

Persistent imprint of historical metallurgy in an alpine watershed evidenced from lake sediments Pb isotopes

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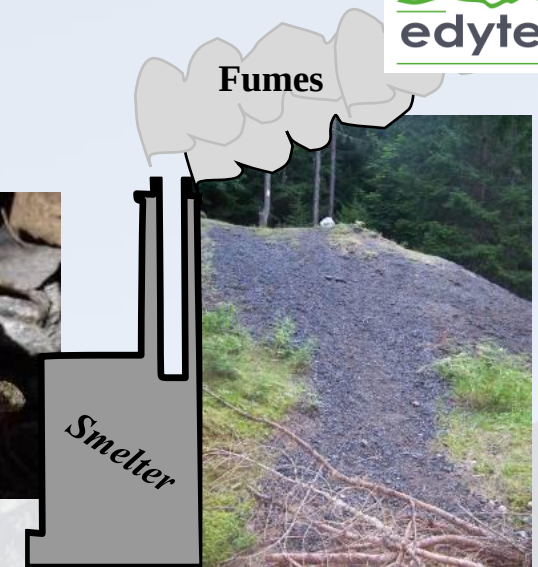
Session : HS9.2 -Transfer of sediments and contaminants in catchments, rivers systems and lakes

Metal transfer into the environment due to mining activities

- Trace metals (TMs) contamination
- Persistence and remobilization
- Here focusing on atmospheric transfer

1 TMs sources

Waste rocks



2 Transfers

Particulate

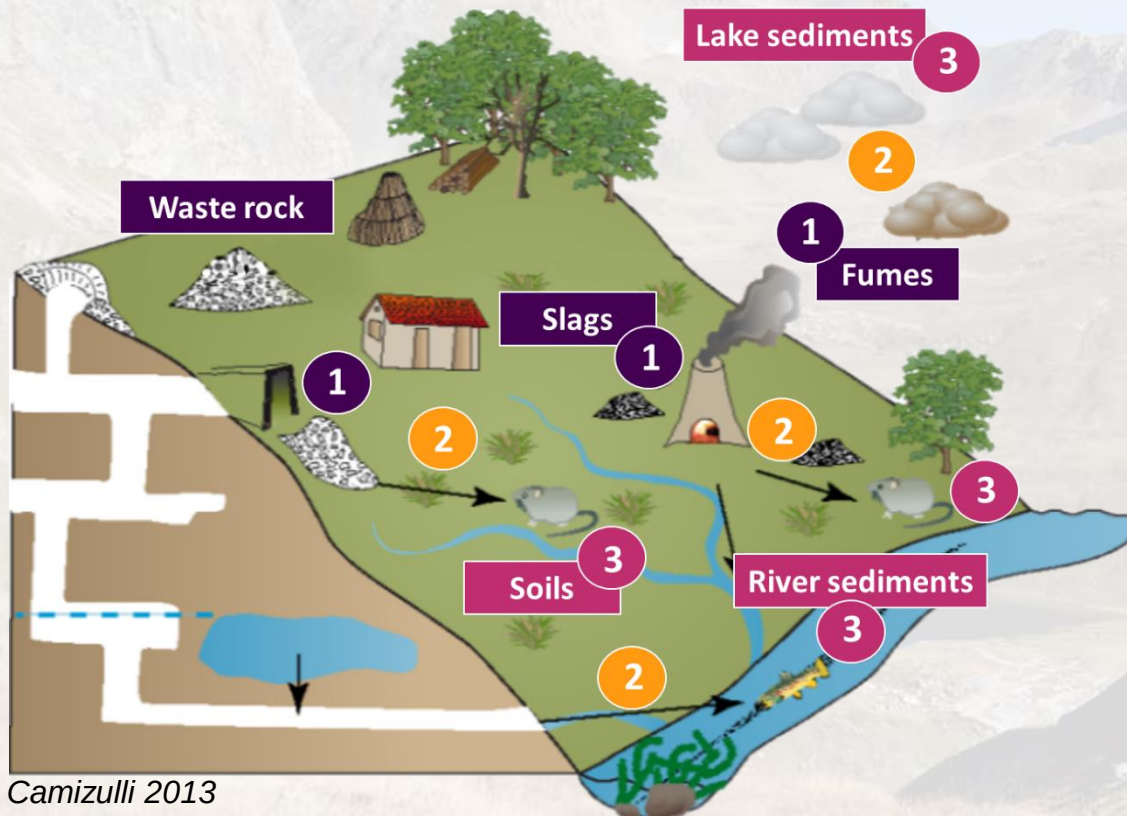
(erosion, gravity, anthropic)

