Journal of Geophysical Research: Planets

Supporting Information for

Where are Mars' Hypothesized Ocean Shorelines? Large Lateral and Topographic Offsets Between Different Versions of Paleoshoreline Maps.

Steven F. Sholes[1,2,3], Zachary I. Dickeson[4,5], David R. Montgomery[1], and David C. Catling[1,2]

[1]Department of Earth and Space Sciences, University of Washington, Seattle, WA, USA.
[2]Astrobiology Program, University of Washington, Seattle, WA, USA.
[3]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA
[4]Department of Earth Sciences, Natural History Museum, London, UK.
[5]Department of Earth and Planetary Sciences, Birkbeck College, University of London, London, UK.

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Introduction

Additional maps to show the full coverage of the mapped levels (Figure S1), provide further insight into the surface geology of the mapped levels (Figure S2), and the differences between the different offset measuring methodologies (Figures S3 and S4). Table S1 summarizes the offset data for each level, method, and pass used. Uploaded separately are comma separated value (.csv) files for each of the mapped levels. These use a polar stereographic Mars projection (north). Elevation data come from the MOLA/HRSC blended digital elevation map at 200 m/px (Fergason et al., 2018). Levels are labeled as First Author + Publication Year + Level + "Z" (for elevation). For example: "Clifford2001_Arabia_Z.csv". Note that elevations from provided geospatial data, i.e., from Ivanov et al. (2017) and Perron et al. (2007), may differ slightly from their respective publications. This is due differing DEMs being used (also explained in the main text).

