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Characterization and interpretation of the fan-shaped and terrace-like features identified in Nepenthes Mensae, Mars

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Nepenthes Mensae is located in the eastern hemisphere of Mars, north of the Martian dichotomy (highland-lowland boundary), east of Isidis Planitia and southwest of the Elysium rise. This region, which was probably covered by the putative Oceanus Borealis in the past, is characterized by a chain of depressions with a knobby terrain of mesas, knobs and buttes, created by erosion of the Martian highlands. The highlands adjacent to Nepenthes Mensae are dissected by numerous channel networks, whose mouths are located along the dichotomy. A geomorphological analysis was carried out using CTX panchromatic images, a HRSC-derived DEM, and THEMIS-derived thermal inertia images (6 m, 50 m and 100 m in resolution, respectively) in a GIS environment in order to assess the possible presence of an ancient sea in the region, and its relation with the drainage basins. This analysis enabled the identification of eight fan-shaped features, seven of them described here for the first time, which were mapped in detail. These putative depositional landforms, which are located at the mouth of the channel networks, show low-gradient plains ($\sim$1 degrees) from 2 to 13 km across, steep fronts ($\sim$11 degrees) ranging between 10 m and 300 m in local relief, and similar thermal inertia values. In some cases, the fan plains are incised by small channels with an overall distributary pattern. Based on their morphological characteristics and spatial distribution, we interpret these landforms as relict Gilbert-type deltas. These putative deltas record the paleobase level of the drainage basins and the possible existence in the past of a stable, long-standing body of liquid water within the depressions in the region, as corroborated by the presence of hydrated minerals. On the other hand, the observation of numerous terrace-like features along the edges of the depressions, and around isolated massifs, may indicate the existence of relict coastal landforms attributable to the ancient sea. This ancient sea may have experienced a long-term water-level decline punctuated by periods of stability, as suggested by the development of the putative deltas and coastal landforms at different elevations, ranging between -1,186 m and -1,975 m, and -1,880 m and -2,150 m, respectively. Around 60% of these landforms occur between -1,900 m and -2,000 m, consistently with the inferred inner sea, which was disconnected from the Oceanus Borealis. Ongoing research on the described landforms and their relation with the distribution of hydrated minerals might shed light on the morphogenesis in the area and the paleohydrological evolution of this equatorial region of Mars.