Aerial

Solute

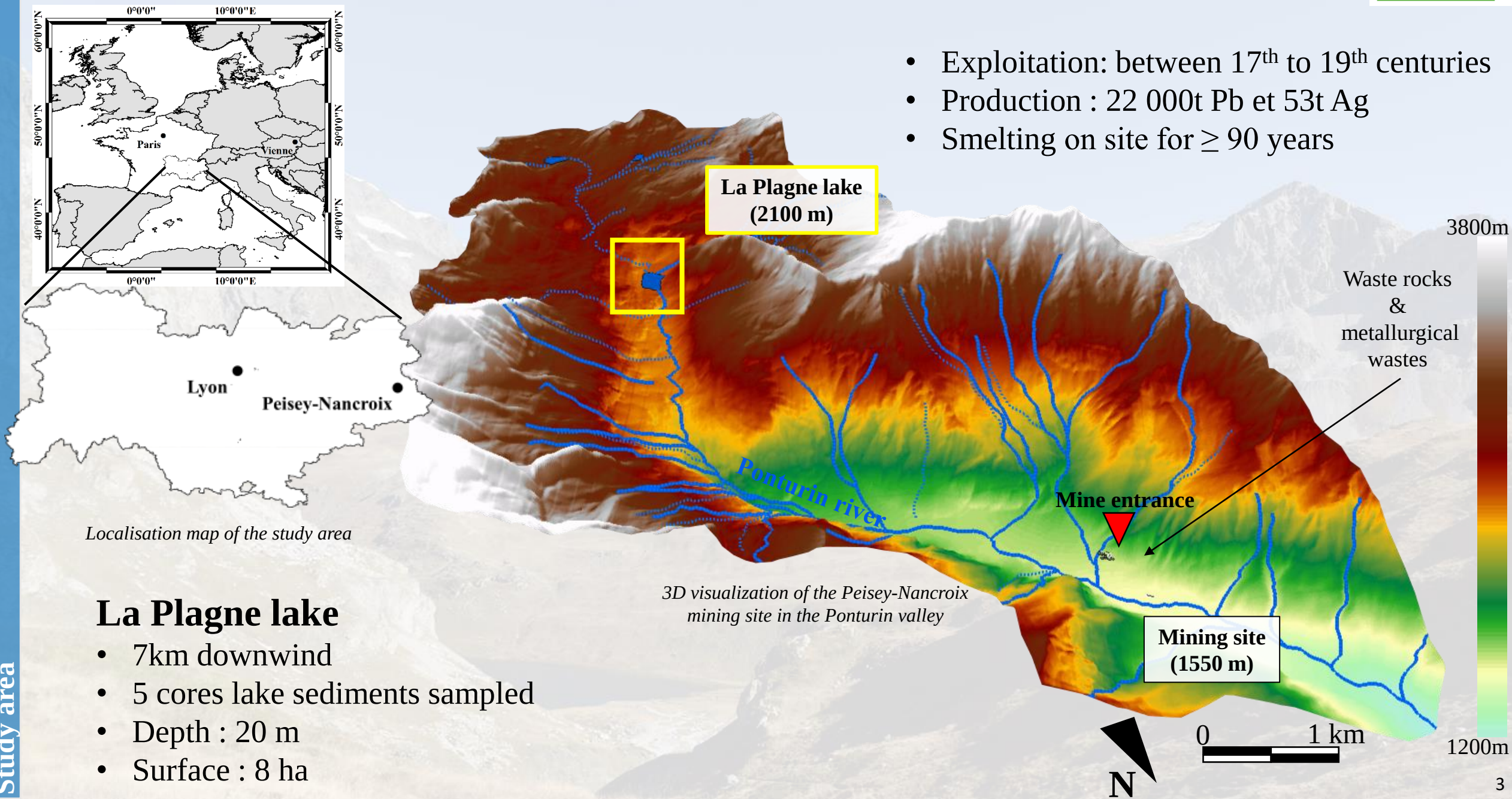
(leaching, weathering)

