

Analogical modeling of glacial processes and their effects on the morphology of mountain ranges

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Context

[FR] Les Glaciations du Pléistocène ont joué un rôle fondamental dans l'évolution topographique et biogéographique des chaînes de montagne aux moyennes et hautes-latitudes. Les processus glaciaires sculptent les paysages de montagne en créant des morphologies dites typiques telles que "vallées en U, vallées perchées et surcreusements" (e.g., Harbor et al., 1988; Preusser et al., 2010; Sternai et al., 2013), mais la dynamique de transformation d'un paysage glaciaire en paysage fluvial et vice-versa reste très mal comprise et ouvre de nombreuses questions sur l'évolution topographique des reliefs glaciaires.

[EN] Pleistocene glaciations played a fundamental role in the evolution of high-elevation and mid- to high-latitude mountain ranges on Earth. Although glacial processes affect the landscape evolution by producing conspicuous morphologies such as "U"-shaped, steep-sided, hanging and over-deepened valleys (e.g., Harbor et al., 1988; Preusser et al., 2010; Sternai et al., 2013), the physics of the transformation of a landform from a fluvial to a glacial state is very elusive and significant questions about the overall effects of glacial erosion on the topographic evolution of a mountain range are still open.

Objectives and Methods

[FR] Ce projet a pour objet d'élaborer des expériences de simulation des processus glaciaires en laboratoire. Différents matériaux seront testés, tels que margarine et argile pour la glace et le socle rocheux, respectivement. L'accent est mis sur la compréhension du mécanisme de formation des vallées en U et notamment du passage de vallée fluviale en V à vallée glaciaire en U. Des modélisations numériques compléteront l'étude en permettant l'exploration large de l'espace des paramètres importants et la comparaison avec les données topographiques et thermochronologiques des Alpes et autres chaînes de montagne englacées. Ces expériences sont inédites, et demandent donc une capacité créative et beaucoup d'ouverture d'esprit.

[EN] This project aims at elucidating the physics of glacial reshaping of a fluvial valley. To this objective, analogue models of glacial processes will be performed using, for instance, margarine and clay as analogue materials for ice and bedrock, respectively. The focus is put on the shift from fluvial "V"-shaped to glacial "U"-shaped valley and the formation of overdeepenings. Analogue models may be integrated by numerical investigations using state-of-the-art numerical models and results will be compared to the present-day morphology and available geochronologic records from the Alps and other glaciated ranges worldwide. We remark that the use of analogue models for reproducing and investigating the formation and evolution of glacial landforms is an absolute novelty, so problem solving skills and lateral thinking are desirable.

Literature

- Harbor, J.M., Hallet, B., Raymond, C.F., 1988. A numerical model of landform development by glacial erosion. *Nature* 333, 347–349.
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- Sternai, P., Herman, F., Valla, P. G., & Champagnac, J. D. (2013). Spatial and temporal variations of glacial erosion in the Rhône valley (Swiss Alps): insights from numerical modeling. *Earth and Planetary Science Letters*, 368, 119-131.



WEB sites

<https://sites.google.com/site/pietrosternai1/home>

Choice of orientation: Sedimentary, Environmental Geology / Alpine tectonics