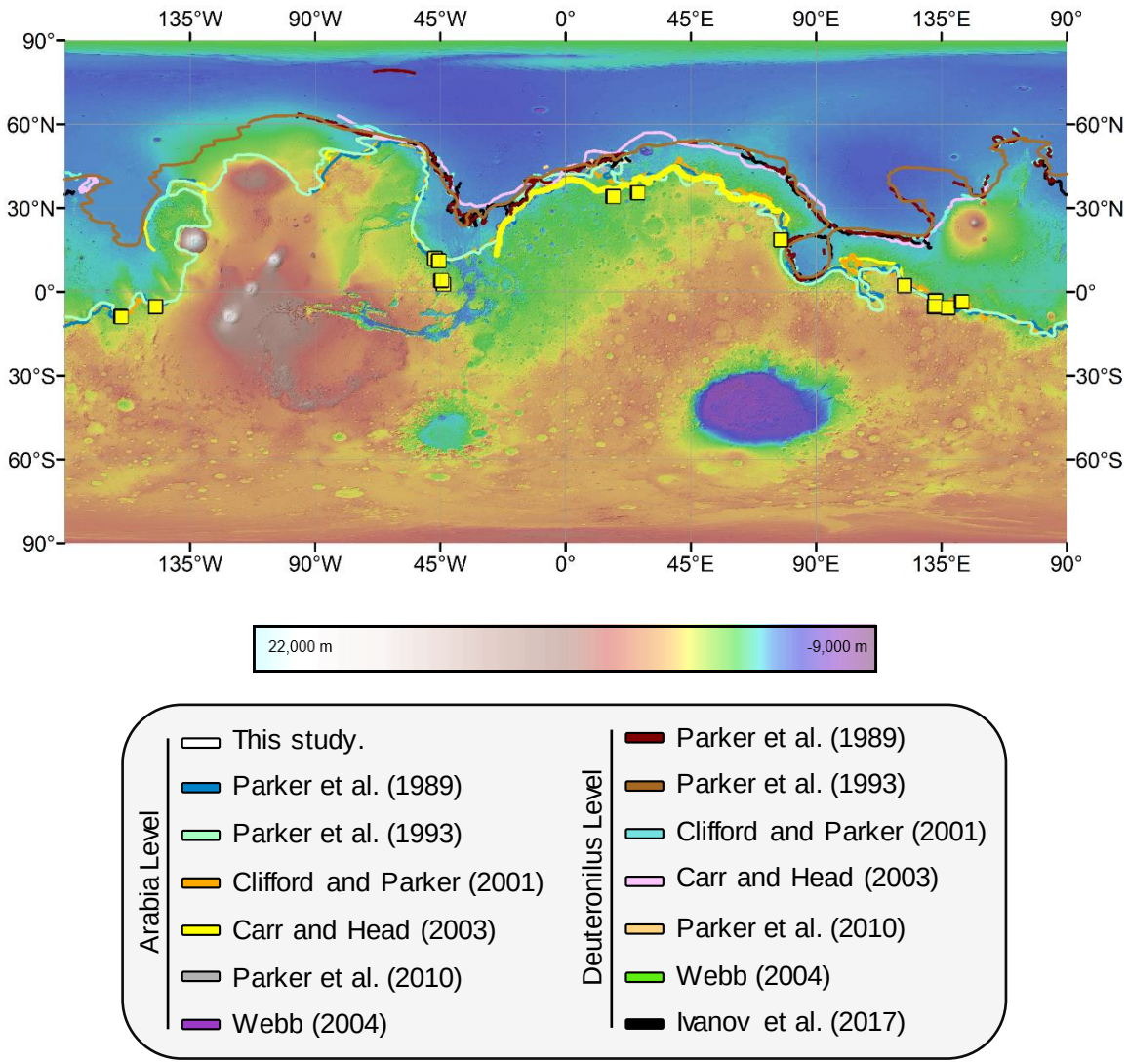

Figure S1. Location of the putative ocean shorelines on a simple cylindrical projection. Yellow squares indicate open deltas from Di Achille and Hynek (2010).