3 Sinks

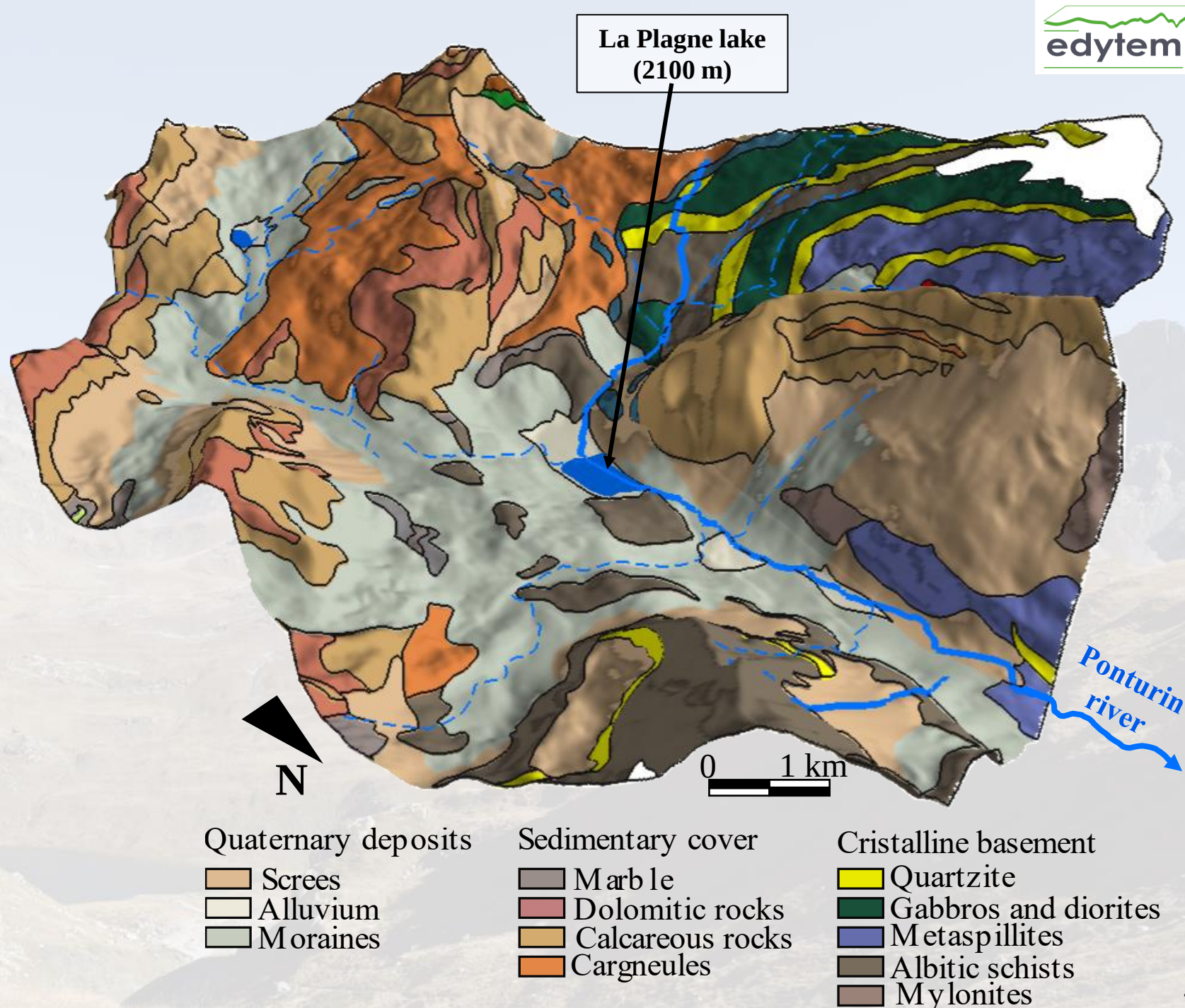
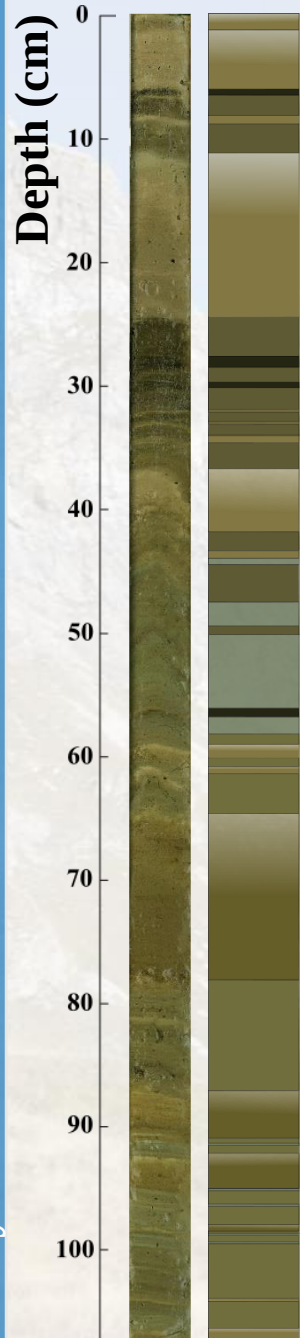


