



Branching geometry of valley networks on Mars and Earth and its implications for early Martian climate

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Mars' surface bears the imprint of valley networks formed billions of years ago and their relicts can still be observed today. However, whether these networks were formed by groundwater sapping, ice melt, or fluvial runoff has been continuously debated. These different scenarios have profoundly different implications for Mars' climatic history, and thus for its habitability in the distant past. Recent studies on Earth revealed that channel networks in arid landscapes with more surface runoff branch at narrower angles, while in humid environments with more groundwater flow, branching angles are much wider. We find that valley networks on Mars generally tend to branch at narrow angles similar to those found in arid landscapes on Earth. This result supports the inference that Mars once had an active hydrologic cycle and that Mars' valley networks were formed primarily by overland flow erosion with groundwater seepage playing only a minor role.