Geologic Mapping Along the Arabia Terra Dichotomy Boundary: Mawrth Vallis and Nili Fossae, Mars. Leslie F. Bleamaster III[1,2], and David A. Crown[1], Planetary Science Institute, [1]corporate address - 1700 E. Ft. Lowell Rd., Suite 106, Tucson, AZ 85719; [2]mailing – Trinity University Geosciences, One Trinity Place #45, San Antonio, TX 78212, lbleamas@psi.edu.

Introduction. Geologic mapping studies at the 1:1M-scale are being used to assess geologic materials and processes that shape the highlands along the Arabia Terra dichotomy boundary. In particular, this mapping will evaluate the distribution, stratigraphic position, and lateral continuity of compositionally distinct outcrops in Mawrth Vallis and Nili Fossae as identified by spectral instruments currently in orbit. Placing these landscapes, their material units, structural features, and unique compositional outcrops into spatial and temporal context with the remainder of the Arabia Terra dichotomy boundary may provide constraints on: 1) origin of the dichotomy boundary, 2) paleo-environments and climate conditions, and 3) various fluvial-nival modification processes related to past and present volatile distribution and their putative reservoirs (aquifers, lakes and oceans, surface and ground ice) and the influences of nearby volcanic and tectonic features on hydrologic processes in these regions.

The results of this work will include two 1:1M scale geologic maps of twelve MTM quadrangles (Mawrth Vallis - 20022, 20017, 20012, 25022, 25017, and 25012; and Nili Fossae - 20287, 20282, 25287, 25282, 30287, 30282).

Mawrth Vallis, an extensive (500 km long) sinuous channel that dissects the heavily cratered surface of Arabia Terra, is located near the western extent of the Arabia Terra plateau. Considered one of the oldest of the outflow channels, along with Ares Vallis [1], this easternmost circum-Chryse Planitia channel may represent remnant scours of catastrophic outflow often attributed to failure of a subterranean aquifer and/or by persistent groundwater sapping. Mawrth Vallis, however, does not exhibit typical outflow channel source region characteristics [2] and may have resulted from a more protracted hydrologic history [3, 4]. Mawrth's source region is highly degraded and appears to head from a degraded crater (18°N, 13°W) but loses definition in both the up and down gradient directions and preserves few pristine bedforms. In addition, Mawrth Vallis channel deposits display inverted topography and several pedestal and buried craters are present indicating that significant modification and degradation has occurred in the region. In fact, much of the geology of the region has been degraded, modified, and reworked into what we observe today, a complex amalgam of geologic materials.

High-resolution image data, merged with spectral maps have revealed local relations between layered deposits and mineralogic assemblages suggestive of aqueous alteration (Figure 1). These local relations and the broader observation of significant burial and exhumation are suggestive of a highly active and protracted sedimentary history, which could potentially have involved several phases of deposition and erosion related to episodic transgressions and/or major climatic variations. The juxtaposition of considerable amounts of aqueous-altered rock (phyllosilicates) with what may have been an ancient Mars ocean is compelling (Mawrth Vallis' mouth is coincident with a portion of the putative Arabia shoreline [5, 6]).

Nili Fossae, located north of Syrtis Major volcano and west of Isidis basin, contains a series of curved depressions, which are oriented roughly concentric to the Isidis basin. The largest trough originates from Hesperian age volcanic flows, extends northward through Noachian etched and cratered units,

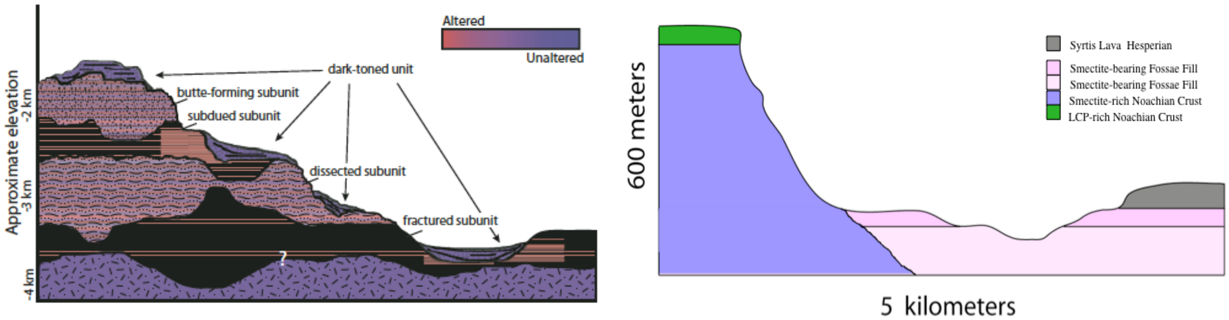

Figure 1. Relative "stratigraphic" positions or horizons of spectral units defined by Michalski and Noe Dobrea, 2007 in Mawrth Vallis (left) and J. Mustard in Nili Fossae (right); however 1:1M mapping has not identified a clear regional bedrock stratigraphy to match the mineralogic outcrops. Identification of geologic relations of these isolated studies and other high-resolution data with our mapping will help to integrate local observations into a regional geologic history and possibly improve constraints on the evolution of volatiles and geologic processes within these regions of Arabia Terra.

and ends near the dichotomy boundary [7, 8]. These structures most likely manifest as the surface expression of an outer ring fault related to the reasonably sized topographic and structural basin created by the Isidis impact into the underlying Noachian crust. Nili Fossae crosscuts materials that span the Noachian to late Hesperian and intersects with structural elements potentially related to original dichotomy formation, suggesting that Isidis has long been an influence on local geologic evolution.

Although masked in regions by volcanic flows from Syrtis Major, aeolian and fluvial deposition, and potential coastal deposits related to an ancient Martian ocean [5], subsequent stripping has revealed outcrops of significant geochemical importance. Like those observed in the Mawrth Vallis region, several outcrops of phyllosilicate-bearing Noachian materials have been revealed by the MEX OMEGA instrument [9, 10]. Phyllosilicates in this location point to the ancient history of Mars when the stability of ground and/or surface water was present for significant periods of time, facilitating the widespread aqueous alteration observed.

Figure 2. Screen shot of current Nili Fossae progress; colors indicate various designations of unit contacts and structural types; line work is ready for conversion to polygons.

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