The Peisey-Nancroix Pb-Ag mine within its watershed

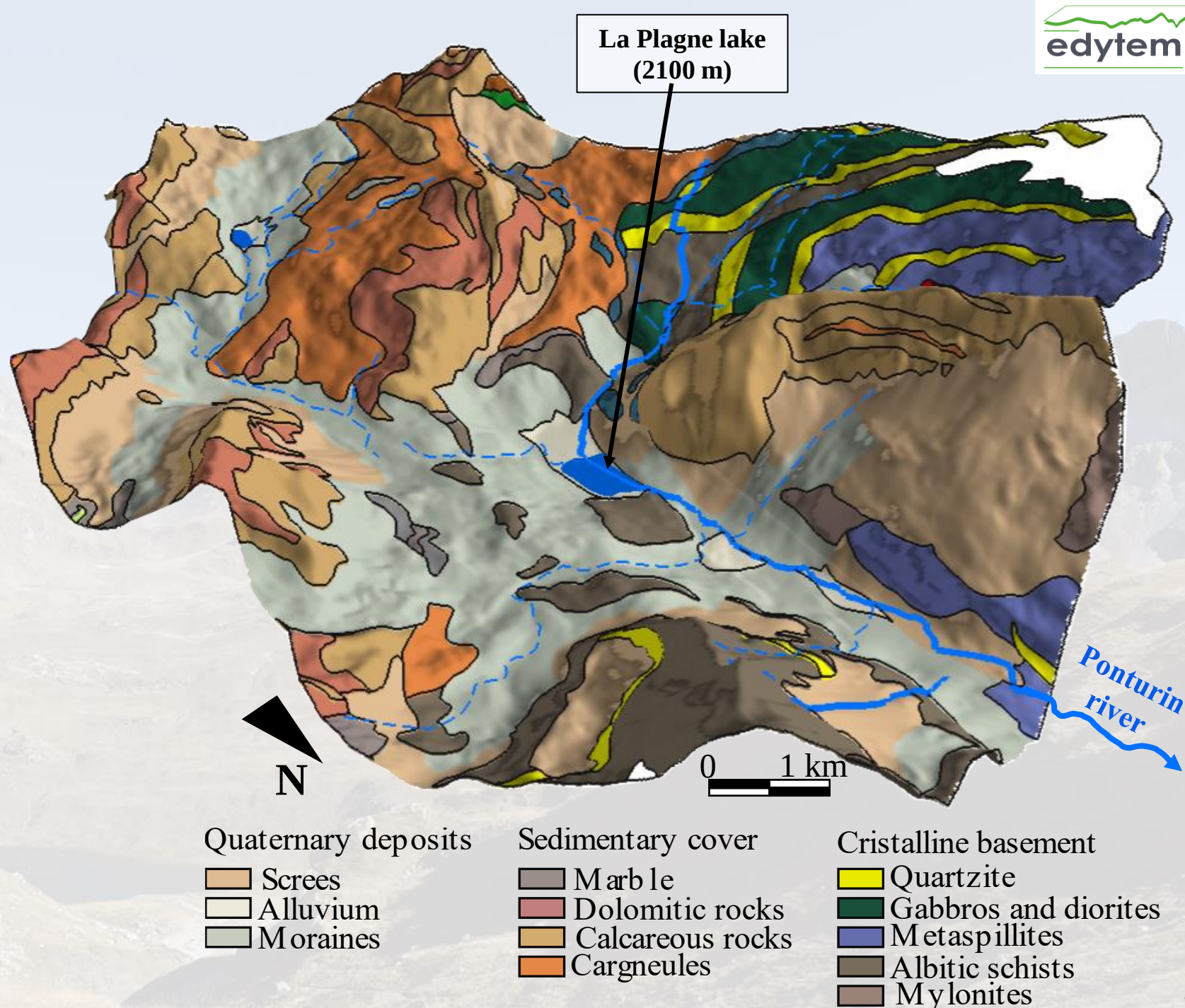
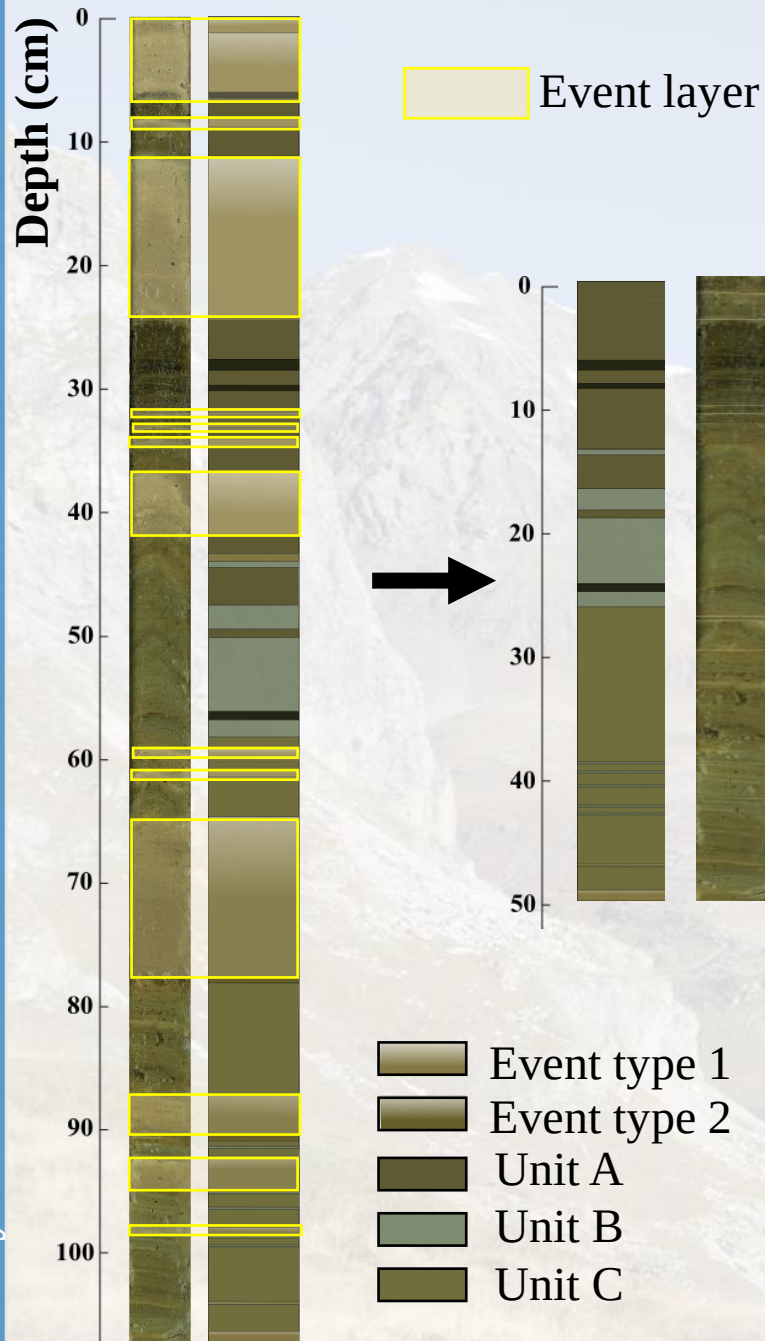
- Exploitation: between 17th to 19th centuries
- Production : 22 000t Pb et 53t Ag
- Smelting on site for ≥ 90 years



