

## Megafloods versus groundwater seepage for the formation of Martian canyons?

Contact persons: at least 2 supervisors

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### Context

The Martian surface is dissected by hundreds if not thousands of canyons that are characterized by amphitheater-headed segments. These canyons on Earth have long been used as a diagnostic indication of carving by groundwater seepage (Howard and McLane, 1988). Recent investigations, however, have suggested that megafloods were responsible for creating such canyons (Lamb et al., 2008; 2014). Whether by groundwater seepage or catastrophic flooding, these processes are critical for understanding landscape evolution and the search for early Mars life.

### Objectives and Methods

This project aims to test the hypothesis of groundwater seepage versus megafloods on two terrestrial sites in the Apulia region, Italy, where groundwater seepage carved the canyons in sandstone and Ásbyrgi Canyon, Iceland due to large floods in volcanic terrain. The primary goals of this project are: 1) estimating the canyon-forming discharge and 2) attempting to set up geomorphic criteria to distinguish Mars canyons that were formed by groundwater seepage versus those formed by megafloods from orbiter data. The investigation will rely primarily on canyon-scale morphological and sedimentological analyses via traditional field and remotely sensed methods, including surveying canyon cross-section and grain size (D50). Furthermore, plan-view images will be acquired by Unmanned Aerial Vehicles (UAV).

### Literature

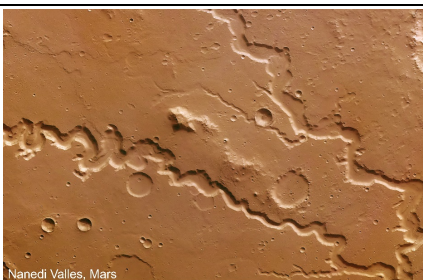
Howard, A. D., & McLane, C. F. (1988). Erosion of cohesionless sediment by groundwater seepage. *Water Resources Research*, 24(10), 1659–1674. <https://doi.org/10.1029/wr024i010p01659>

Lamb, M. P., Dietrich, W. E., Aciego, S. M., DePaolo, D. J., & Manga, M. (2008). Formation of Box Canyon, Idaho, by Megaflood: Implications for Seepage Erosion on Earth and Mars. *Science*, 320(5879), 1067–1070.

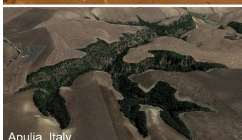
<https://doi.org/10.1126/science.1156630>

Lamb, M. P., Mackey, B. H., & Farley, K. A. (2013). Amphitheater-headed canyons formed by megaflooding at Malad Gorge, Idaho. *Proceedings of the National Academy of Sciences*, 111(1), 57–62.

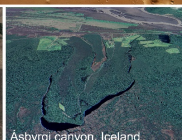
<https://doi.org/10.1073/pnas.1312251111>



Nandedi Valles, Mars



Apulia, Italy



Ásbyrgi canyon, Iceland

### WEB sites



ECOLE LEMANIQUE DES SCIENCES DE LA TERRE  
DES UNIVERSITÉS DE GENÈVE ET DE LAUSANNE

Master ès Sciences in  
Earth sciences

**Choice of orientation : (supprimer les orientations qui ne conviendraient pas)**  
Sedimentary, Environmental and Reservoir Geology