

A COMPLETE DEPOSITIONAL SYSTEM IN MELAS CHASMA, MARS. J. M. Metz¹, J. P. Grotzinger¹, D. Mohrig², A. McEwen³, C. Weitz⁴, ¹Geological and Planetary Sciences, California Institute of Technology, Pasadena CA, joannah@caltech.edu, ²University of Texas, Austin, TX., ³Lunar and Planetary Lab, University of Arizona, Tucson AZ, ⁴Planetary Science Institute, Tucson AZ.

Introduction: Identification of complete source-to-sink systems on Mars is rare, because commonly parts of the system are not preserved, are eroded, or are covered by later deposition. Southern Melas Basin in Valles Marineris is an exception, as it could represent a complete erosional to depositional system, from the fluvially-incised source region in the surrounding highlands to the terminal sediment sink formed by the sublacustrine fans in the topographically lowest part of the basin (Figs. 1b, 2).

Fluvial incision of bedrock, interpreted as caused by runoff from precipitation [1,2], drains the ridges bordering the western and eastern parts of the basin (Fig. 1b). Sediments generated during erosion of the upland areas were transported by fluvial drainage systems to form a classic, cone-shaped alluvial fan at the western edge of the basin. Sediments which pass through the alluvial fan were deposited as clinoforms, which may record a potential shoreline or upslope channel levee part of the submarine fan system [3]. The clinoforms give way further down the topographic profile to a sublacustrine fan, very similar in morphology to the Mississippi submarine fan [4]. This ultimate depositional low in the system provides the terminal sink for the sediments. The presence of sublacustrine fans in Melas Chasma indicates that a significant body of water was present and stable at the surface of Mars for at least 10^2 to 10^4 years, which provides important constraints for past environmental conditions on Mars.

Data Sets: We utilized HiRISE, CTX, and CRISM images and Digital Elevation Models constructed from HiRISE stereo pairs to study two depositional fans in southwestern Melas Chasma.

Sublacustrine Fans: The fan complex near the western end of southern Melas Basin is composed of multiple lobes with dendritic finger-like terminations that branch off at high angles in the downstream direction (Fig. 1a). The surface of the fans are marked by numerous channels and has an average surface slope of $\sim 1^\circ$. The morphology of these fans is distinct from other previously identified fans on Mars and appears most similar to terrestrial submarine fans.

References: [1] Mangold N. et al. (2004) *Science*, 305, 78-81. [2] Quantin C. et al. (2005) *JGR*, 110, E12S19. [3] Dromart G. et al. (2007) *Geol.*, 35, 363-366. [4] Metz J. M. et al. (2009) *JGR*, 114, E10002.

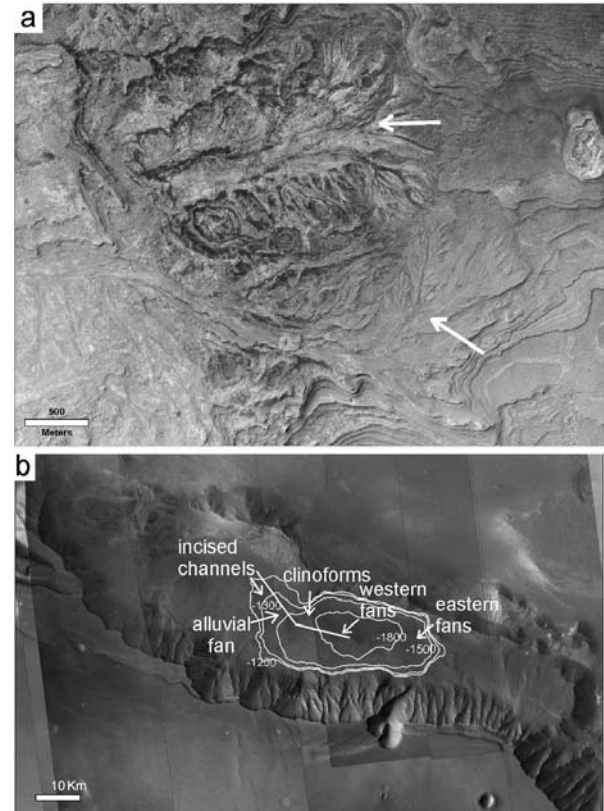


Fig 1. a.) Arrows highlight two depositional fans identified in southwest Melas Chasma which have been interpreted as sublacustrine fans. b.) Features of a source-to-sink system in a small basin in southwest Melas Chasma. The white line indicates the topographic profile shown in Fig. 2.

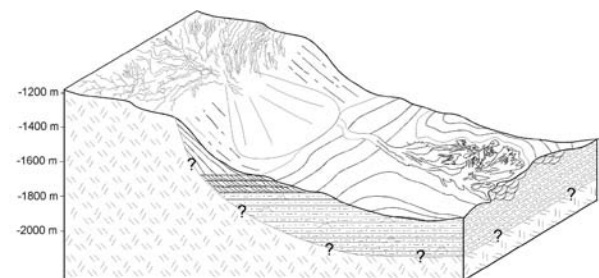


Fig. 2. Ideal schematic arrangement of environments including sublacustrine fans, clinoforms, alluvial fan and incised channels. Topography indicated by white line in Fig. 1b. The sublacustrine fans occur in the topographically lowest part of the basin and represent the terminal sediment sink.