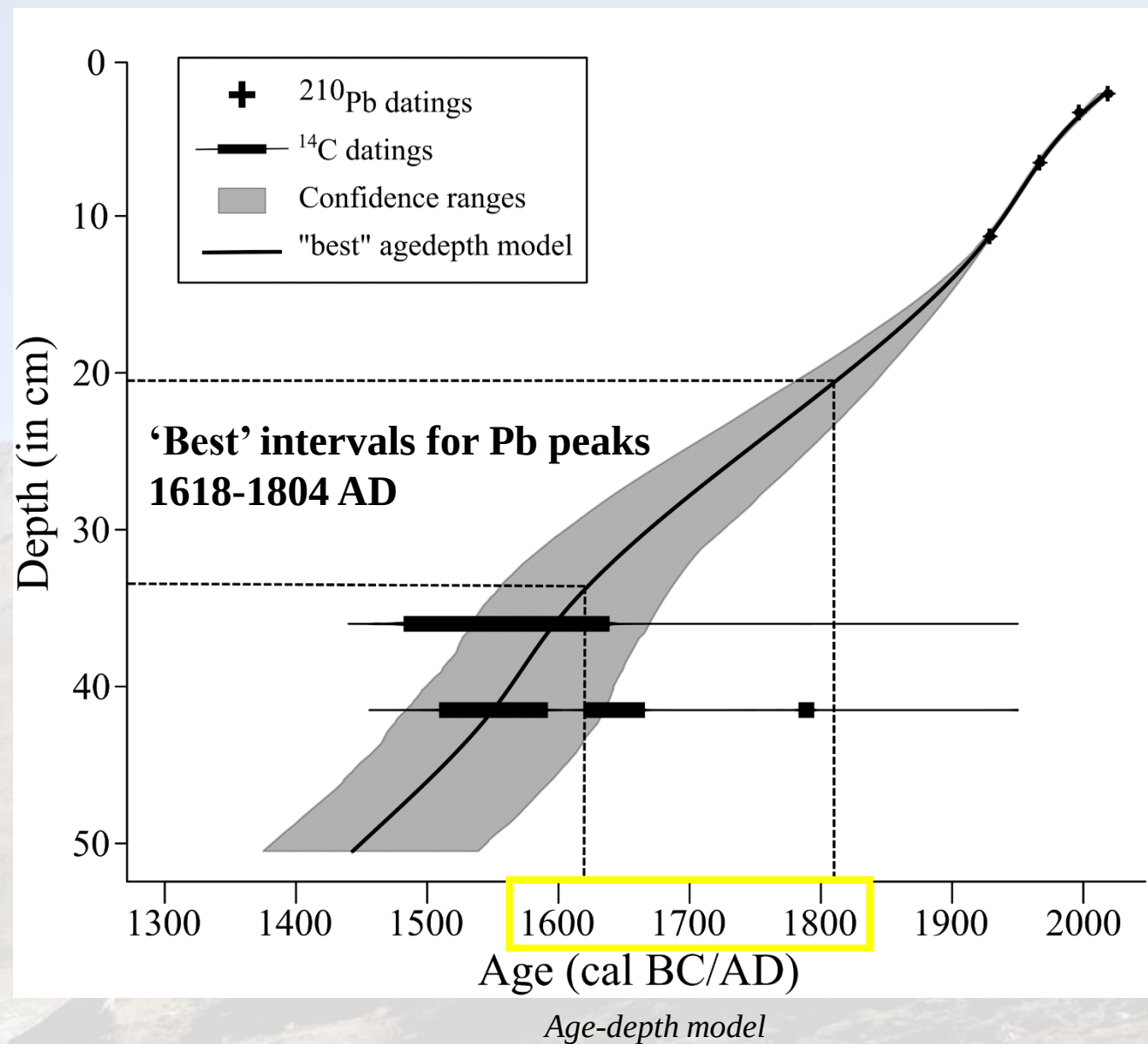
