

Characterizing A Potential Remnant of the Hypanis Delta

Christina Singh (csingh1@conncoll.edu)¹, Jacob Adler², Frances Rivera-Hernández²

¹Connecticut College, Department of Physics, Astronomy, and Geophysics, ²Georgia Institute of Technology, School of Earth & Atmospheric Sciences

Motivation: Water, Hypanis, and Life?

- Hypanis delta may provide constraints on water budgets, climate, & habitability on early Mars
- Deltas are great exploration targets on Mars as they provide evidence for stable liquid water and are good at preserving biosignatures

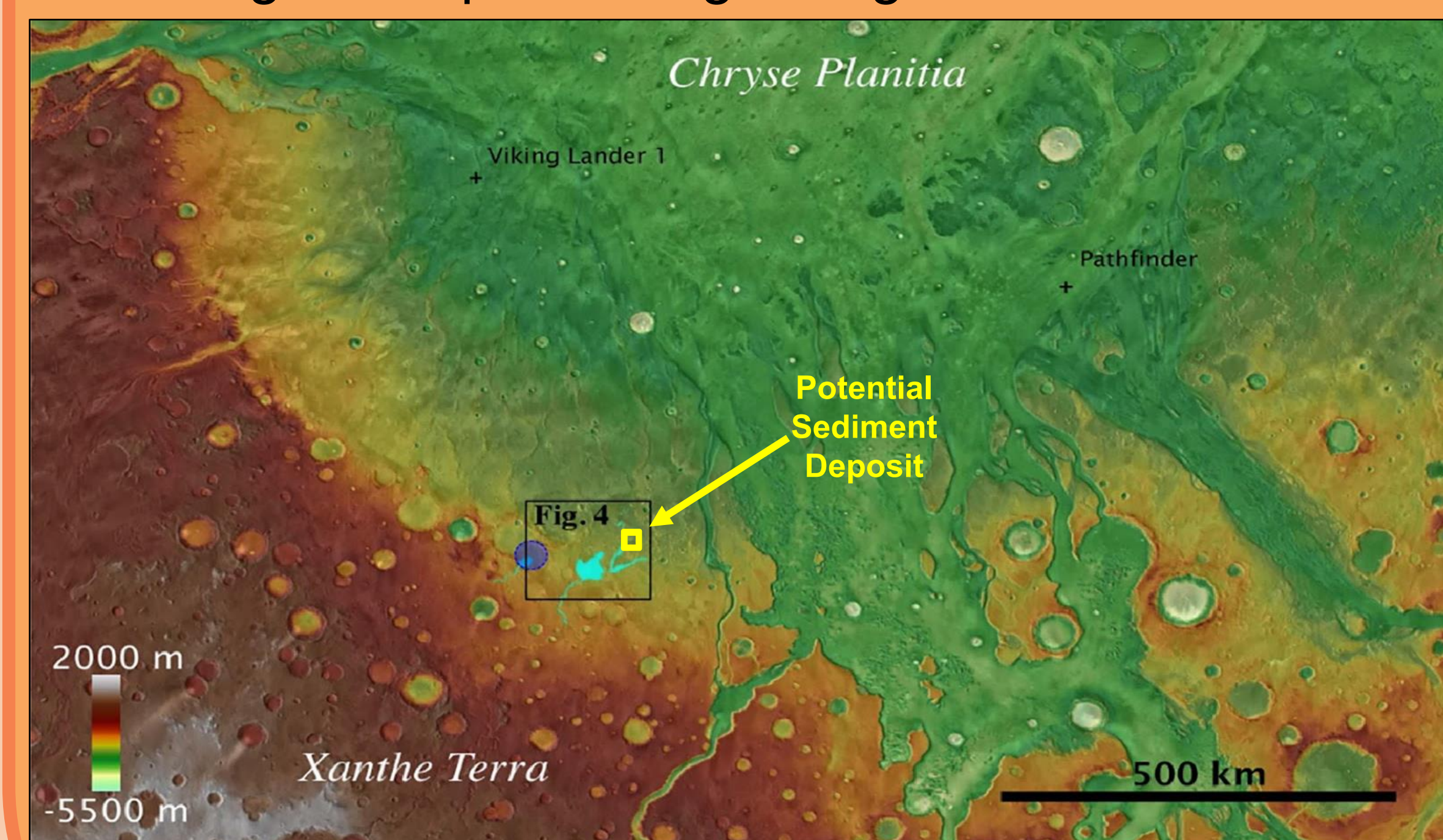


Figure 1: Regional view of the Hypanis system along the Mars dichotomy boundary where there is a topographic drop from Xanthe Terra into Chryse Planitia region.

