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► To cite this version:

Benjamin Cancès, Marie Ponthieu, Mathilde Rebiffé, Pascale Ruffaldi, Vincent Robin, et al.. Geochemical and palynological analysis of peatlands of the Bitche military camp (Moselle, France). International Symposium of LabEx DRIIHM 2022, Jun 2022, Nantes, France. , 2022, 10.34972/driihm-4a1c5f . hal-03716545

HAL Id: hal-03716545

<https://hal.science/hal-03716545>

Submitted on 18 Jul 2022

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Geochemical and palynological analysis of peatlands of the Bitche military camp (Moselle, France)

Benjamin Cancès¹, Marie Ponthieu¹, Mathilde Rebiffé¹, Pascale Ruffaldi³, Vincent Robin², Anne-Véronique Walter-Simonnet³, Jessy Jaunat¹, Béatrice Marin¹, Pascale Bauda²

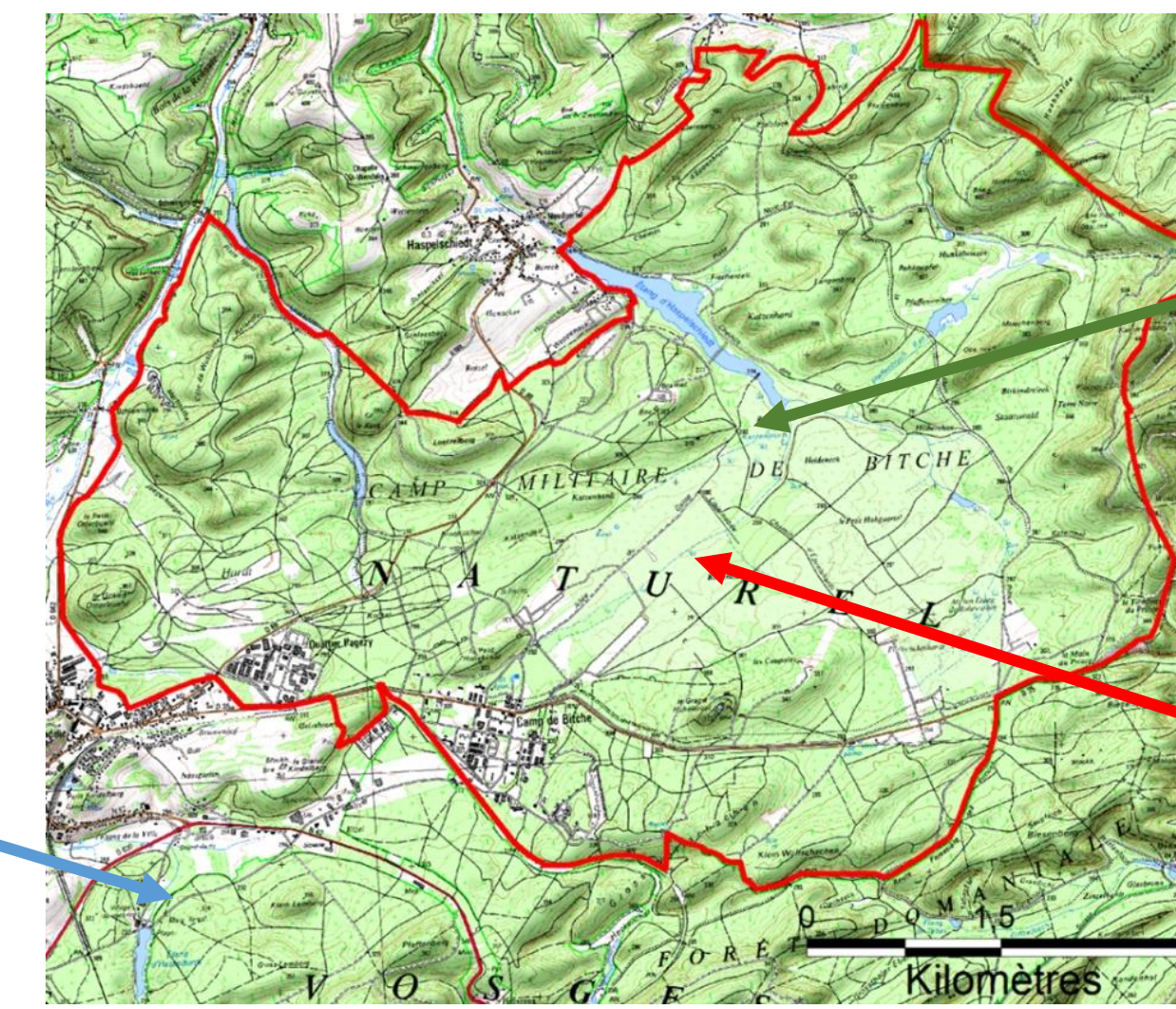
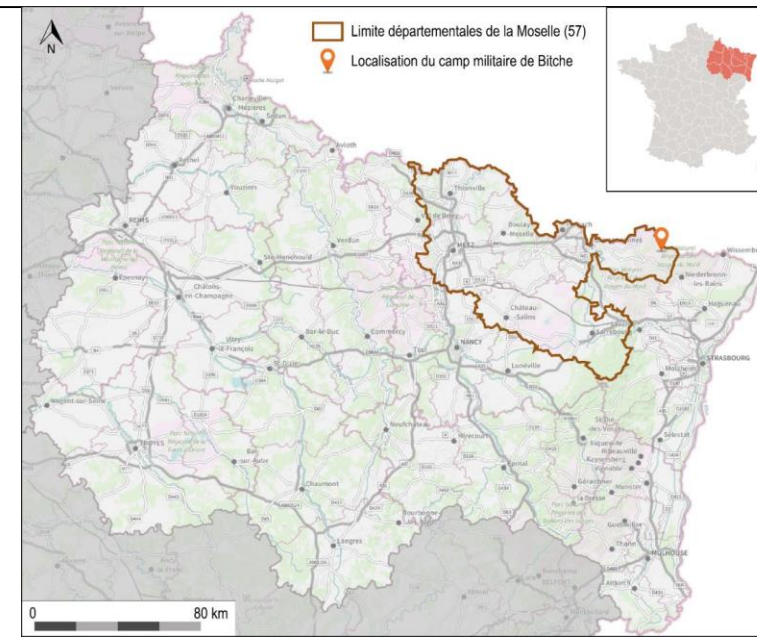
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Study area

