short of the lowest terrestrial rates. Water-worn valley networks are common, but the best preserved valleys form an immature system that has had only a modest effect in shaping the landscape. The record suggests that warm, wet conditions necessary for fluvial activity were met only occasionally, such as might occur if caused by large impacts or volcanic eruptions. A major change occurred at the end of the Noachian. The rates of impact, valley formation, weathering, and erosion dropped precipitously. On the other hand, volcanism continued at a relatively high rate throughout the Hesperian, resulting in the resurfacing of at least 30% of the planet. Large floods formed episodically, possibly leaving behind large bodies of water. The canyons formed. The observations suggest the change at the end of the Noachian suppressed most aqueous activity at the surface other than large floods, and resulted in the growth of a thick cryosphere. However, the presence of discrete sulfate-rich deposits and sulfate concentrations in soils suggests that water activity did not decline to zero. After the end of the Hesperian around 3 Gyr ago the pace of geologic activity slowed further. The rate of volcanism during the Amazonian was roughly a factor of 10 lower than that in the Hesperian and confined largely to Tharsis and Elysium. The main era of flooding was over, although small floods appear to have occurred episodically until geologically recent times. Canyon development was largely restricted to the formation of large landslides. Erosion and weathering rates remained extremely low. The most distinctive characteristic of the Amazonian is the formation of features that have been attributed to the presence, accumulation, and movement of ice. Included are the polar layered deposits, glacial deposits on volcanoes, ice-rich veneers at high latitudes, and a variety of landforms in the 30–55^{o} latitude belts, including lobate debris aprons, lineated valley fill, and concentric crater fill. Most of the gullies on steep slopes also formed during this era. The rate of formation of the ice-related features and possibly the gullies probably varied as changes in obliquity affected the ice stability relations.

References

Acuna, M.H., Connerny, J.E., Ness, N.F., Lin, R.P., Mitchell, D., et al., 1999. Global distribution of crustal magnetization discovered by the Mars Global surveyor MAG/ER experiment. Science 284, 790–793.

Aharonson, O., Zuber, M.T., Rothman, D.H., 2001. Statistics of Mars' topography from the Mars Orbiter Laser Altimeter: Slopes, correlations, and physical models. J. Geophys. Res., 106 (E10), 23723–23735

Anderson, F.S., Grimm, R.E., 1998. Rift processes at the Valles Marineris Mars: Constraints from gravity on necking and rate-dependent strength evolution. J. Geophys. Res. 103, 11113–11124.

Andrews-Hanna, J.C., Phillips, R.J., 2007. Hydrological modeling of outflow channels and chaos regions. J. Geophys. Res. 112, E08001, doi:10.1029/2006JE002881.

Andrews-Hanna, J.C., Zuber, M.T., Banerdt, W.B., 2008. Global structure of the Martian dichotomy: An elliptical impact basin. LPSC XXXIX, Abstract 1980

Arvidson, R.E., Seelos, F.P., Deal, K.S., Koeppen, W.C., Snider, N.O., Kieniewicz, J.M., et al., 2003. Mantled and exhumed terrains in Terra Meridiani, Mars. J. Geophys. Res. 108, E12, doi:10.1029/2002JE001982.