

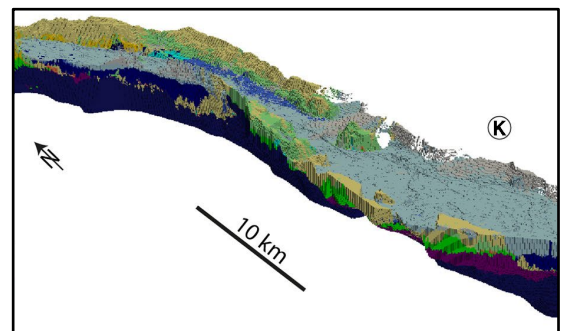
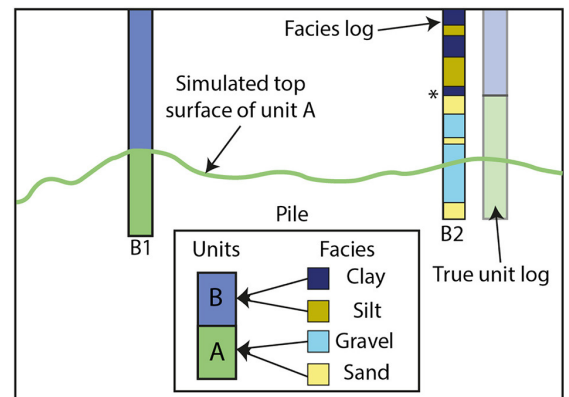
## From boreholes observations to 3D geological models of quaternary formations in the canton of Vaud

### Context and objectives

3D geological models are increasingly used by scientists, public authorities or private companies for a broad range of applications including drinking water supply, geothermal energy, or civil engineering. Recent developments in automated, open-source packages such as [ArchPy](#), have demonstrated the benefits of using these tools in combination with open-access databases.

The construction of such models requires borehole data containing consistent geological information. However, borehole data are often incomplete. While it is relatively easy to describe a borehole in terms of its lithology, it is much harder to have the same level of detail on the stratigraphy while it is required for many geomodelling algorithms. To circumvent this lack of data, one can infer stratigraphical information from existing data using statistical learning algorithms.

The objective of this master is to explore and test these methods to extract information from geological logs, infer stratigraphy in boreholes and subsequently integrate it into geological models. This research will be conducted using open data from the Canton of Vaud.



### Methodology

The work involves coding in Python and getting familiar with statistical learning libraries (Scikit-learn, Pytorch). The student will not start from scratch as our team has already developed prototypes that gave decent results but could be improved. In particular, the student will compile a list of algorithms and Deep Learning network architectures to test, determine the pros and cons of each method, as well as their limitations. The most promising algorithms will be tested on different datasets to verify the scalability of the approach. If time permits, the impact on groundwater predictions of using newly generated boreholes to refine existing geological models will be investigated.

**Bibliography:** Schorpp, L., Straubhaar, J., & Renard, P. (2024). From lithological descriptions to geological models: an example from the Upper Aare Valley. *Frontiers in Applied Mathematics and Statistics*, 10, 1441596. [link](#)

### Supervision and collaboration

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