



**Figure 2.4** Swirling textures on the floor of Hellas at 40° S, 52° E. The textures suggest plastic deformation, the result possibly of slumping of waterlogged sediments or interaction between ice and the sediments (HIRISE).

drainage. If the observed degradation of craters superimposed on the rim was due to fluvial erosion, then most of the drainage was likely local with the water accumulating in local lows to be lost by infiltration or evaporation. Such a scenario is also consistent with the apparent failure to transport large amounts of sediment from the Hellas drainage basin into the central depression. The sediment eroded from the highs must simply have accumulated in local lows.

Whether there were ever oceans on Mars is one of the planet's most controversial issues (Carr and Head, 2002; Clifford and Parker, 2001; Head et al., 1999; Parker et al., 1989, 1993, see also Chapters 9 and 10). Discussion has focused mainly on the possibility of post-Noachian oceans because they could have resulted from the large post-Noachian floods discussed later and because any evidence for oceans would be better preserved for the post-Noachian than that for the Noachian. However, the Noachian is the time for which we have the best evidence for conditions under which oceans might be present. Clifford and Parker (2001) argue from estimates of the global inventory of water and the thermal conditions implied by the valley networks that possibly one-third of the planet was covered by oceans during parts of the Noachian. Moore and Wilhelms (2001) identify two possible Noachian shorelines within Hellas (see Chapter 7), and Howard et al. (2005) proposed that the absence of valleys in the Noachian of northwest Arabia resulted from burial by sediments, along the periphery of a northern ocean. Despite these suggestions, the prospect for finding compelling geomorphic evidence of former Noachian oceans is poor, since such