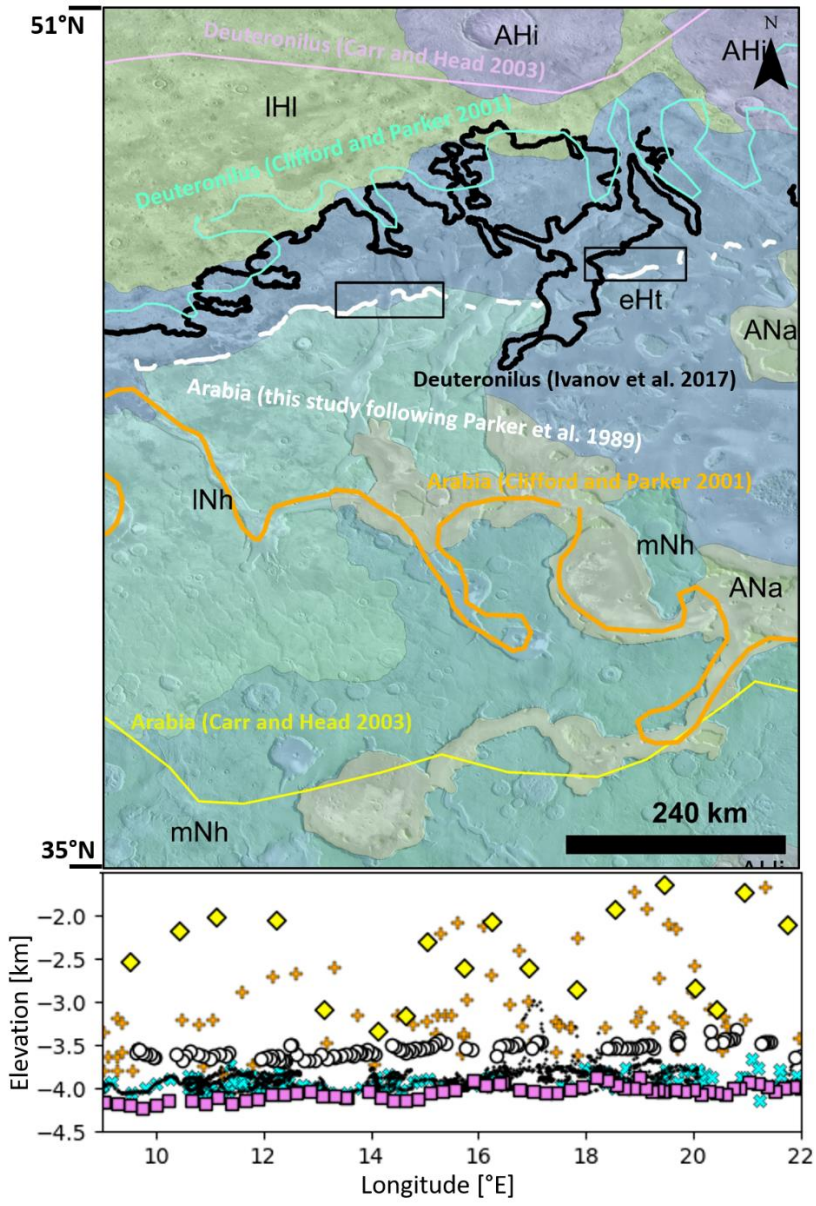

Figure S2. Geological units overlain on Figure 4 (MOLA colorized elevation over THEMIS-IR daytime mosaic). Our mapped Arabia Level (white lines) roughly follows the contact between the early Hesperian transitional (eHt) unit and the late Noachian highlands (lNh) unit. The Deuteronilus Level roughly follows the contact between the eHt and late Hesperian lowlands (lHl) units. mNh: middle Noachian highlands unit, Ana: Amazonian and Noachian apron unit, Ahi: Amazonian and Hesperian impact unit (Tanaka et al., 2014). Colored lines indicate the vector data of the Arabia (yellow lines) and Deuteronilus (purple lines) from Carr and Head (2003) along with the Deuteronilus Level from Ivanov et al. (2017) (black lines) and our mapped version of the Arabia Level (white lines) based on the criteria set out in Parker et al. (1989). Elevation plot for the levels from Figure 3 is reproduced here.

