MORPHOMETRY OF SMALL VALLEY NETWORKS ON MARS. Victor R. Baker* and John B. Partridge, Department of Geosciences, University of Arizona, Tucson, AZ 85721. *Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ 85721.

Twenty-four small valley networks were selected from tne near equatorial belt of Martian heavily cratered terrain, between latitudes 35°S and 20°N, and between longitudes 30°W and 180°E. Many networks included both pristine and degraded segments (1). The study networks were selected from areas previously mapped as showing the densest valley network populations on the planet (2). Total lengths of the networks varied from 690 to 2840 km. The complete networks, including both pristine and degraded segments, show a very consistent relationship between basin magnitude M and network length $L_T$, as follows

$$M = 0.034\ L_T + 4.9.$$

The regression line (Figure 1) has r = 0.94, and the relationship shows that each first order tributary head maintains about 30 km of valley length. This is far less than observed in terrestrial networks, which typically show 0.1 to 0.2 km of channel per first-order stream source, according to data in Patton and Baker (3). However, magnitude is highly dependent on basin scale, image resolution, and terrain relief (4). The data are only relevant for comparison in the Martian geomorphic setting.

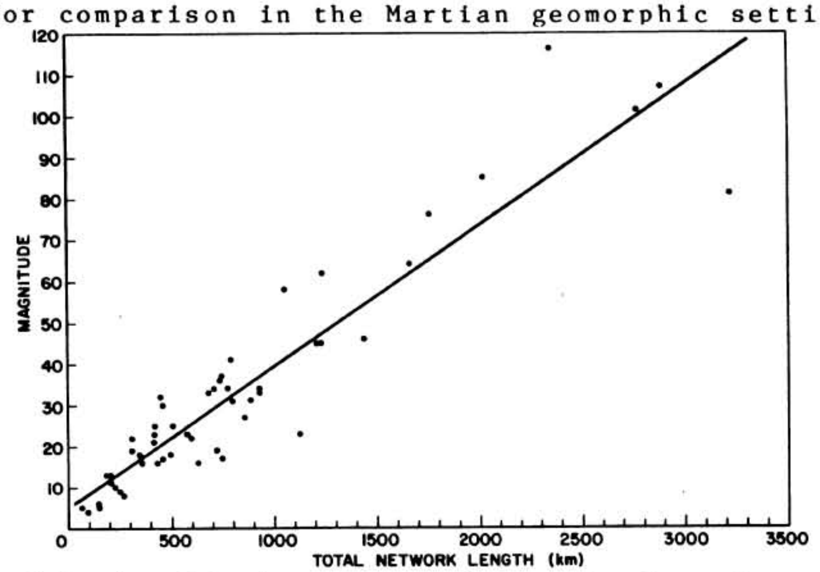


Figure 1. Relationship between basin magnitude and network length for small valley network systems on Mars.

The magnitude versus length relationship reflects the extremely low density of Martian small valley networks. While this is qualitatively obvious for Martian networks (5), drainage density has proven very difficult to quantify for Martian networks for the following reasons: (a) the scale and resolution of the available imagery does not permit network delineation in a manner that is both consistent planet-wide and also comparable to terrestrial data bases, and (b) so much undissected terrain exists between Martian networks that drainage divides cannot be accurately determined. Utilizing the method of Kochel *et al.* (6) we used the headward extent of tributaries to arbitrarily define drainage basin areas. Because this method ignores undissected surfaces between tributaries, it does not yield high variability for pristine versus degraded networks. Drainage densities typically range from 0.23 $km/km^2$ for pristine networks to 0.29 $km/km^2$ for degraded networks (Figure 2).

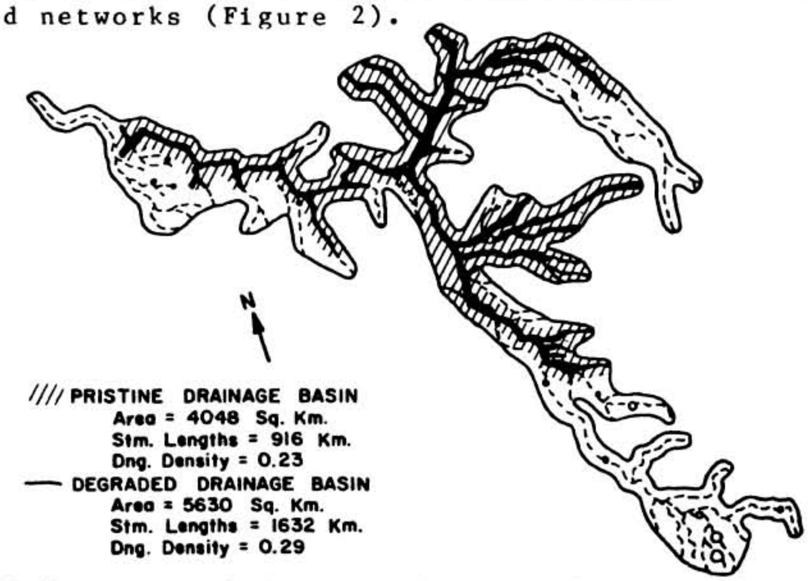


Figure 2. Definition of drainage basin and measured parameters for a typical small valley network.

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