



HAL
open science

Metal and organic matter dynamics in permafrost environments

Yannick Agnan, Marie Alexis, Romain Courault, Marianne Cohen, Tony Zanardo, Margaux Sauvage, A. Kohli, L. Pinta, Maryse Castrec-Rouelle

► **To cite this version:**

Yannick Agnan, Marie Alexis, Romain Courault, Marianne Cohen, Tony Zanardo, et al.. Metal and organic matter dynamics in permafrost environments. Arctic Week 2019 - Ministère de l'Europe et des Affaires Etrangères, Dec 2019, Paris, France. hal-02428601

HAL Id: hal-02428601

<https://hal.science/hal-02428601>

Submitted on 9 Jan 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



"Metal and organic matter dynamics in permafrost environments"

Agnan, Yannick ; Alexis M.A ; Courault R ; Cohen M ;
Zanardo T ; Sauvage M ; Kohli A ; Pinta L ; Castrec-Rouelle M

CITE THIS VERSION

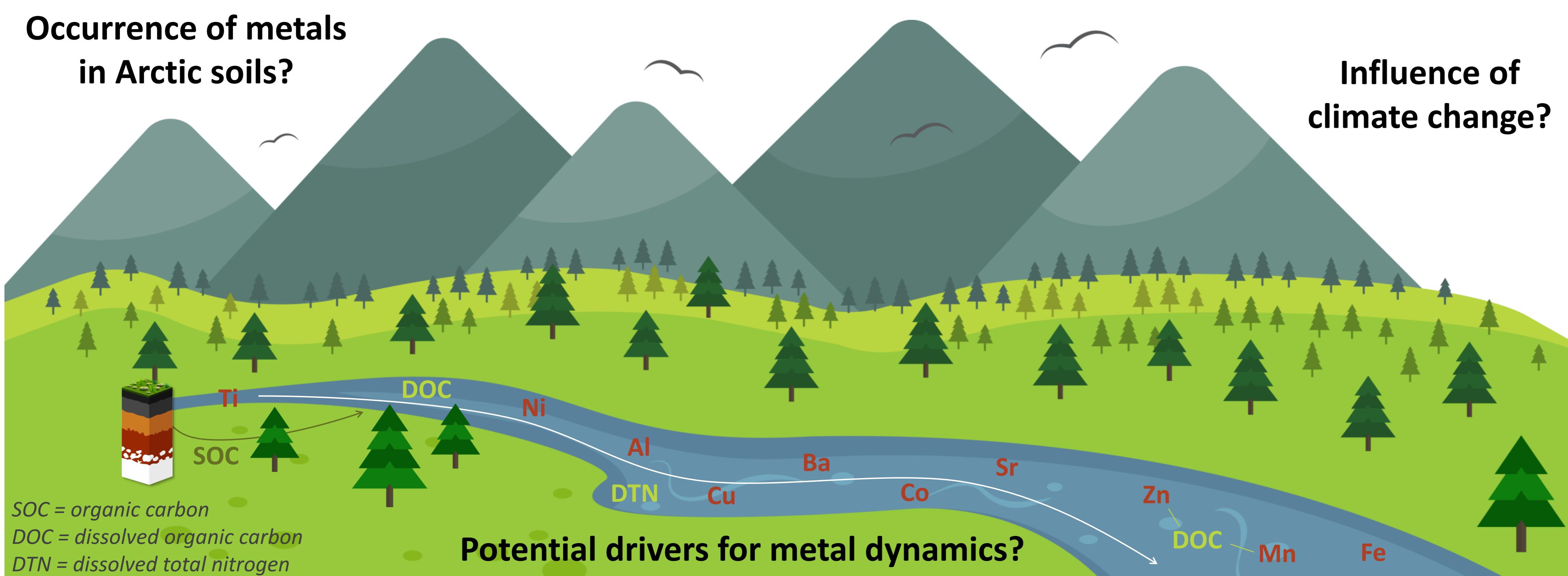
Agnan, Yannick ; Alexis M.A ; Courault R ; Cohen M ; Zanardo T ; et. al. *Metal and organic matter dynamics in permafrost environments*. Artic Week (Paris, France, du 09/12/2019 au 13/12/2019). <http://hdl.handle.net/2078.1/224188>