Bitche military camp (Moselle, France)

- Area = 3500 ha
- Crossed by several streams
- Over a Triassic sandstones aquifer
- Military activities since 1900

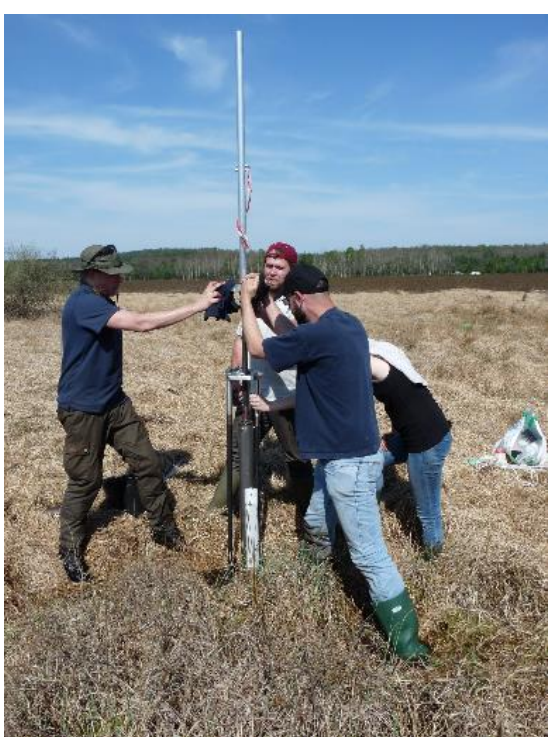


Moors and peatlands of the camp: ten entities (173 ha, 5% of the total area of the camp) classified as Natura 2000 sites