Background: Hypanis System Formation

- Hypanis delta system consists of (Fig. 2):
 - Contributing river drainage network (Hypanis Valles)
 - The main delta body (A)
 - A remnant lobe (B) and channels (C and D)
- Hypanis likely formed in large sea/ocean where sediments accumulated in layers (Fig. 3)
- Newly identified stack of sedimentary layers may be a remnant Hypanis deposits
 - Would extend size of Hypanis system

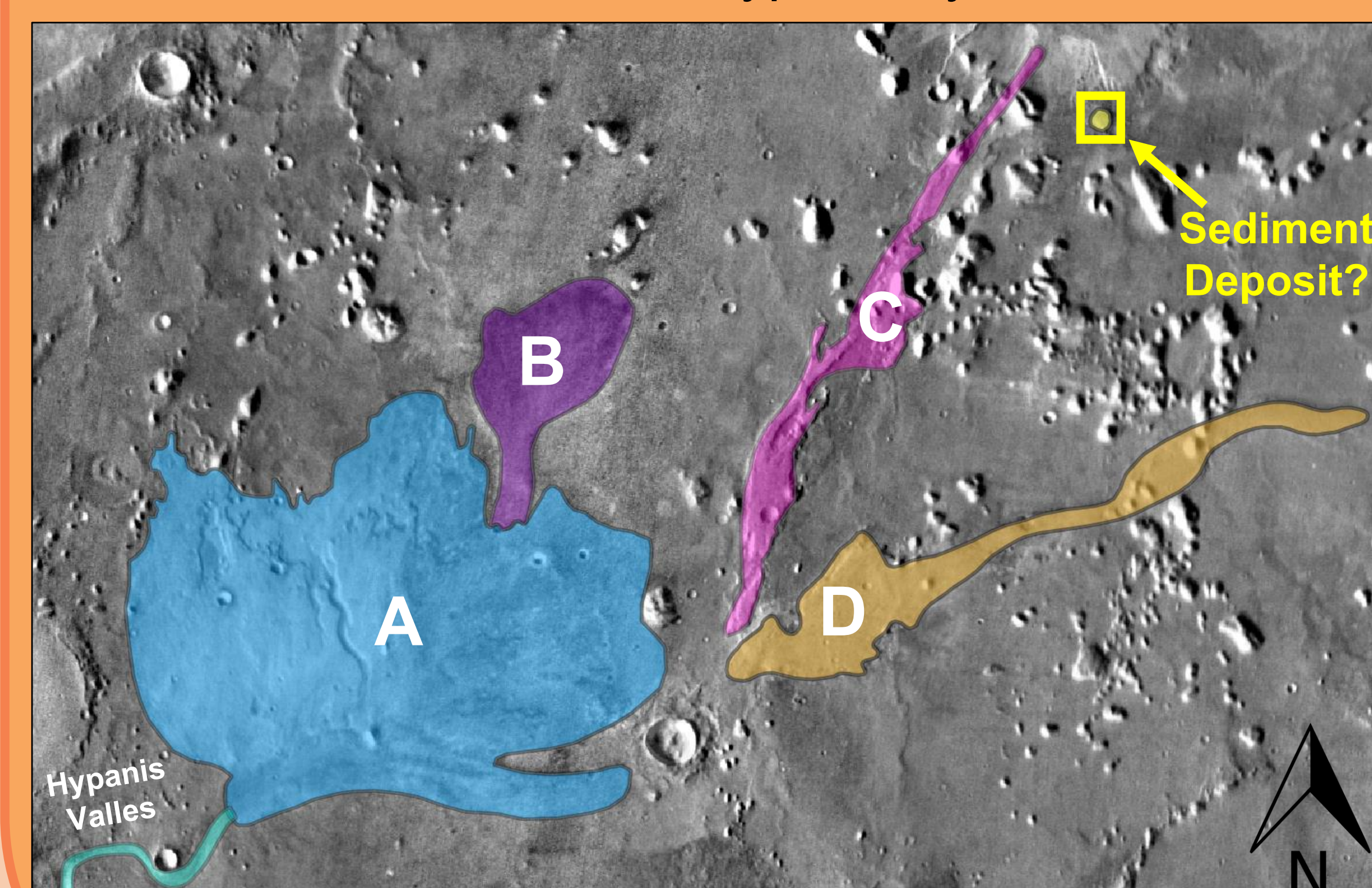


Figure 2: The main lobe [A] of the Hypanis system and its remnant lobe [B] and channels [C, D]. New potential deposit of the Hypanis delta is marked in a yellow box.