Le dépôt institutionnel DIAL est destiné au dépôt et à la diffusion de documents scientifiques émanants des membres de l'UCLouvain. Toute utilisation de ce document à des fins lucratives ou commerciales est strictement interdite. L'utilisateur s'engage à respecter les droits d'auteur liés à ce document, principalement le droit à l'intégrité de l'œuvre et le droit à la paternité. La politique complète de copyright est disponible sur la page [Copyright policy](#)

DIAL is an institutional repository for the deposit and dissemination of scientific documents from UCLouvain members. Usage of this document for profit or commercial purposes is strictly prohibited. User agrees to respect copyright about this document, mainly text integrity and source mention. Full content of copyright policy is available at [Copyright policy](#)

Occurrence of metals in Arctic soils?

Influence of climate change?



CONTEXT

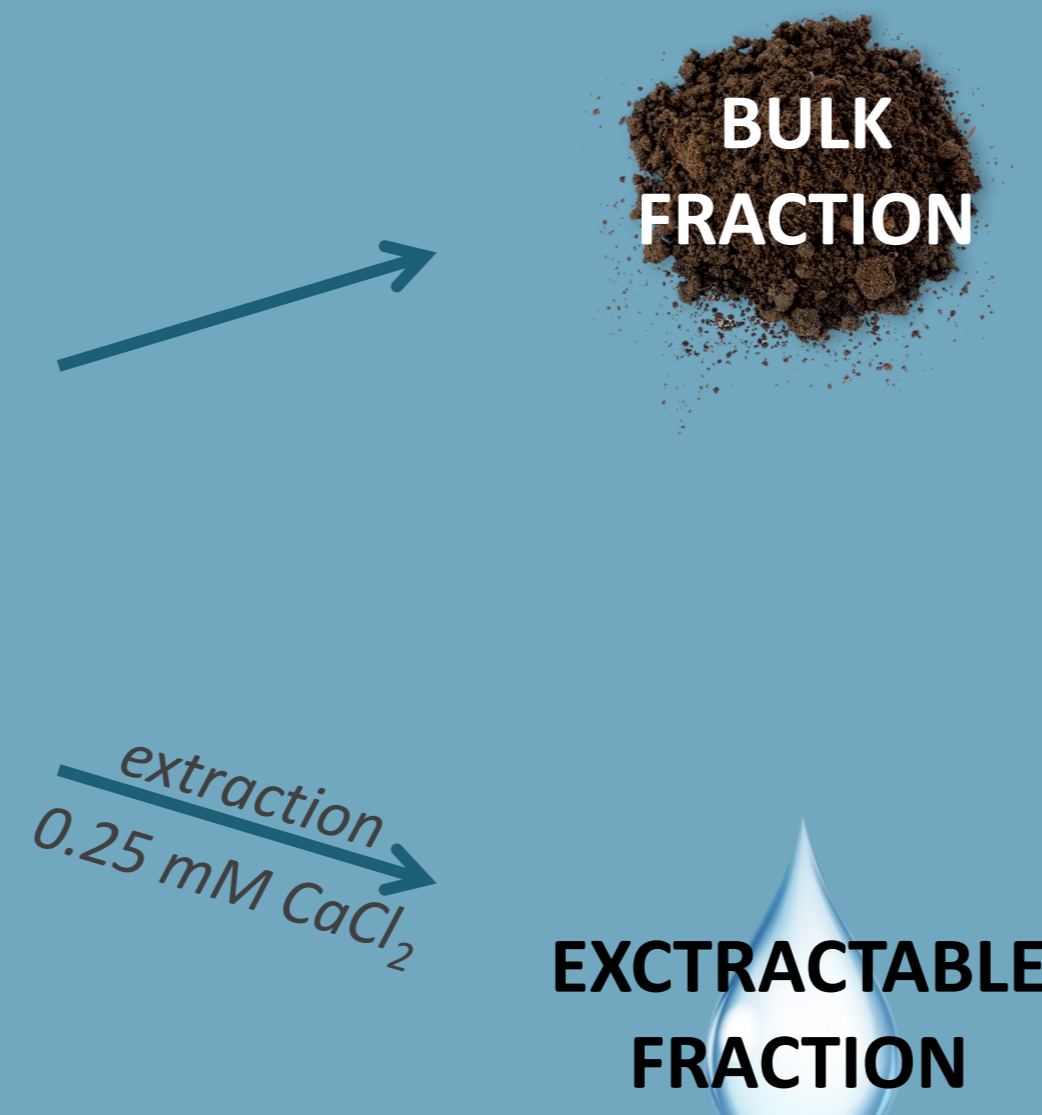
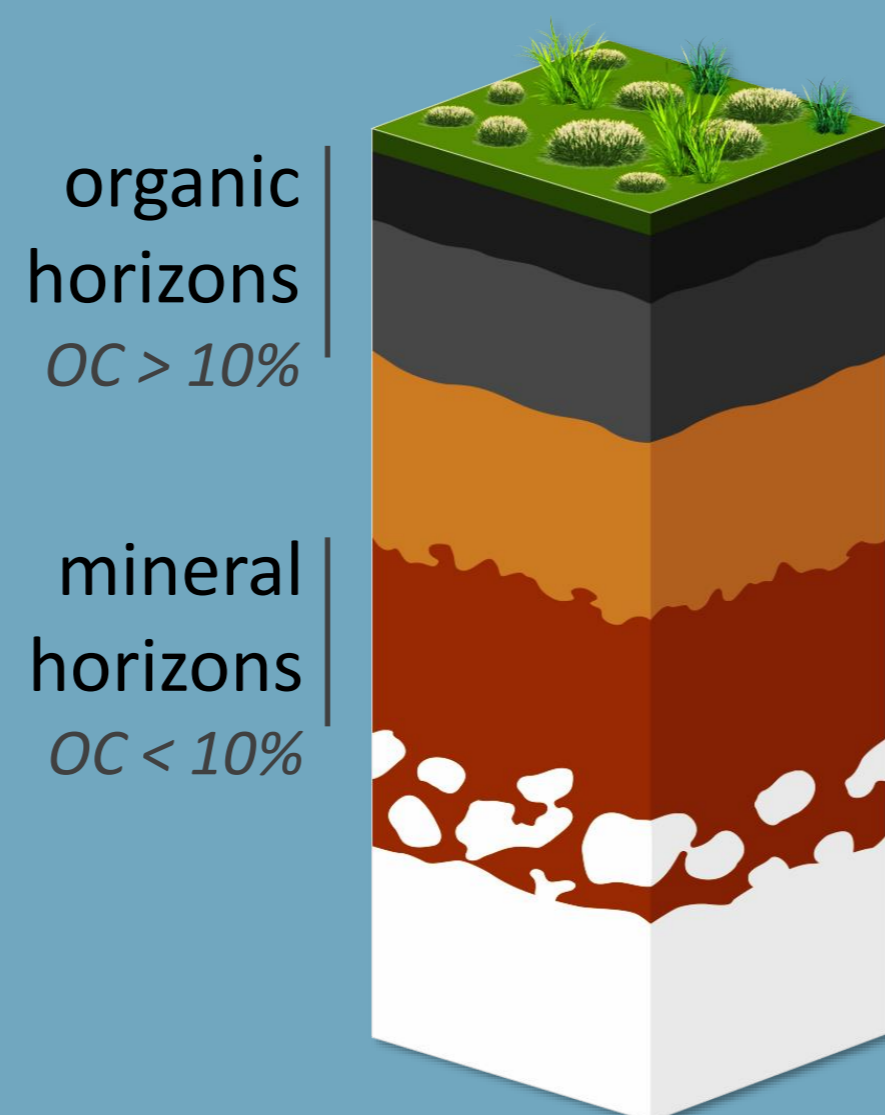
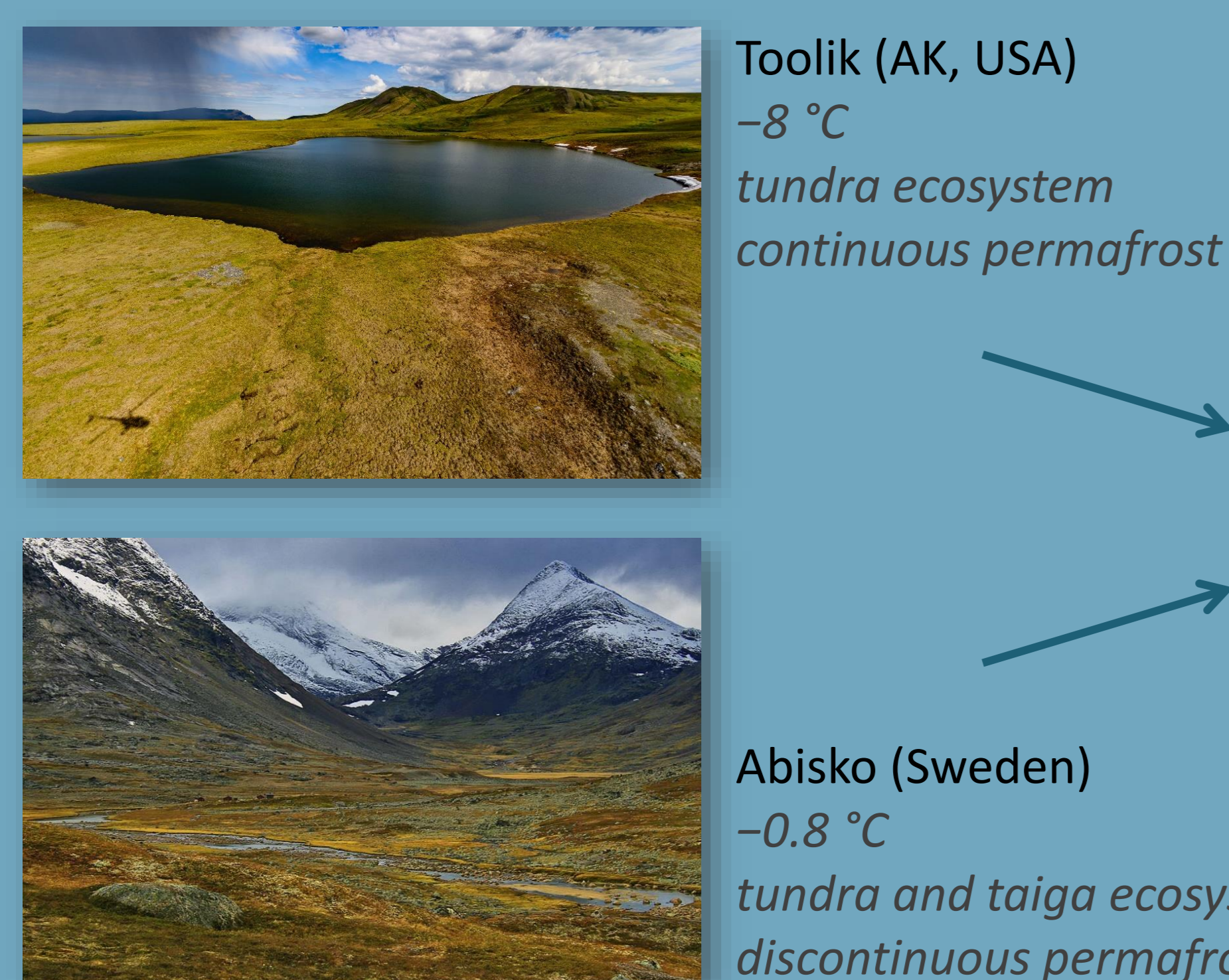
MATERIALS & METHODS

