MARTIAN LOBATE DEBRIS APRONS: COMPILATION OF A NEW GIS-BASED GLOBAL MAP. F. C. Chuang[1], D. A. Crown[1], D. C. Berman[1], J. A. Skinner[2], K. L. Tanaka[2], [1]Planetary Science Institute, 1700 E. Fort Lowell Road, Suite 106, Tucson, AZ 85719, [2]U.S. Geological Survey, 2255 N. Gemini Drive, Flagstaff, AZ 86001 (chuang@psi.edu).

Introduction: The mid-latitudes of Mars represent areas of geologically young volatile-driven activity where ice has played a major role in shaping the surface geology [1-5]. Recent research has focused on small-scale landforms observed in high-resolution images such as gullies, arcuate ridges, viscous flow features, as well as widespread ice-cemented mantling deposits [5-6]. Other features, such as lobate debris aprons and lineated valley fill in eastern Hellas and in the fretted terrain along the dichotomy boundary, rock glaciers at the base of Olympus Mons, and fan-shaped glacial deposits on the flanks of the Tharsis volcanoes have been proposed as evidence for extensive mid-latitude glaciation [7-13]. Recent modeled subsurface data from the MRO SHARAD instrument suggests that lobate debris aprons in both eastern Hellas and Deuteronilus Mensae are analogous to terrestrial debris covered glaciers with kilometers-thick water ice capped by a thin non-ice lag [14-15]. These data, coupled with climate models showing volatile accumulation zones that correspond to debris apron locations [16-17], are shedding new light on the history of Mars during the Amazonian Period.

Scientific Rationale: Although numerous past studies have focused on various aspects of lobate debris aprons, there is currently no systematic and comprehensive compilation of their distribution. Debris aprons and lineated valley fill were not included as distinct units in previous global maps of Martian geology, mostly due to the 1:15M map scale, and were only included in descriptions of regional units in a recent geologic map of the northern plains [18]. In areas with high concentrations of aprons, where geologic mapping has been done on various Mars Transverse Mercator quadrangles, debris aprons have been mapped as a distinct geologic unit [19-23]. However, these maps do not adequately cover all known apron populations.

For these reasons, we are undertaking the compilation of a new GIS-based global map of lobate debris aprons (including lineated valley fill and concentric crater fill) in order to better understand the global inventory and distribution of these relict ice-rich features. This work will be done as a stand-alone research project, which can then be imported as a GIS data "layer" into a new global digital geologic map of Mars [24] that will eventually be made available to the scientific community through the U.S. Geological Survey's web services.

Global Map and Database: The map will contain the boundaries of existing debris aprons and an associated database, including information on their distribution (e.g., latitude, longitude, elevation), morphometric and morphologic properties (e.g., volume, surface area, textures). The boundaries of former debris aprons, identified as circumferential depressions adjacent to mesas and plateaus [25] will also be included. Previous work by [26-28] has compiled various morphometric parameters for the eastern Hellas, Tempe Terra/Mareotis Fossae, and Deuteronilus Mensae (Figure 1) apron populations that will be included (Table 1). Apron volume estimates will help to constrain the magnitude of geologic processes and amounts of volatiles involved in formation of apron and fill deposits. A statistical characterization of the global population will also be done to compare these features to terrestrial analogues and provide insight into emplacement processes (Figure 2).

The map and associated database is intended to be a living archive, which will initially contain our results, but also be open to editing and ingestion of associated map data from other investigators (e.g., apron measurements, crater counts, etc). We recognize that some map standardization issues will need to be adopted prior to formal mapping such as a representative mapping scale for all feature types, mapping of only apron materials or both materials and the geologic features they are associated with, etc. As part of our work, we intend to characterize debris aprons in the global population based on their observed surface textures from available image datasets, analyze apron surface degradation, and derive age constraints from populations of small impact craters.