Background: Delta Bedding

- Topset, foreset, and bottomset beds
- Nearly flat, continuous morphology (calm environment)

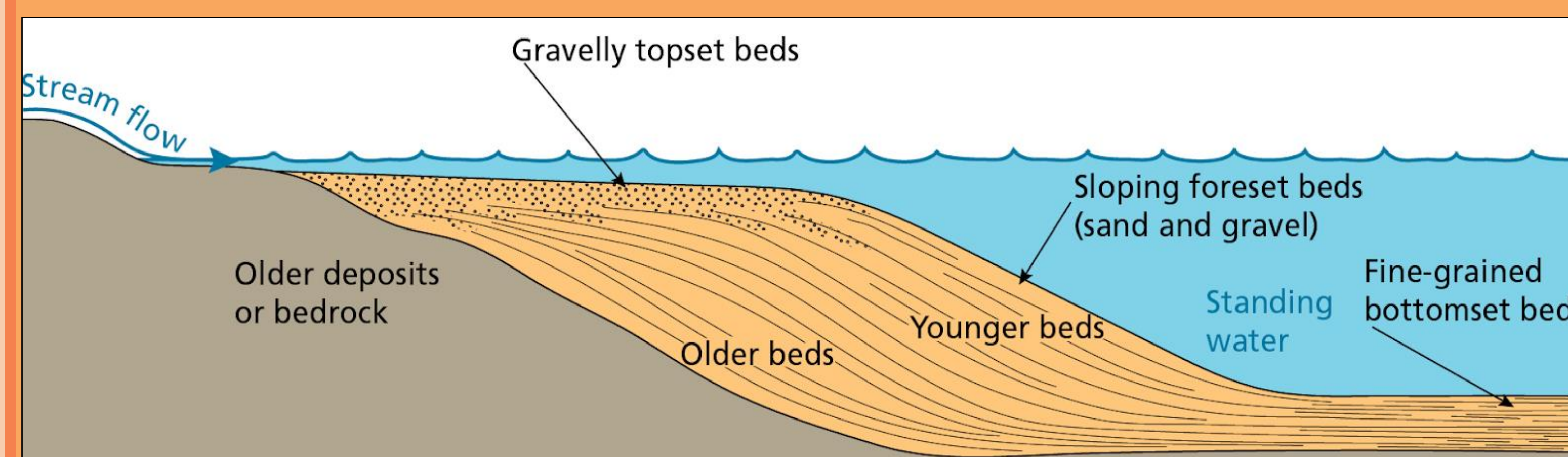


Figure 3: The typical stratigraphy of a delta consisting of topset, forset, and bottomset beds. The overall topography of deltas is nearly flat making them calm environments. When sediment is deposited into a delta, organic materials can be buried and thus persevered under layers of sediment.