RESULTS & DISCUSSIONS

Comparison of two study areas

Sampling and sample preparation

Chemical analysis



- Metals: XRF / ICP-OES / ICP-MS
- Organic matter: EA (C and N), ¹³C NMR
- Metals: ICP-OES / ICP-MS
- Organic matter (DOC and DTN): DOC analyzer
- pH_{CaCl2}

BULK FRACTION

- Mineral soil horizons show higher metal concentrations than organic ones. Differences between Abisko and Toolik in mineral soil horizons result from distinct lithologies (Fig. 1).
- Concentrations do not show the same patterns between the two study areas in both horizons, indicating various inputs and dynamics of metals.

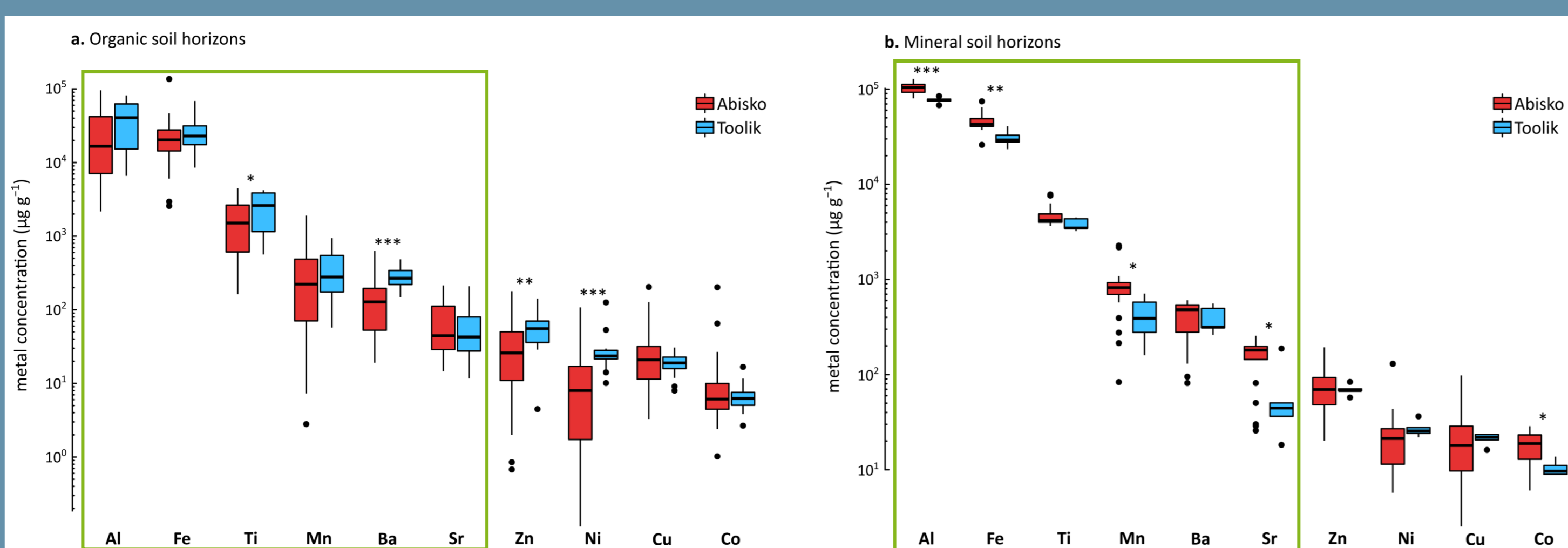


Fig. 1. Metal concentrations in organic (a) and mineral (b) soil horizons. *p < 0.05, **p < 0.01, ***p < 0.001.

EXTRACTABLE FRACTION

- Extractability of metals ranged from <0.01 to >10% of soil total metal concentrations according to the considered soil horizon and metal (Fig. 2): extractability is higher in the organic soil horizons.
- Differences between Abisko and Toolik appeared for aluminum, titanium, and barium, indicating different transfer processes involved.