Objectives

- To reconstruct environmental changes in landscapes over time under the influence of natural and/or anthropogenic factors
- To understand the human footprint on these environments (chemical contamination)
- To assess the chemical reactivity of peat towards Pb, Cu and Zn

Methodology



Peat profiles

- 3 peat cores : Katzenbruch « KAT » (168 cm), Allée du Galop « GAL » (184 cm) and Horn (284 cm)
- Major and trace elements concentrations (FPXRF)
 - Pb isotopes
 - Radiocarbon dating
 - Pollen analyses

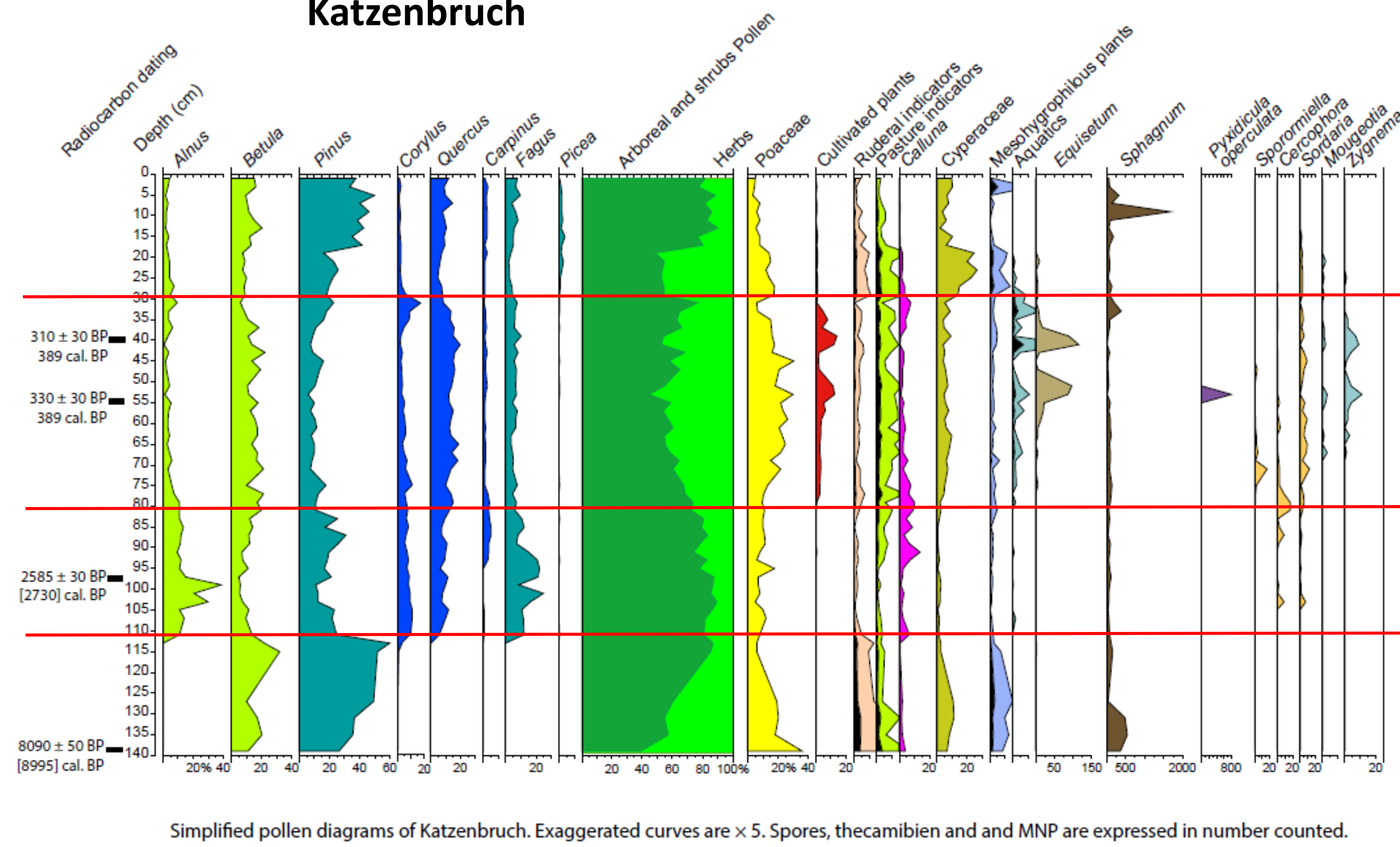
Desorption experiments

- Batch experiments on KAT and GAL surface horizon sampled nearby the peat cores
- Solid/Solution = 2 g.L⁻¹ (IS = KNO₃ 10⁻³ M)
- pH range : 1-6
