

Geologic Stratigraphy, Delta Morphology, and Regional History of Hypanis Delta, Mars

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Hypanis is a large Noachian aged fan-shaped deposit that has been interpreted by many as being a delta in Xanthe Terra along the dichotomy boundary. The position of the putative delta at the edge of an open basin and its preserved morphology including potential access to bottomset beds had made Hypanis a compelling candidate future landing site for Mars 2020 and ExoMars. Its topographic location, without a clear local closed basin, may even imply a large northern sea. We further previous studies of Hypanis delta by 1) analyzing the stratigraphy of floor plains materials surrounding ancient deltaic deposits 2) conducting a survey of sedimentary bed strike and dip distribution, and 3) presenting a regional history model that includes a diversity of volcanic, sedimentary, tectonic, and impact processes identified. Hypanis delta has previously been dated at ~3.8 Ga based on crater counts in the Hypanis Valles catchment and previous fluvial system analysis estimates 150 km³ of sediment deposited. We utilize 17 HiRISE and 8 CTX DTMs to measure fluvial and stratigraphic quantities, a CTX 5 m/pixel mosaic basemap (USGS), and THEMIS day/night IR images. We determine map unit stratigraphy (relative ages) from superposition and cross cutting relationships supported in our 3D models. We discuss periods of subaqueous sedimentation, fluvial migration, volcanic resurfacing, and multiple periods of erosion throughout the study region to explain the observed morphologies and inferred geologic timeline.

Additional work focuses on newly discovered tectonic features prevalent in the low-lying plains unit. These ~2 m wide linear features suggest orthogonal jointing and relatively recent faulting. We assess whether these features could be related to the cooling of Hesperian lava plains or isostatic uplift from a removed glacier or eroded landmass.