MARTIAN SEDIMENTARY BASINS AND REGIONAL WATERSHEDS. R.A. De Hon, Department of Geosciences, University of Louisiana at Monroe, Monroe, LA 71209 <gedehon@ulm.edu>

Summary. Mars is divided into eleven regional-scale watersheds that feed low-lying regions as penultimate sedimentary traps. These closed, topographic basins served as major sedimentary provinces.

Background. Names of martian sedimentary provinces are derived from smooth, level plains which occupy the lowest portion of each topographic basins [1]. The Borealis Province is entirely within the northern lowlands. Elysium, Amazonis, Chryse, Isidis, and Aeolis Provinces straddle the martian highland–lowland boundary. Their watersheds drained highland terrains and fed into low-lying regions of the northen plains. Solis, Argye, Hellas, Icaria, and Australe Provinces are located entirely within the cratered highland region of the planet.

Paleolakes and Northern Ocean. The lowest portion of each basin received sediments from higher reaches of the watershed. At times water ponded to form lakes [2-7]. During extremely humid periods of martian history many basins fed by groundwater discharge, glacial melt water, or rainfall may have filled to capacity and developed open drainage to allow exchange from topographically high basins to lower ones. Extreme flooding also allowed adjacent paleolakes to coalesce as single bodies of water. During the maritime epoch [8-9] Amazonis, Chryse, Elysium, Aeolis, and Borealis basins were joined as one continuous northern ocean. Thus, the northern lowlands served as the ultimate destination for sediments shed from the highlands.

Most highland basins show evidence of some communication between higher basins and adjacent, lower basins. The high plateau of Solis Planum exhibits surface drainage eastward through Her Desher Vallis–Nirgal Vallis into the upper parts of the Chryse Basin [1] as well as discharge westward into Amazonis as proposed by Dohm et al. [10]. Likewise, the Argyre basin overflowed northward through Nirgal–Uzboi Valles [11] into the Ladon basin and Margaritifer Basin [12] and eventually into Chryse Planita. The various interconnected lowlands of Icaria Province probably spilled over the southern rim into Argyre [1] providing a continuous pathway from the southern polar region to the northern ocean.

No evidence has been found to establish a connection of Hellas to adjacent, lower watersheds, but Australe lowlands of the south-polar region probably communicate with Hellas through low portions of the southern Hellas rim. Thus, Hellas was probably a terminal basin for 10-15 % of the planet surface drainage..

Sedimentary Deposits. Except for poorly-resolved layering in the canyon walls, early studies could only speculate on the extent of stratification of the martian subsurface [13-14]. MOC images reveal layered materials, not only in the walls of canyons but on the canyon floors, the floors of craters, and within other topographically enclosed regions [15, 16]. Thus, a rich depositional stratigraphy is available from which to interpret martian geologic history on a scale comparable to that of the earth.

Each watershed was at one time a closed-basin of internal drainage. As such, sediments shed by overland flow were trapped in the lowest part of the basin. All eleven watersheds are marked by smooth plains at their lowest elevations representing sedimentary deposits. Most plains exhibit partially buried craters that attest to their origin by the deposition material that fills topographic low areas. The absence of partially buried craters in some parts of basins is evidence that the filling-material is thick enough to completely mask subjacent craters. The material of the basin floors is presumed to be fluvial and lacustrine sediments, but eolian processes probably contribute to the total fill in the basin. The possibility of volcanic material cannot be discounted.

Basins on the edge of the highlands are in positions to receive maximum sediment input. Large elevation differences provide high potential energy for the movement of surface debris from surrounding highlands to basin floors. Sediment deposition in these basins was sufficient to fill the original closed depression. Topographic closer is minor or absent in Chryse, Amazonis, and Aeolis basins. Late in their sedimentary history discharge into these basins was routed across the surface to dump into the adjacent downslope basin. Although current data does not allow unequivocal distinction between sedimentary strata, volcanic flows, or some combination of the two, seismic sounding in future missions could establish the thickness of fill and the original configuration of these basins.