Methods: Mapped Deposit and Characterized Layers

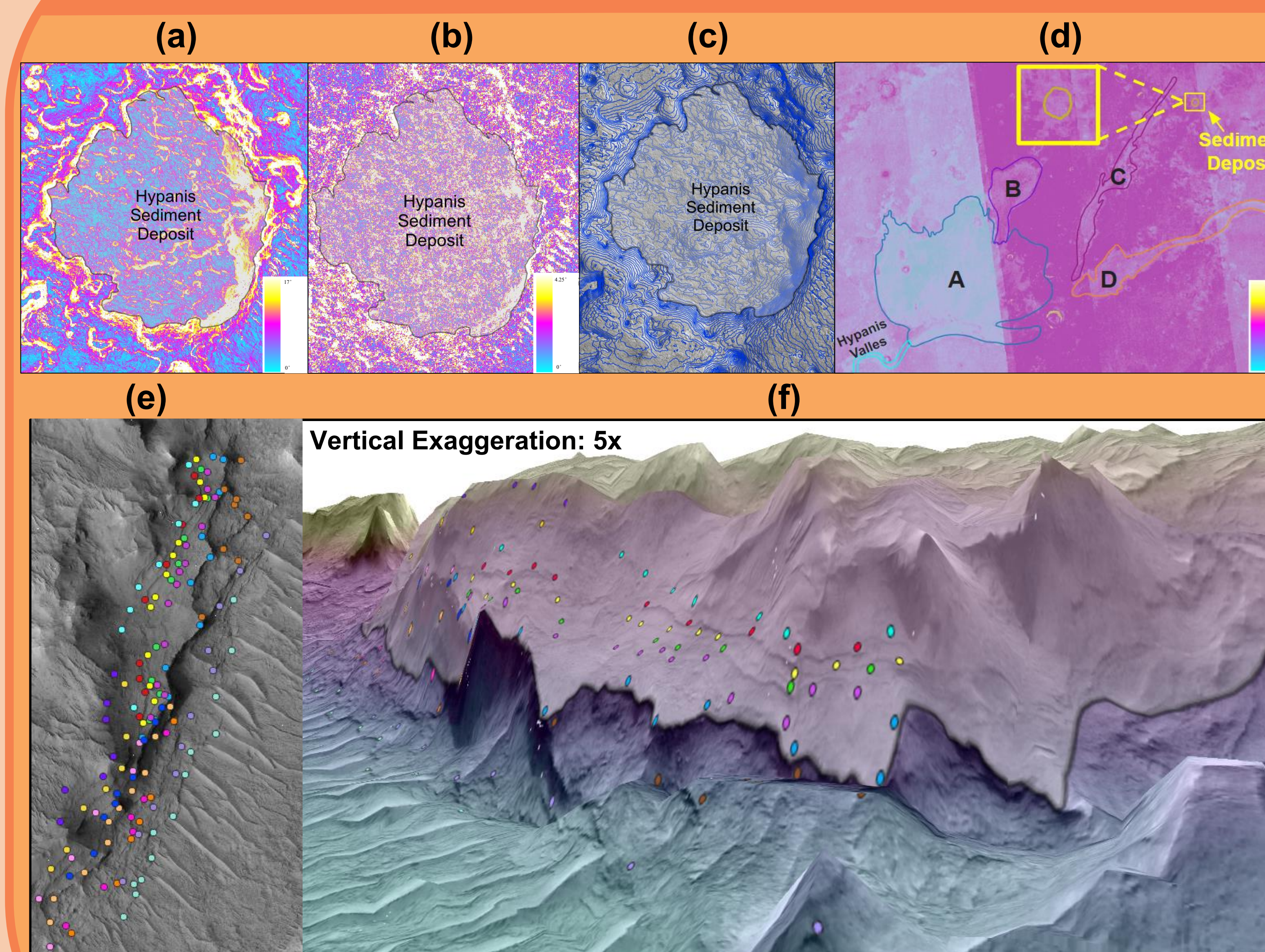


Figure 4: Maps of slope (a), roughness (b), elevation contours (1m spacing) (c), thermal inertia (THEMIS) (d), and elevation (DEM) (f). 3D DEM view and overhead view (e) of datasets used to determine the extent of the distal sediment deposit and to locate layers in the deposit.

Preliminary Interpretations

Three possibilities:

- Sedimentary deposit not linked to Hypanis
- Part of main delta lobe (Length: 100 km, Area: 3,000 km²)
- Or... Another delta lobe of Hypanis system²

Future Work

- Re-analyze sequence of events that formed the Hypanis system
- Better constrain size of paleo-sea/ocean
- Quantify errors for layer dips