- Agitation for 24 hours
- ICP-OES analyses of the supernatant



Pollen analyses

Katzenbruch



Contemporary period : Increase in forest cover and significant development of pine. Little contemporary anthropisation detected due to very dense forest cover.

Modern times : Forest regression around the site. Intensification of agricultural activities. Strong presence of coprophiles (*Sporormiella*, *Cercophora* and *Sordaria*), indicators of pastoralism.

Iron Age : Dominant forest cover. Establishment of diversified oak forests and oak-beech forests.

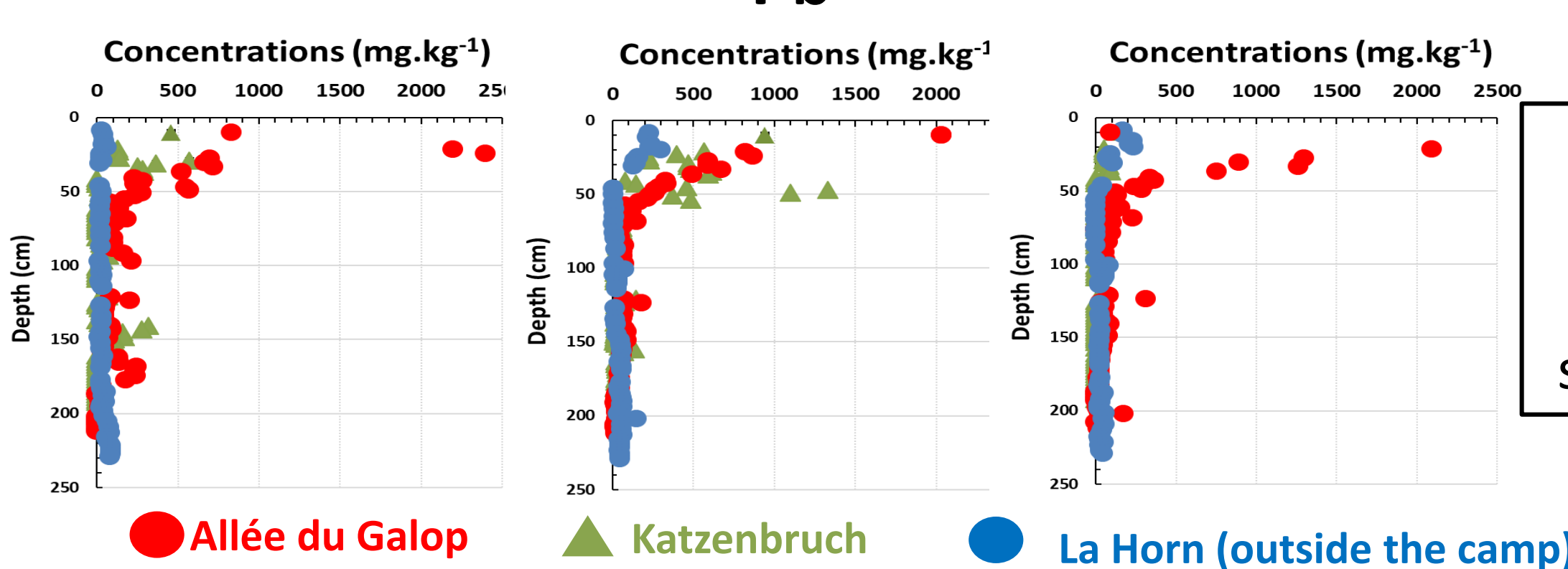
Mesolithic : An open environment that gradually closes. Dominant species: pine and birch forming open, light forests.

