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From Arctic Fieldwork to the Classroom: Translating Permafrost Biogeochemistry into Climate Education

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Arctic is warming nearly four times faster than the global average, with major consequences for permafrost (i.e., perennially frozen ground) biogeochemistry. As a result, thawing permafrost releases previously frozen soil carbon as greenhouse gases, with the permafrost carbon feedback estimated at 120 ± 85 Gt C by 2100. As a PhD student in permafrost biogeochemistry in Belgium, I use geochemical tracers, including silicon isotopes, to investigate freeze–thaw processes in permafrost soils and quantify carbon exported from thawing ground.

Beyond investigating these mechanisms, I considered it essential to communicate these findings to a broader audience and to raise awareness of Arctic climate change and its global implications. As a result, I conducted outreach activities including public talks and photo exhibitions based on four field campaigns in Alaska and Lapland. This experience has evolved into a structured outreach program in schools, with workshops combining field photos, simplified process-based explanations, and analogies to illustrate biogeochemical processes occurring in Arctic soils. To date, more than 25 workshops have been delivered in primary and secondary schools (~700 students, ages 6–18), including in socio-economically disadvantaged areas of Belgium.

Through this outreach work, I developed strategies for effective science communication. The workshops pursue several objectives: introducing young audiences to scientific careers, sharing lab and Arctic field experiences, and explaining why permafrost research matters beyond polar regions. By linking permafrost thaw to greenhouse gas emissions that affect the global climate system, Belgian students better understand why Arctic processes are directly relevant to their own lives.

A key challenge in climate outreach with young audiences is to avoid triggering eco-anxiety. The workshops therefore combine scientific explanations with visual immersion in Arctic landscapes, fostering emotional connection, curiosity, and a sense of care rather than fear. Particular attention is given to schools in socio-economically disadvantaged areas, where access to scientific resources and climate education may be more limited. This contribution highlights how geochemistry-based research can serve as a powerful foundation for meaningful and inclusive climate outreach.

Beyond schools, these workshops gained national visibility through coverage on Belgian prime-time TV (RTL 19h; >320,000 viewers).