Preliminary Results: Best-fit Planes for Layers

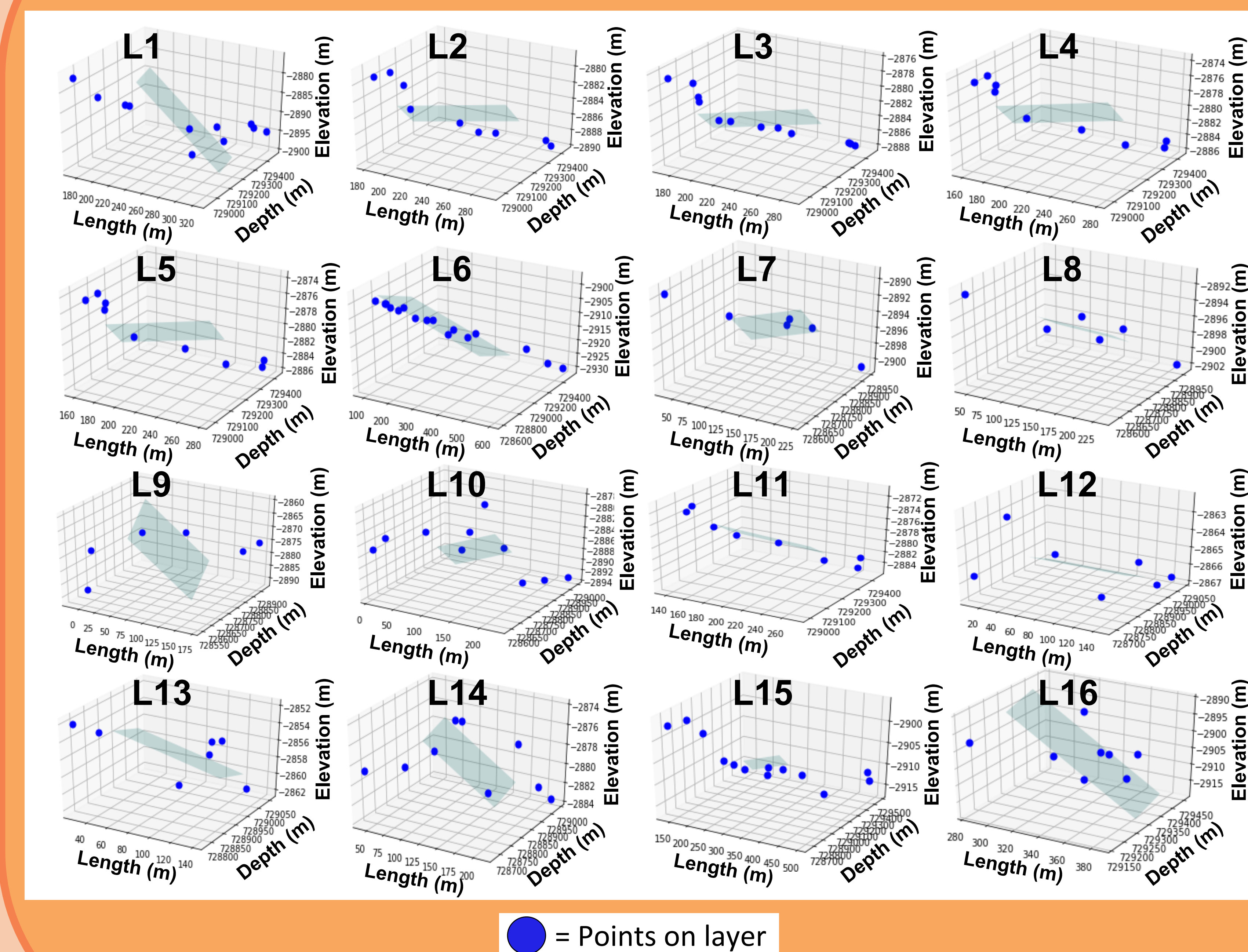


Figure 5: Best-fit planes for each layer of sediment identified in our study.

Preliminary Results: Orientations of Delta Layers

Layer	Dip Angle °	Dip Direction °	Number of Points
1	10.76	95.37	11
2	2.42	-42.03	9
3	2.71	-48.18	12
4	1.83	-23.40	13
5	2.71	-41.55	9
6	2.25	63.86	15
7	2.91	-33.48	6
8	1.35	13.04	6
9	12.41	121.04	6
10	3.85	-39.60	10
11	1.75	21.59	8
12	0.46	3.12	7
13	1.86	64.80	7
14	2.96	101.24	9
15	2.58	-40.42	13
16	13.64	96.42	8

Figure 6: Table with dip angles and dip directions of various sediment layers.

References

- Jacob B. Adler, James F. Bell III, Peter Fawdon, Joel Davis, Nicholas H. Warner, Elliot Sefton-Nash, Tanya N. Harrison, Hypotheses for the origin of the Hypanis fan-shaped deposit at the edge of the Chryse escarpment, Mars: Is it a delta?, Icarus, Volume 319, 2019, Pages 885-908, ISSN 0019-1035, <https://doi.org/10.1016/j.icarus.2018.05.021>
- Peter Fawdon, Sanjeev Gupta, Joel M. Davis, Nicholas H. Warner, Jacob B. Adler, Matthew R. Balme, James F. Bell, Peter M. Grindrod, Elliot Sefton-Nash, The Hypanis Valles delta: The last highstand of a sea on early Mars?, Earth and Planetary Science Letters, Volume 500, 2018, Pages 225-241, ISSN 0012-821X, <https://doi.org/10.1016/j.epsl.2018.07.040>