Metal contamination

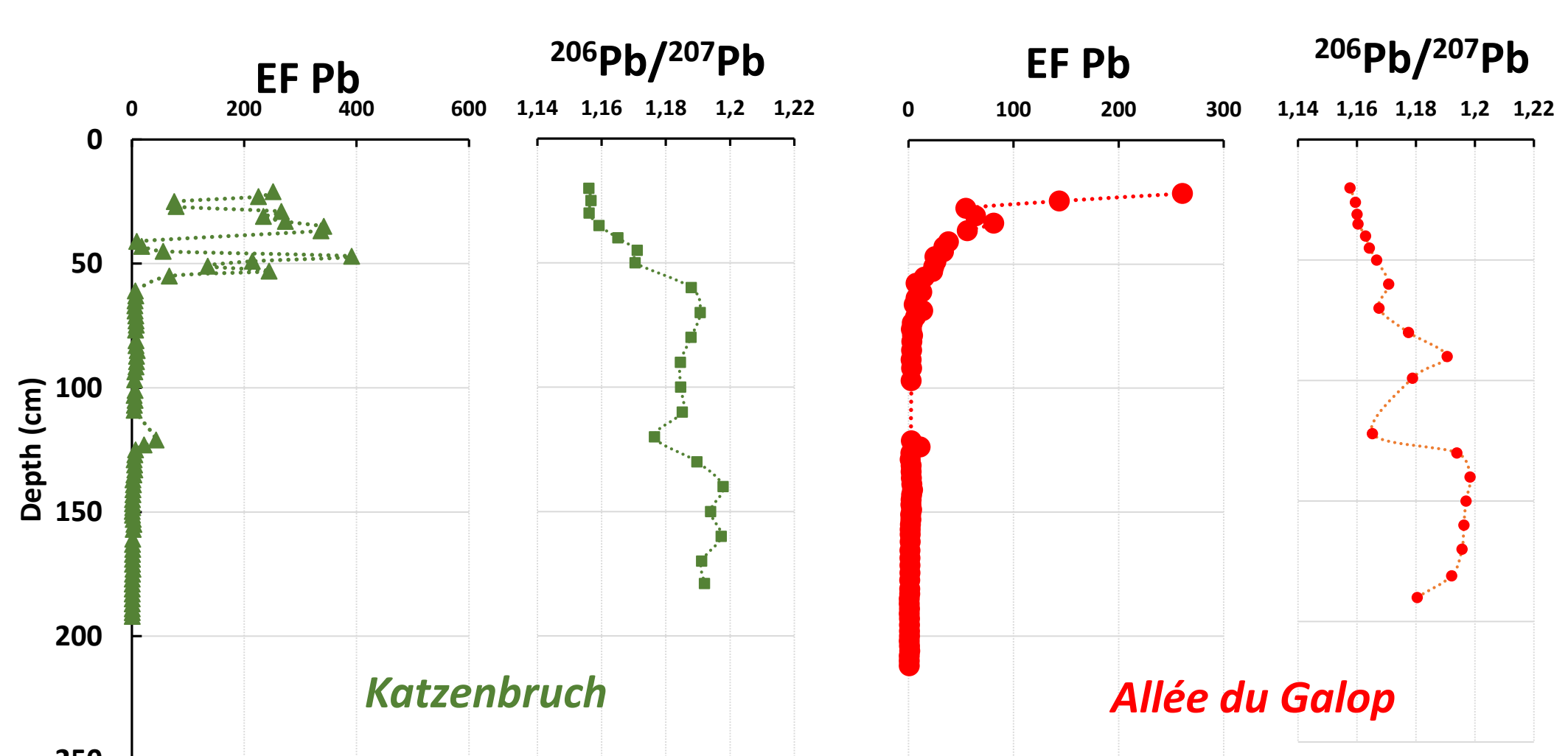
Cu

Pb

Zn



High metal concentrations (Pb, Cu, Zn) at the surface (0-50 cm depth)

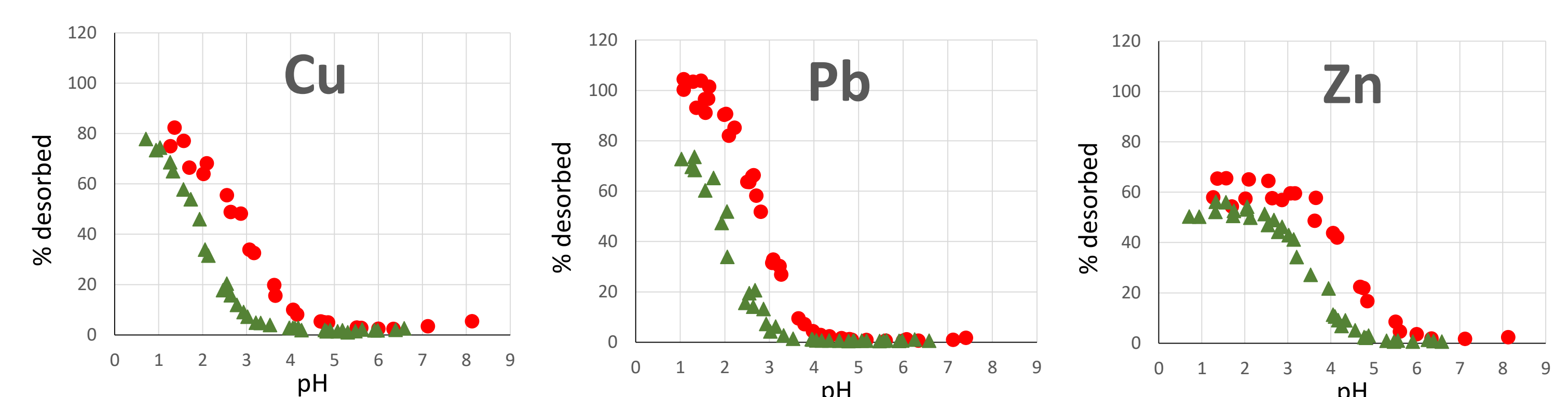


“Contemporary” military contamination ?
 Past contamination sources ?

$$\text{Enrichment factor (EF)} = \frac{([\text{metal}]/[\text{Al}])_{\text{sample}}}{([\text{metal}]/[\text{Al}])_{\text{saprolite}}}$$

Desorption experiments

	pH	Organic Matter %	Cu mg.kg ⁻¹	Pb mg.kg ⁻¹	Zn mg.kg ⁻¹
Allée du Galop	5,3	43,3	565	1242	67
Katzenbruch	4,3	84,3	152	465	53



- Highest metal retention on Katzenbruch peat (highest OM content and highest OM reactivity ?)
- Similar behaviour of Cu and Pb : lower mobility than Zn
- Low risk of surface water contamination

Perspectives

- Further radiocarbon dating to refine age-depth model of the peats and improve environmental reconstruction
- Identification of a site closer to former industrial activities (glassworks, mines)
- Modelling of the desorption experiments → reactivity of organic matter and chemical speciation of Cu, Pb and Zn