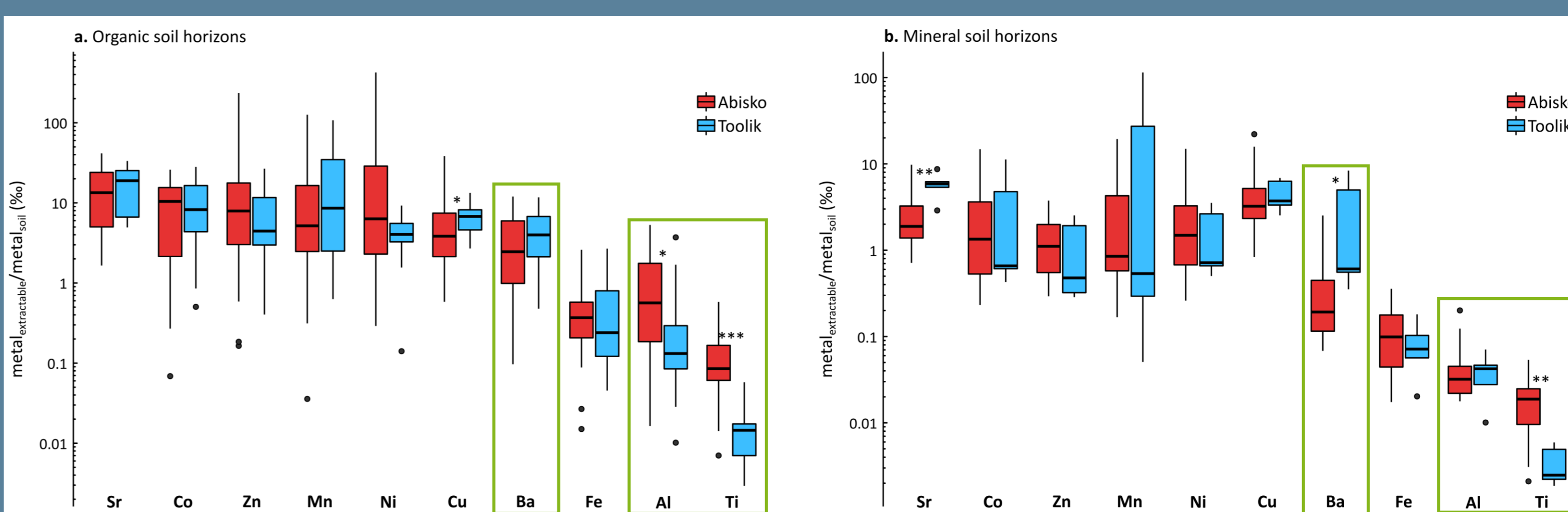


Fig. 2. Ratios between extractable and soil concentrations for each metal in organic (a) and mineral (b) soil horizons. *p < 0.05, **p < 0.01, ***p < 0.001

ENVIRONMENTAL CONTROL

- DOC production is related to SOC quality based on distinct decomposition degrees (Fig. 3a) and likely on different decomposition processes (Fig. 3b).
- As illustrated for aluminum and titanium, metal extractability is directly related to SOC extractability (Fig. 4).
- Metal extractability is also related to either soil pH (aluminum) or study area characteristics (titanium) such as climate or permafrost conditions.

