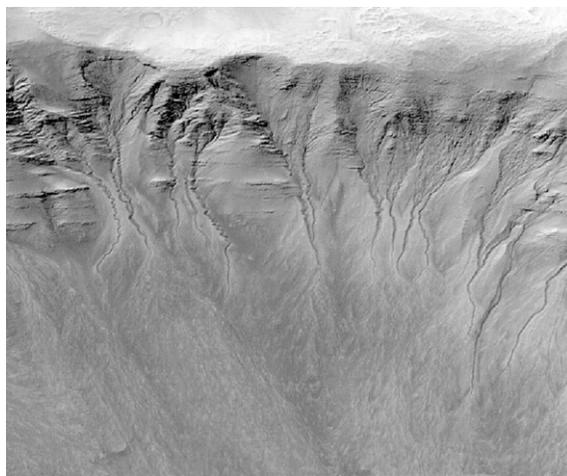


be discovered as high-resolution imaging accumulates. The most prominent examples of young outflow channels are the Athabasca, Grjota, Rahway, and Marte Valles in southeast Elysium. These have crater ages that range from 2 to 140 Myr, according to Burr et al. (2002), and some cut plains with crater ages of 10 Myr (Berman and Hartmann, 2002). All the young outflow channels start at fault-created fissures. If formed by water, they imply that in places liquid water is present at depth, below the cryosphere, and can be released to the surface by tectonic activity, even in the present epoch. They also imply the occasional presence of young lakes.

Very few demonstrably Amazonian valley networks have been identified. Unusually young valley networks occur in Melas Chasma and to the west of the south end of Echus Chasma (Mangold et al., 2004) and in the crater Lyot (Dickson et al., 2009). While the units they dissect are late Hesperian (2.9–3.4 billion years old), the valleys could be Amazonian. Similarly, some of the valleys on densely dissected volcanoes such as Ceraunius Tholus and Hecates Tholus could be Amazonian. However, the most prominent unambiguously Amazonian valley networks are on Alba Patera. The origin of these valleys is unclear. Some form hierarchical networks that resemble those formed by terrestrial drainage systems, but interspersed among such networks are channels that are clearly formed by lava, so that the role of precipitation in forming these valleys remains obscure. If formed by precipitation, then one possibility is that they formed by melting of ice deposits that accumulated during periods of high obliquity (Forget et al., 2006).

Gullies are by far the most common fluvial-like features that formed in the Amazonian (Figure 2.9). They typically consist of an upper theater-shaped alcove that tapers downslope to converge on one or more channels that extend further downslope to terminate in a debris fan (Malin and Edgett, 2000). They are mostly



**Figure 2.9** Gullies a few meters across in the south-facing wall of Newton crater at 41° S, 192° E. The gullies cut through several ledges and extend almost up to the crater rim (MOC).