,000,000-scale mapping investigation includes the Argyre floor and rim, transition zone, and the southeast margin of the Thaumasia plateau. Also shown is a possible paleolake basin (wide arrow) located on the western margin of the Argyre impact basin and the Uzboi drainage system (narrow arrows) and possible spillway separating AWMP from the Argyre basin at a present-day topographic interval nearing 1.5km (dashed line).*

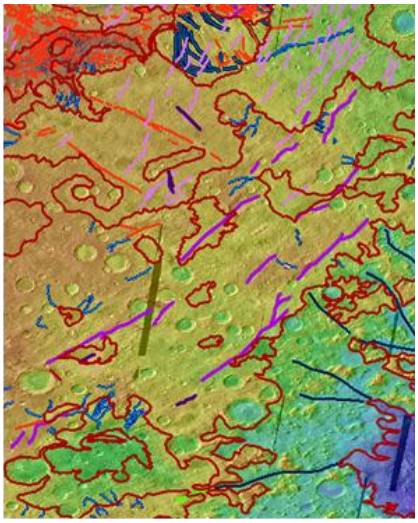

Fig. 2. *The northwest part of the Argyre map region exemplifying mapped graben (red lines); large faults (hundreds of kilometers in length), several of which are related to the Argyre impact event (violet lines); erosional landforms such as valleys, many of which are influenced by the Argyre impact event (light and dark blue lines); wrinkle ridges (pink lines), and geologic contacts (red lines). North is at top and the scene is approximately 1,250 kilometers across.*

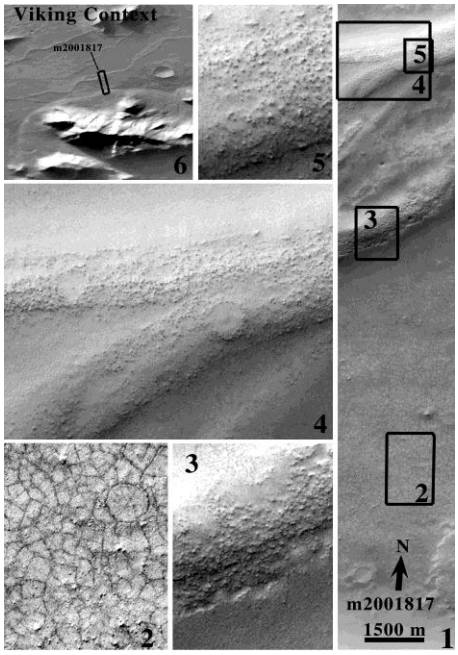

Fig. 3. *Martian sinuous ridges (glacial eskers?) and polygon-cracked smooth plain (glaciolacustrine?) in the southeast part of the Argyre basin. Other interpretations of these features are possible and have been proposed [see 11 and references therein]. Reproduced from [8].*

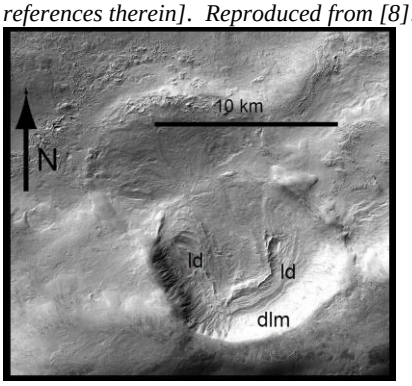

Fig. 4. *CTX image showing differentially-eroded layered deposits (ld) within a basin in contact with slope-forming dissected and lobate materials (including debris aprons) (dlm). Both point to water enrichment and aqueous actvity among other possible activities such as wind erosion.*

into and maybe confirm or refute whether flooding and glaciation contributed significantly to the geologic and paleohydrologic records of the Argyre region [e.g., 7-8]; (3) elucidate the extent of Argyre-related tectonism [6,15]; (4) establish a spatial and temporal geologic context for local to regional geologic, geophysical, geochemical, hydrologic, and climatic studies; and (5) contribute to the next cycle of landing site evaluation and selection for purposes of identifying optimum life habitats and potentially discovering life and its environmental conditions.

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