Smaller topographic depressions within the regional provinces collected and retained sediment that was shed into them by local slopes. Many local

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basins existed as temporary paleolakes and sedimentary traps. Once filled, drainage traversed the filled basin to lower levels. These local traps may complicate interpretation of strata in the lower basins. Timing and sequence of delivery of materials to the lowest basin floor will involve unraveling the timing of opening and closure of intermediate reaches of the loosely integrated sediment dispersal system.

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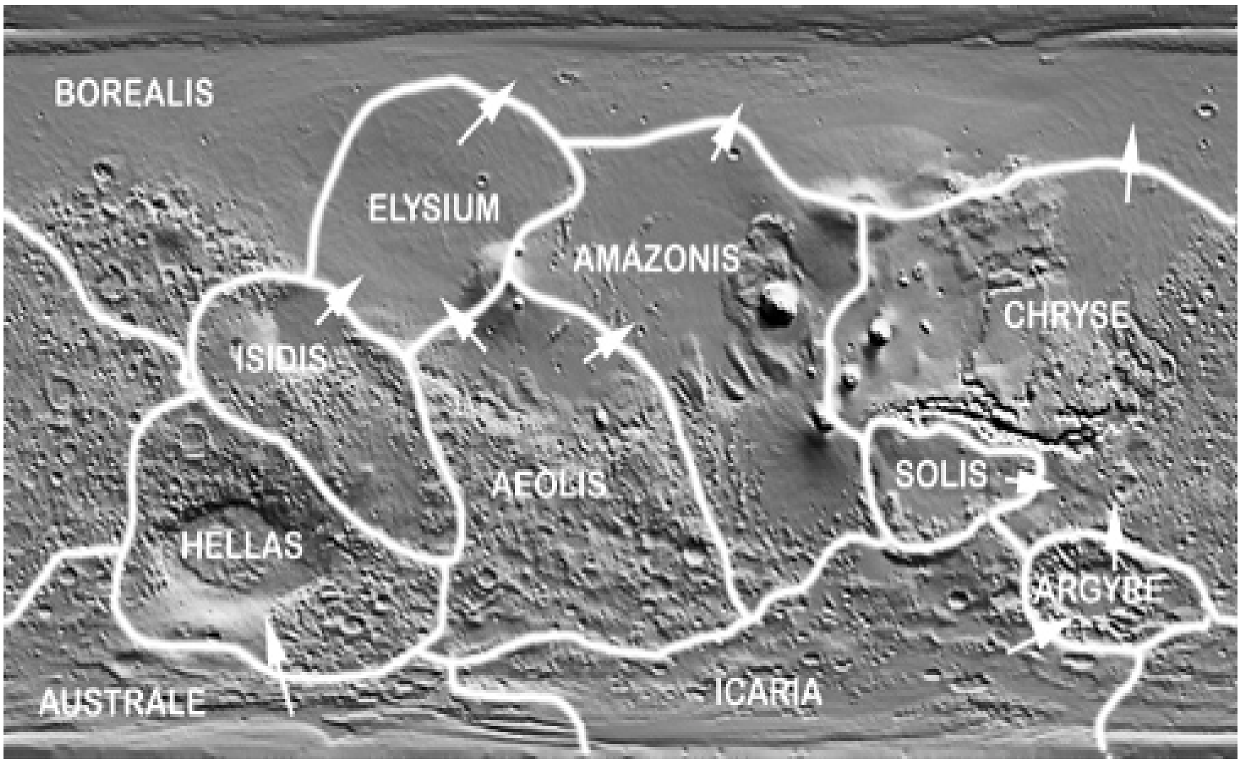

FIGURE 1. Sketch map of sedimentary provinces and potential pathways of exchange (arrows) between provinces. Each province contains a low-lying plain representing sedimentary deposition in the lowest part of the basin.