Université de Neuchâtel
Centre d'hydrogéologie et géothermie

MSc in Hydrogeology and Geothermics

Thesis topic proposal 2026

Temperature sensitivity of carbon cycling and priming effects in iron-rich organic soils

Context and objectives

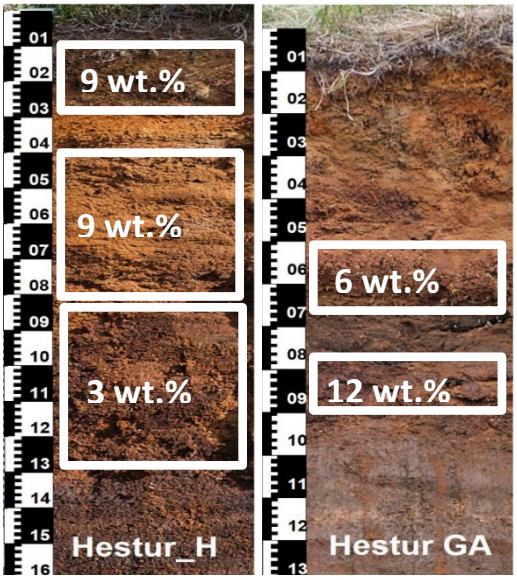

Figure 1. Examples of iron-rich organic soil profiles sampled from the volcanic-influenced soils of Iceland. These soils regularly undergo flooding, due to common and intense precipitation events.

Soils store vast amounts of carbon, but the stability of this carbon is highly sensitive to soil moisture, temperature and mineral interactions. In flooded soils, iron minerals play a crucial role in protecting organic matter from decomposition, yet soil warming may alter these protective mechanisms and stimulate microbial CO_2 production. Further, the addition of fresh carbon substrates may lead to increased microbial activity (priming effects). This MSc project will explore how temperature affects carbon mineralization dynamics in an iron- and carbon-rich soil through a controlled soil incubation experiment. By tracking CO_2 release and quantifying the priming effect across different temperatures, the study will reveal how microbial processes respond to changing temperature conditions. The results will contribute to a better understanding of soil carbon–iron interactions under climate change.

Methodology

This project will involve designing anoxic soil incubations at different controlled temperatures (1°C to 30°C). Headspace gases will be regularly sampled for CO_2 and CH_4 emissions. In addition, you will analyze trends in porewater geochemistry (redox potential, pH, dissolved Fe, dissolved organic carbon), and at the end of the experiment, selective chemical extractions will assess changes in the iron mineralogy of the soil. All samples will be analyzed in the Environmental Chemistry laboratory at UNINE.

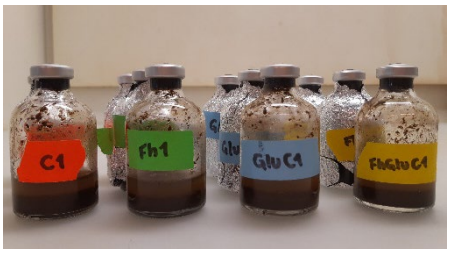

Figure 2. Examples of anoxic soil incubation bottles.

Literature:

ThomasArrigo et al. (2023) *Environ. Sci. Technol*, 57, 9204-9213, ThomasArrigo and Kretzschmar (2022) *Geoderma*, 428, 116217

Supervision and collaboration

The project will be supervised by Prof. Laurel ThomasArrigo and a Postdoc/PhD student in the Environmental Chemistry group (to be determined)

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