UNDERSTANDING THE HISTORY OF A DIVERSE INVERTED LANDSCAPE: SUMMARY AND PLAN FOR FINISHING THE 1:500K GEOLOGIC MAP OF AEOLIS DORSA, MARS. R. E. Jacobsen, D. M. Burr, R. M. Borden, S. P. E. Peet, and A. S. Boyd. Earth and Planetary Sciences Department, University of Tennessee, Knoxville, TN 37996 USA (RJacobsen@vols.utk.edu and dburr1@utk.edu).

Introduction: This abstract summarizes our fourth year’s work on a 1:500k USGS geologic map of the Aeolis Dorsa (AD) region, Mars [1-3] and compares the work done to the recently released Planetary Geologic Mapping Protocol—2018 (PGMP) [4; see link]. Finally, this abstract presents a plan for completing the map package for submission and review.

The AD region is located north of the Highland-Lowland Boundary (HLB), ~800 km east of Gale Crater, and south of the Cerberus lavas [Fig. 1A]. The primary focus of the proposed work has been to investigate thousands of sinuous ridges, interpreted to be inverted fluvial features [5,6 and refs. therein]. Fortunately, the great diversity of landforms in AD has motivated additional investigations of geomorphic processes, e.g., lacustrine processes, tectonics/collapse processes [7], and aeolian processes associated with the Medusae Fossae Formation (MFF) [e.g., 8].

Scientific results from mapping: The stratigraphy and paleohydrology of the AD deposits were analyzed to elucidate the history of fluvial activity in the region. The larger Martian hydrologic timeline, is encapsulated in the stratigraphy of Aeolis Dorsa, particularly in the transition from wide meandering fluvial deposits and channel fills to alluvial fans [9-11 and refs. therein]. Close examination of AD deposits and comparisons with terrestrial analogs suggest meandering fluvial and debris-flow deposits formed only in southern AD and in the presence of weathered sediments [10]. The presence of these deposits and weathered sediments in southern areas, and there absence in northern areas, suggests enhanced weathering in the south possibly caused by orographic precipitation near the HLB [5,10]. Results from additional analyses of AD deposits and comparisons with terrestrial analogs improve the accuracy and precision of empirical relationships for estimating paleodischarges on Mars [12]. Results from morphometric analyses of meander scrolls in the AD region and comparisons with terrestrial analogs suggest confounding factors in the interpretations of eroded fluvial deposits [13].

Several craters in the AD region preserve post-impact sedimentary deposition [9]. Close inspection of these intra-crater deposits suggests branching ridges and layered outcrops, among others, are consistent with deltaic deposits and sedimentary deposition in lacustrine and near-lacustrine environments [14].

The AD region hosts numerous tectonic features [7,9]. A large “southern depression” separates AD from the southern highlands and is interpreted to have formed by extension along the HLB [15]. Wrinkle ridges are observed throughout the AD region and have NE-SE orientations evidencing compressive stresses [16] possibly from loading of lavas at Elysium.

The AD region includes abundant aeolian landforms, e.g., dunes and yardangs [1-3]. Many of these features have been associated with the widespread MFF [8]. However, the relationship between the MFF and dark sands in the AD region is enigmatic. Examination of high-resolution visible-wavelength images suggest that dark sands cluster in the southern depressions and adjacent to Aeolis and Zephyria Planas [17]. These locations are consistent with the only two visually confirmed outcrop sources of dark sand, the southern highlands and the MFF [17].

Protocol: The recently released PGMP—2018 presents expectations for standardized geologic maps, published by the USGS [4]. Map packages must include GIS files, a geologic map, Description of Map Units (DOMU), Correlation of Map Units (COMU), Explanation of Map Symbols (EOMS), map text (pamphlet), figures, captions, and tables [4].

Status of map package: The GIS files and the geologic map are nearly complete [Fig. 1B]. GeoContacts, with validated topology, have been placed throughout the map area and outline 19 map units. There are 10 different linear feature types, mapped over crater features, tectonic features [16], and fluvial features [10]. The DOMU and COMU have been drafted [18; see poster for full unit descriptions].

Mapping results show Noachian to Hesperian-age highlands moderately deformed by impact cratering, and transitional units deformed by extensional tectonics [15]. These units are interleaved with richly stratified plana units of aeolian and volcanioclastic origins (i.e., MFF). Plana, highlands, and transitional units hosted widespread fluvial and lacustrine deposition and waning hydrologic activity during the Hesperian and Amazonian periods [5,10,14,18]. Later, fluvial and lacustrine deposits were repeatedly buried by widespread aeolian and/or volcanioclastic deposition (MFF), and subsequently exhumed by aeolian processes, forming yardangs and aeolian bedforms [8,17].

Finishing the map package: A new basemap built from blended CTX images has been incorporated into the mapping project [19]. A coordinate system file will be included with the new basemap. The locations of some GeoContacts and features need editing to align...
with the new basemap. Editing location features and surface features is ongoing. Type locations and additional characteristics are being added to the DOMU. A separate table of stratigraphic contacts and their locations will augment the COMU; and, an EOMS will be drafted this summer.

These edits and changes are being made by REJ. At the end of July 2018, GIS files and the map will be transferred to DMB, who will review the content in dialog with co-authors and write the map text. REJ will assist with map text figures, captions, and tables. DMB will then coordinate with USGS on map package submission, compliance review, technical review, and Map Coordinator review, to be completed in 2019, with a first No Cost Extension to the supporting grant.


**Figure 1:** (A) MOLA gridded topography shows the location of the AD map region (black box), between the southern highlands and the Cerberus lavas. (B) Draft of 1:500k map of the AD region [18] overlain on a blended mosaic of CTX images [19].