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Evolution of valleys width : A Mars-Earth comparison

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The analyses of the valleys on Mars are used to reconstruct the climate on Early Mars ($\sim$ 3.5 Gy). Thus, many studies indicate a strong analogy between earth and mars networks (dendritic organization, drainage density Strahler ordering) which is compatible with a widespread rain (today Mars is arid, cold and the water can only be vapor/snow). But, many features are too different with the Earth classic valleys networks to conclude definitively on the Early climate of Mars.

Here, we study the evolution of the width of valleys with drainage area. This method lies on the relationship between the evolution of the channel width (W) versus the discharge of the river or the upstream drainage area (A) such as $W_c = bA^{0.5}$ (e.g *Leopold and Maddock, 1953; Montgomery and Gran, 2001*). On Mars, one of the difficulties is to plot the width of the channel but recent studies on Mars and on Earth indicate that the valley bottom width W_v strictly follows the same evolution than the channel width (e.g. *Mattheus and Rodriguez 2011, Phillips, 2011*).

Thereby, we analyzed 366 basins on Earth from 4.10^{-02} to 6.10^{06} km^2 and 355 basins on Mars from 7.10^{-02} to $2.8.10^{06}$ km^2. For Earth $W_v = bA^{0.46}$ with $0.005 < b < 0.047$. For Mars $W_v = bA^{0.27}$ with $0.046 < b < 0.19$. Martian valleys are ten times wider for small tributaries (< 100 km^2) but ten times smaller for large tributaries $>$100.000 km^2).

Our observations are compatible with an inefficient system with strong supply of water, on small systems, which is less and less transmitted at the outlet, on large systems. The origins of this inefficiency will be discussed.

Leopold, L. B. and T. Maddock (1953). The hydraulic geometry of stream channels and some physiographic implications. United States Geological Survey Professional Paper.

Montgomery, D. R. and K. B. Gran (2001). "Downstream Variations in the Width of Bedrock Channels." Water Resour. Res.

Jonathan D. Phillips (2011): Drainage area and incised valley fills in Texas rivers: A potential explanation. Sed. Geol.

Mattheus and Rodriguez (2011) Controls on late Quaternary incised-valley dimension along passive margins evaluated using empirical data. Sedimentology.