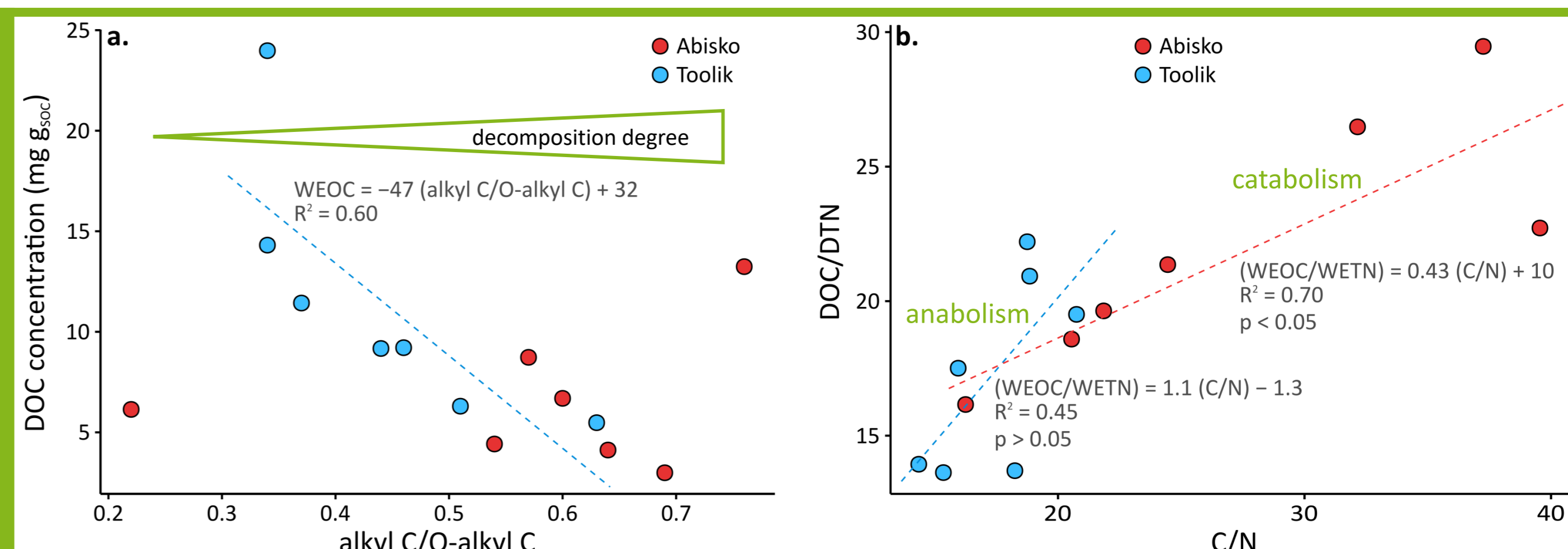
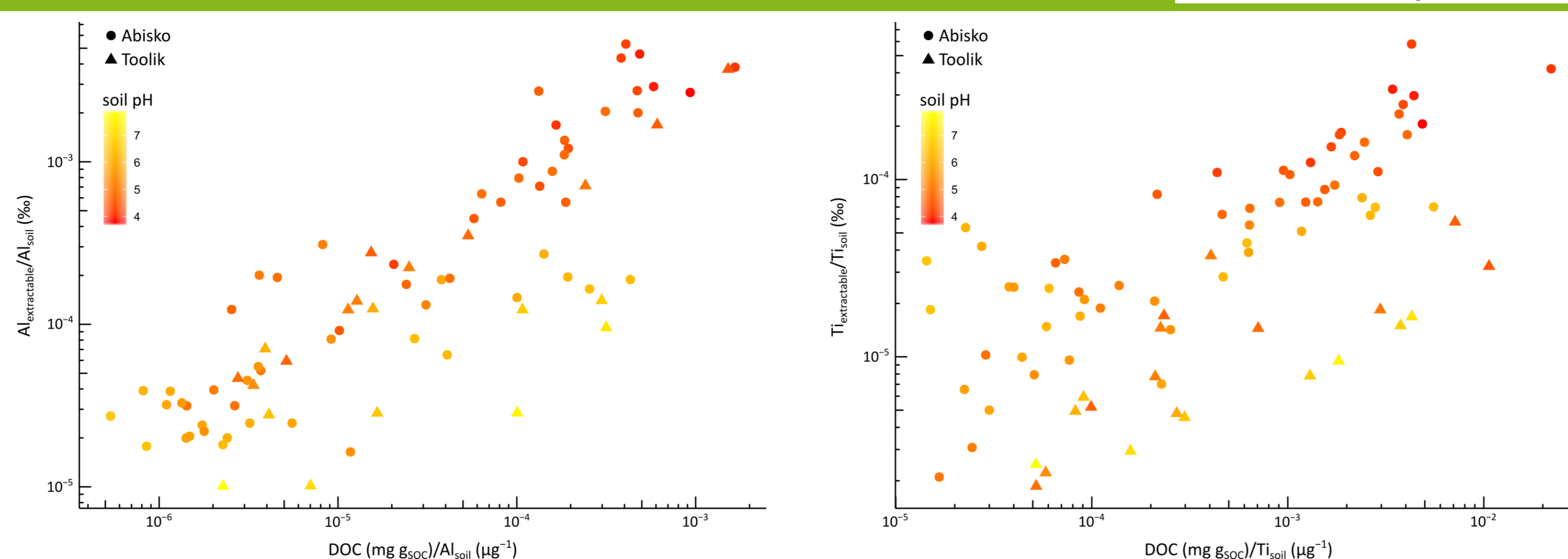


Fig. 3. SOC quality: DOC concentration as a function of SOC composition (a) and DOC/DTN as a function of C/N (b).

Fig. 4. Aluminum and titanium extractability as a function of DOC quantity according to soil pH_{CaCl2} (color scale) and study area (shapes).



Acknowledgements

We thank ENVEXX team (Sorbonne Université), C. Olson, and M. Jiskra for sampling support and C. Anquetil, E. Aubry, A. Guittet, and B. Rigaud for analytical support. We also thank D. Obrist for sharing the Toolik soil samples.

Sampling was funded by a Sorbonne Université (ENVEXX) award for Abisko and by U.S. NSF awards (OPP1739567 and OPP1304305) for Toolik. The analytical founding was provided by METIS.

Contact

yannick.agnan@biogeochimie.fr
marie.alexis@sorbonne-universite.fr