

Nirgal Valles: New Evidence for an Ancient Sapping Network on Mars

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Previous studies of Nirgal Valles on Mars have indicated that this long, sinuous valley network most probably has a groundwater sapping origin, based upon area dissection; tributary number, length, and entry angles; and tributary head characteristics. Using the latest data from the Mars Global Surveyor spacecraft, this study lends support to this hypothesis by (1) providing high-resolution images of steep, alcove shaped tributary heads which lack any indication of a surface runoff connection, (2) providing a reason for the lack of fluvial channel indications in the bottom of the valley by showing their potential obscuration by mass-wasting and eolian debris fill, (3) confirming the general U-shaped valley profile for even the upper portions of the reach, as opposed to an expected V-shape for small tributaries from surface runoff, and (4) providing a longitudinal profile for the main channel of the valley network: indicating that the network did not increase its discharge rate with increasing distance down the reach (concave-up profile), but instead seems to exhibit a *decreasing* discharge rate with distance down the reach (concave-down profile). Anomalous local peaks in the profile seem to be the result of channel fill due to ~3.0 billion of years of canyon wall mass-wasting and eolian deposition evident in the valley, with no clear evidence for regional uplift along the reach of this network. Further investigation will be necessary to confirm (at higher resolution) the odd convex longitudinal profile for this channel and to see if other Martian valley networks share this as a common characteristic.

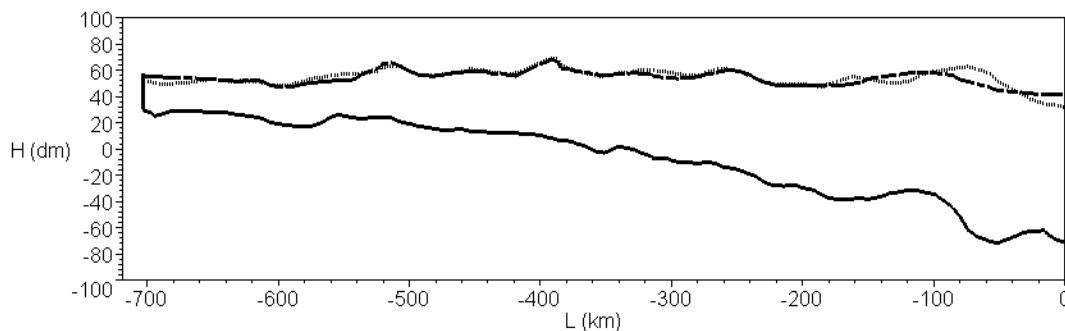
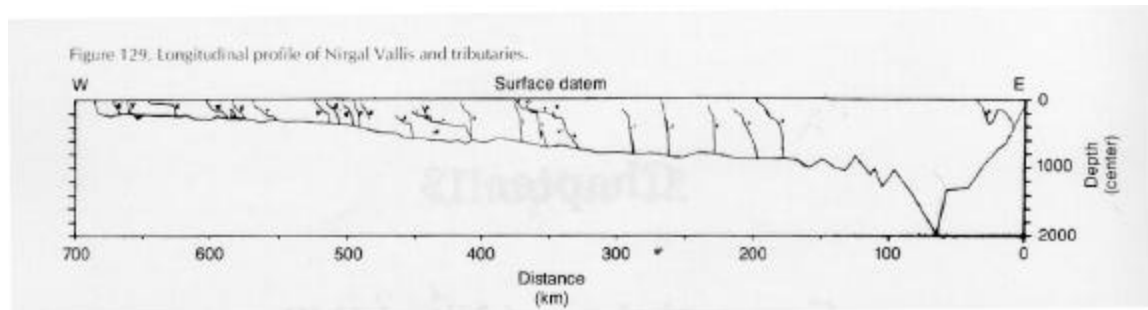


Figure: (top) An older (*Timothy Parker, 1988*) longitudinal profile for Nirgal Valles produced by measuring shadows in the valley floor (70 data points) from Viking images. (bottom) The longitudinal profile for the Nirgal Valles main channel produced by this study (150 MOLA data points), plotted along with the height of the surrounding terrain (canyon walls: dot=north, dash=south) -- vertical exaggeration = 100:1. Note the concave-down (convex) trend of the profile.