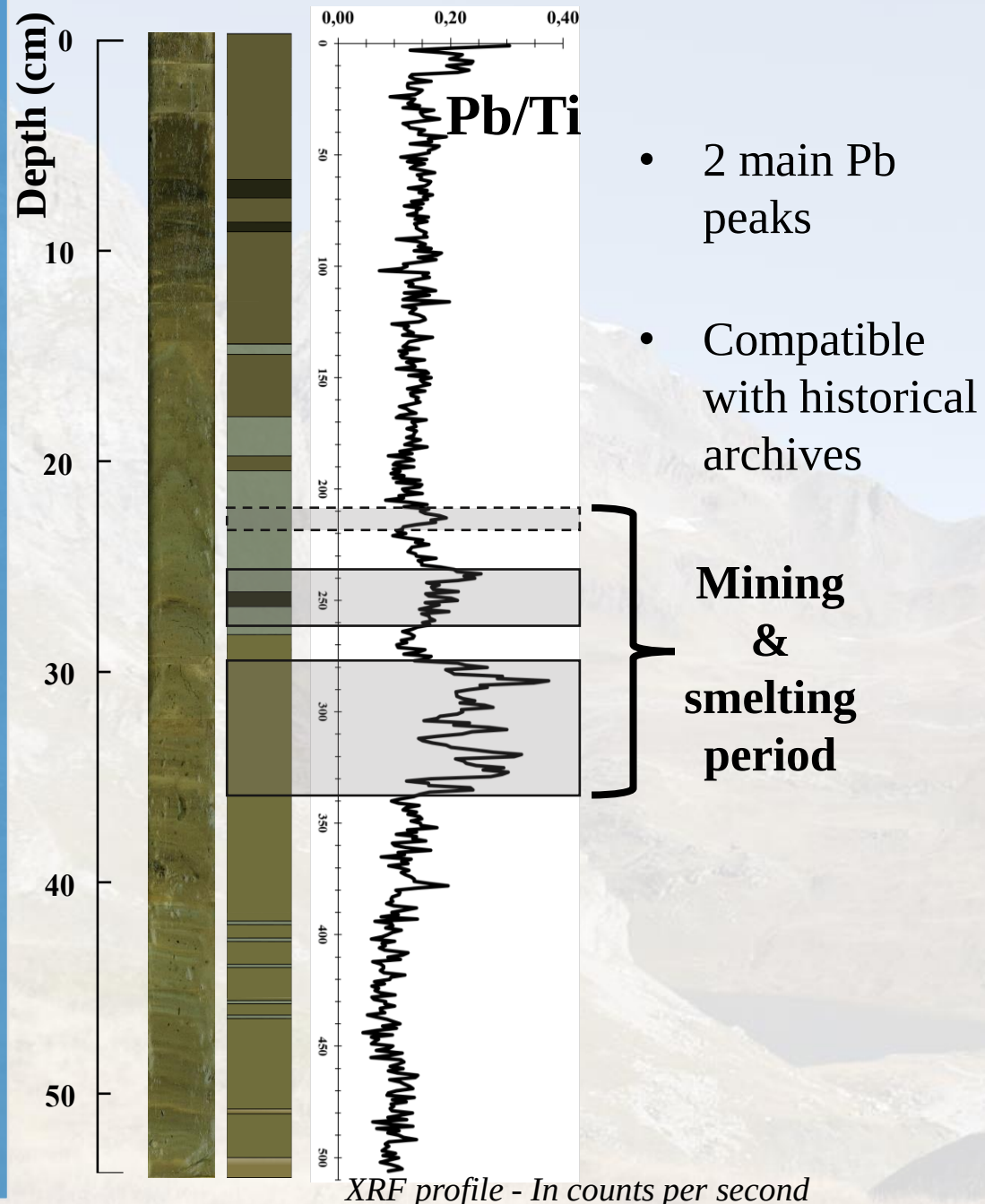
La Plagne lake watershed