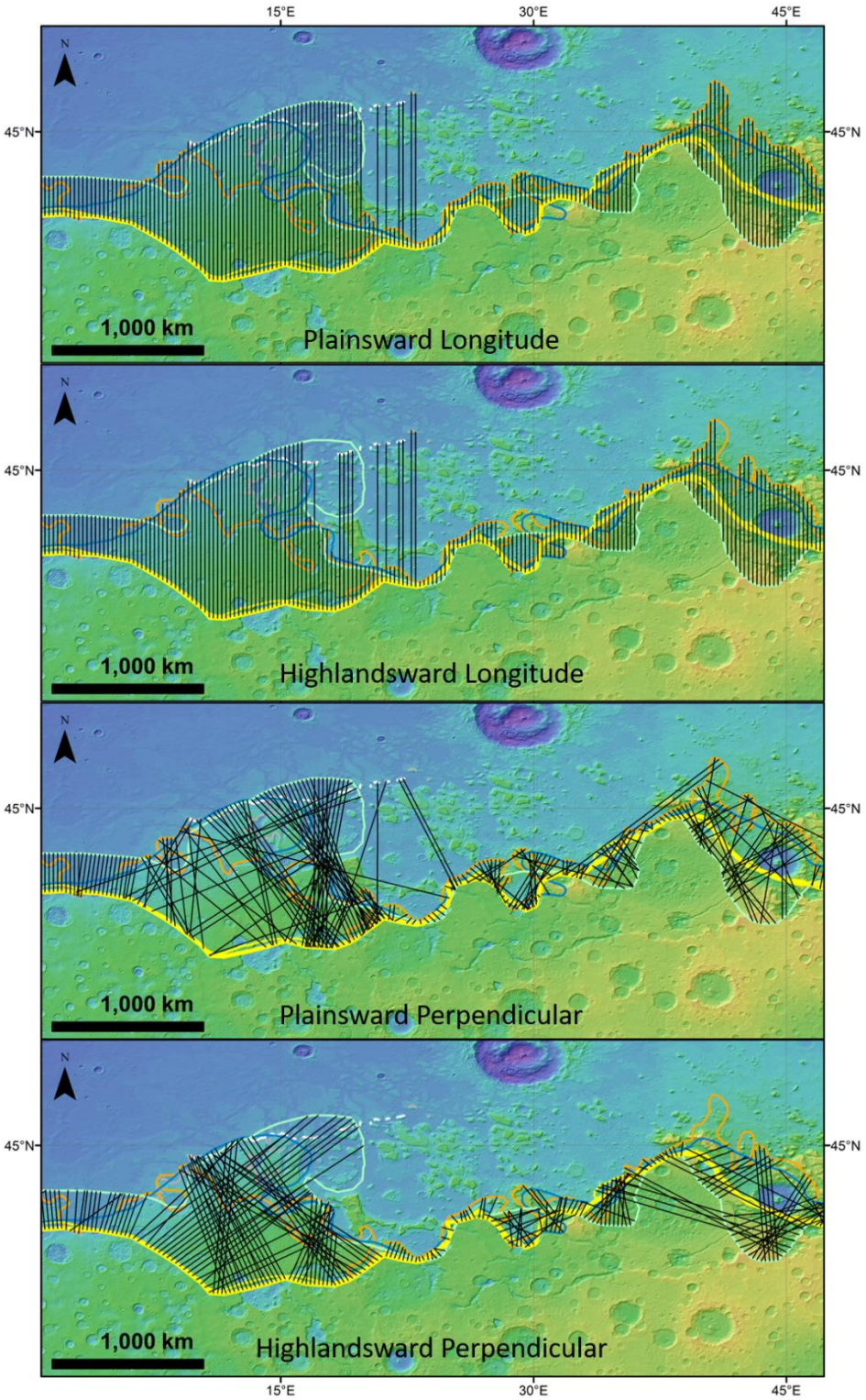

Figure S3: Offsets for the Arabia Level within the Deuteronilus Mensae region for the longitude and perpendicular methods and both the highlandsward and plainsward passes. Simple cylindrical projection.

