Completion and Submission of the Terra Sirenum Map Project Robert. C. Anderson[a], James M. Dohm[b], S. Robbins[c], and J. Schroeder[a], [a]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109, [b]The Museum, The University of Tokyo, Hongo 7-3-1, Bunkyo-ku, Tokyo 113-0033, Japan, [c]Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, Colorado USA.

Introduction: The Terra Sirenum region, which is located to the southwest of Tharsis, records not only the development of the Tharsis magmatic complex, at least since the Middle Noachian [1-3] up to present-day, but just as importantly, contains some of the oldest stratigraphic units of the western hemisphere region of Mars. Detailed examination of the structures and units within this region provided an excellent window into identifying the tectonic processes that influenced the ancient (pre-Tharsis) phase of the geologic evolution of Mars. Here, we present an overview from our mapping effort detailing the status of our mapping project.

Mapping Status: We have completed a detailed 1:5,000,000-scale geologic map of the Terra Sirenum region (referred to hereafter as the Memnonia-Sirenum region), which includes mapping stratigraphic units and identifying tectonic, erosional, depositional, and impact structures (**see Figure below**). We followed the procedure for mapping surface units defined by [4] and [5]. Stratigraphic units were differentiated based on both stratigraphic (crosscutting, overlap, and embayment) and contact relations and morphologic characteristics. High resolution MOC, NA, CTX, HiRise, and HRSC data were utilized to compile the geologic map information.

Crater statistics have been completed for our map units of the Terra Sirenum region using a new global impact crater database [6-7]. In addition, all impact craters with diameters ≥ 3 km were manually examined to identify only those superposed on the most recent resurfaced terrains (those impact craters that display pristine rims and ejecta blankets and well-defined, bowl-shaped basins with little to no infill that have no visible evidence of volcanic, fluvial, and tectonic resurfacing). The superposed impact craters were verified through ConTeXt camera images where there was coverage [8].

Hypothesized Geologic History of the Memnonia-Sirenum Region: Dynamic geologic activity identified within this region includes the formation of large (hundreds to over a thousand kilometers long) north trending, structurally controlled basins and ranges; the basin and ranges are similar to those of the Basin & Range, southwest United States [9, 10]. In the case of the Earth, both magmatic upwelling and plate tectonism are hypothesized to have contributed to the Basin & Range.

The basins and ranges of the Memnonia-Sirenum region are interpreted to have formed pre-Tharsis and/or early Tharsis magmatic upwelling [9, 10]; pre-Tharsis activity would have occurred during an early phase of Martian evolution when the dynamo and associated magnetosphere were still in operation, based on stratigraphy, cross-cutting relations, crater statistics, and paleomagnetic data. Subsequently, the basins have acted as a long-term catchment of water and rock materials, evidenced through the geomorphology and CRISM-based geochemistry. Evidence of this includes Mangala Valles sourcing from a Tharsis-centered fault of Memnonia Fossae and the identification of phyllosilicates and chloride salt deposits. Highly degraded massifs with well-developed valley networks have been identified and interpreted to be ancient volcanic constructs formed during the early development of the rift systems.

The formation of Tharsis contributed significantly to the geologic history of the Memnonia-Sirenum map region, including the emplacement of lava flows prominent in the region's northeast and east-central parts. To the east and northeast of the map region, the evolution of Tharsis included the formation of igneous plateaus, volcanoes, lava flow fields, and fault, rift, and ridge systems, dating back to the Middle Noachian.

Ensuing growth of Tharsis and related inundations in the northern plains contributed to the present-day, Basin & Range-like topography, including a subsequent stage of basin formation and subsidence. The latest stage of basin formation, for example, is pronounced through the central basin, with subsidence linked to the formation of Mangala Valles at the basin's northern end and contemporaneous in time with major Stage 4 (Late Hesperian-Early Amazonian) Tharsis activity; the central basin is the lowest standing part of the map region and contains the lowest density of impact

craters of any of the north-trending, structurally controlled basins. Similar to the prominent Mangala Valles, which sources at a Tharsis-centered fault of Memnonia Fossae, aqueous activity including the formation of valley networks, collapse depressions, pit-crater chains, and vent structures such as candidate mud volcanoes manifested along the Tharsis-centered fault systems even into geologically recent time (Late Amazonian).

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