Work Plans: We are currently adapting existing maps of debris aprons to a mapping base in simple cylindrical projection. Our primary mapping base is a combination of global gridded MOLA DEM (128 ppd; ~463 m/pix) and global THEMIS day IR mosaics (100 m/pix). We will also use higher-resolution images such as HRSC, CTX, MOC, THEMIS VIS, and HiRISE on an as-needed basis.

Map Contributions: We welcome contributions of GIS-based data of lobate debris aprons and(or) related ice-rich features to our global map. Although we prefer GIS-ready datasets, other formats such as Illustrator or Photoshop can be utilized. Please direct inquiries to the lead author.

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Table 1. Morphometries of Debris Aprons (after [28])

Population*	EH	TM	DM	Total
Number	89	65	191	345
Length (km)	9.9±6.8	4.3±3.8	8.0±7.6	7.8±7.0
Area (10^3 km^2)	0.55±0.8	0.29±0.5	1.03±2.81	0.77±2.16
Volume (10^3 km^3)	0.31±0.6	0.11±0.3	0.49±1.69	0.37±1.31
Slope (deg)	4.0±2.0	3.5±1.0	3.3±1.4	3.4±1.5
Front thick^ (km)	0.34	0.13	------	------
Relief (km)	1.2±0.8	0.6±0.4	0.7±0.5	0.8±0.6

* EH= Eastern Hellas, TM= Tempe Terra/Mareotis Fossae, DM= Deuteronilus Mensae

^ subset of regional population

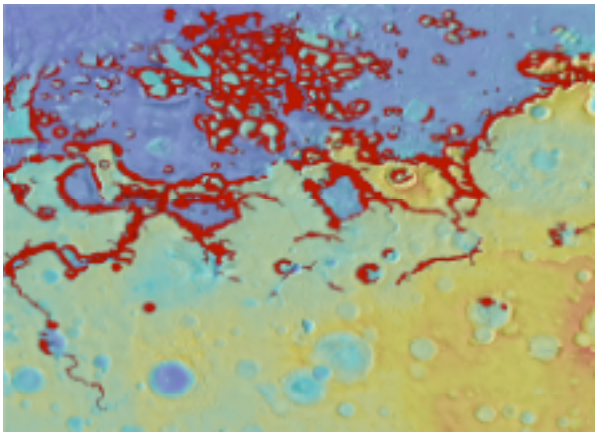

Figure 1. Map of 191 lobate debris aprons and lineated valley fill deposits in the Deuteronilus Mensae region of Mars (area shown: 30º-48º N, 15º-40º E). This map, along with those for East Hellas and Tempe Terra/Mareotis Fossae, will be used as part of the global map of debris aprons.

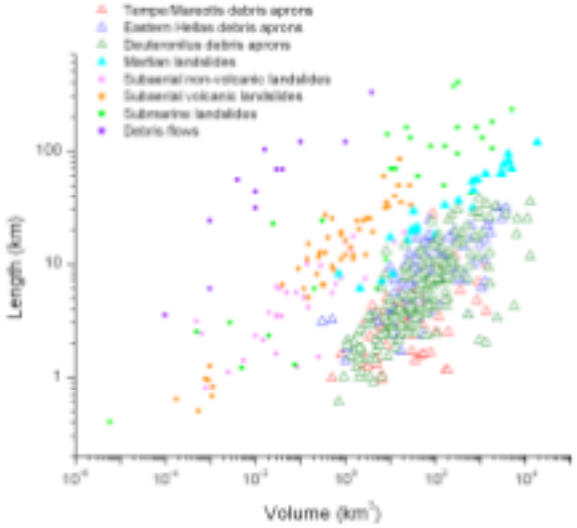

Figure 2. Plot of length versus volume for 345 Martian debris aprons, 29 Martian landslides and a suite of terrestrial mass-wasting features (32 subaerial non-volcanic landslides, 50 subaerial volcanic landslides, 44 submarine landslides, and 12 debris flows). Debris apron data from [28] and all other data from [29].