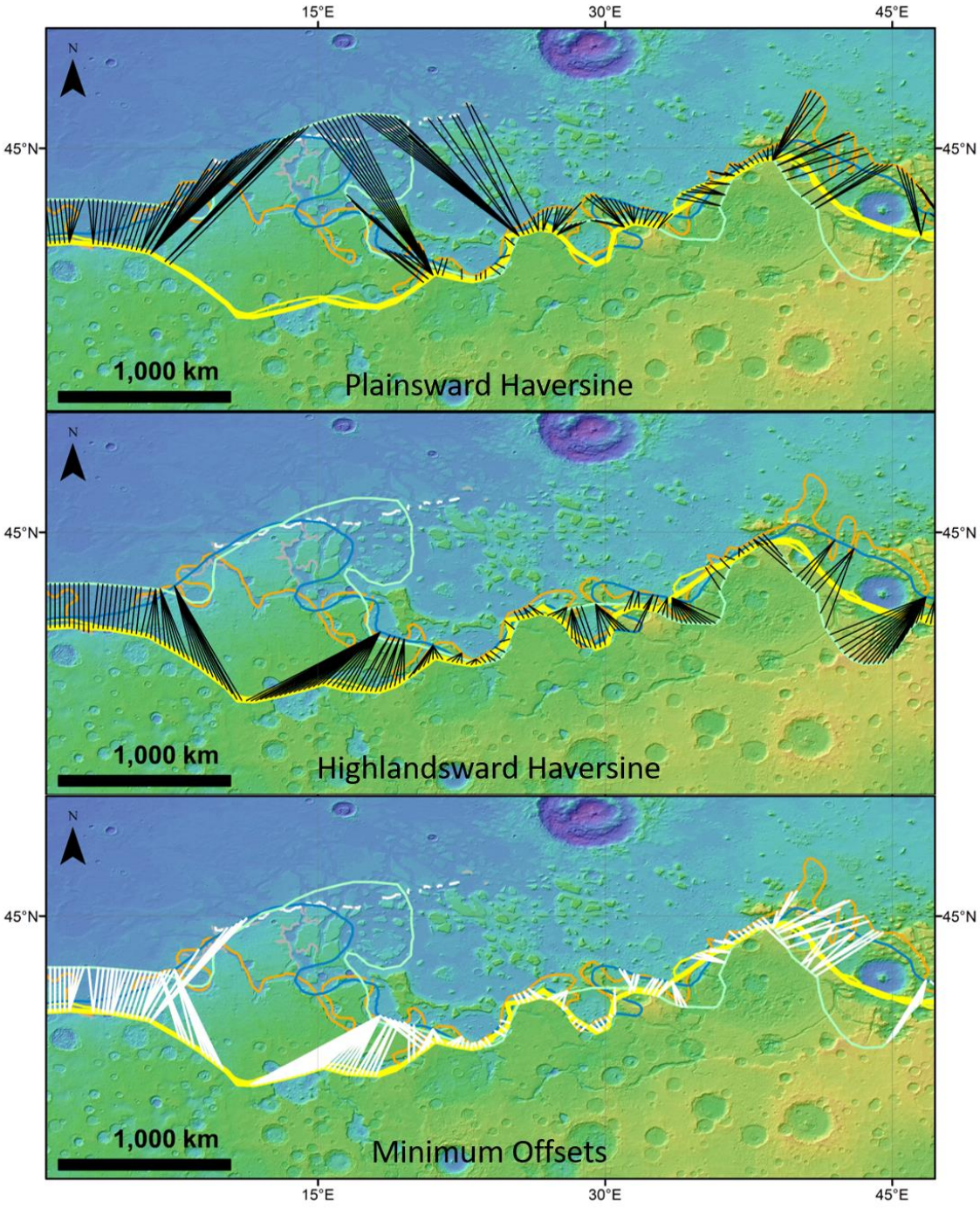

Figure S4: Offsets for the Arabia Level within the Deuteronilus Mensae region for the Haversine function minimization method via both the highlandsward and plainsward passes. Simple cylindrical projection. Minimum offsets figure shows the smallest offset between all methods and passes at each 0.25° longitude. It largely follows the Haversine method but underestimates the overall geometric offsets between all the versions of the levels. The perpendicular method can often overestimate the offsets but can more accurately reflect the offsets when the levels trend roughly longitudinally (N/S).

Table S1. Summary of the different lateral offset distance measurement methods used in the study (all values in kilometers). Offsets are measured in 0.25° longitudinal spacings via both a plainsward-most and highlandsward-most pass. The mean offset ("Mean" method) takes the mean of all available method/pass combinations at each longitude while similarly the minimum offset ("Minimum" method) takes the smallest offset among each method/pass at each longitude. However, due to the nature of the Haversine methods (which finds the minimum distance between each highland point and all plains points, and vice-versa), the minimum offset tends to fail to capture the geometries of the levels themselves and thus the mean offset is a better descriptor of the data.

Level	Method	Pass	Mean	Standard Deviation	Maximum Offset
Arabia	Longitudinal	Highland	269	448	2,506
		Plains	201	332	2,369
	Perpendicular	Highland	162	201	1,458
		Plains	168	221	2,149
	Haversine	Highland	129	164	1,127
		Plains	115	102	647
	Mean	--	141	142	1,093
	Minimum	--	66	67	1,093
Deuteronilus	Longitudinal	Highland	230	189	1,321
		Plains	296	343	1,671
	Perpendicular	Highland	206	206	1,575
		Plains	294	408	1,978
	Haversine	Highland	146	90	455
		Plains	200	216	1,213
	Mean	--	180	177	936
	Minimum	--	95	77	434