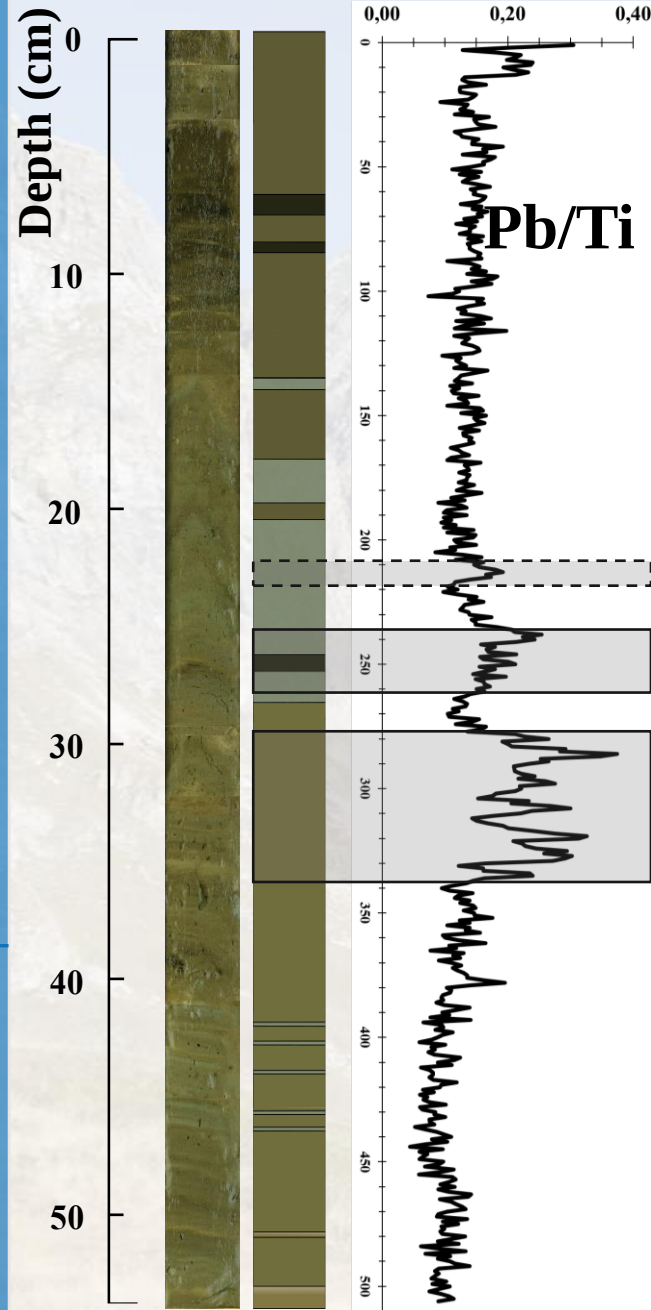
La Plagne lake watershed



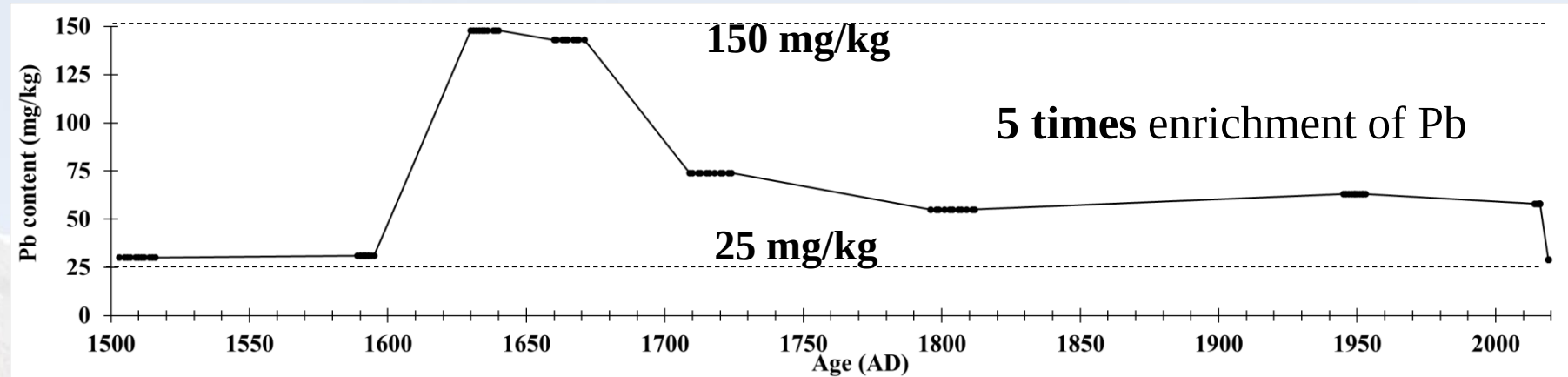
Local atmospheric contamination : Pb enrichment



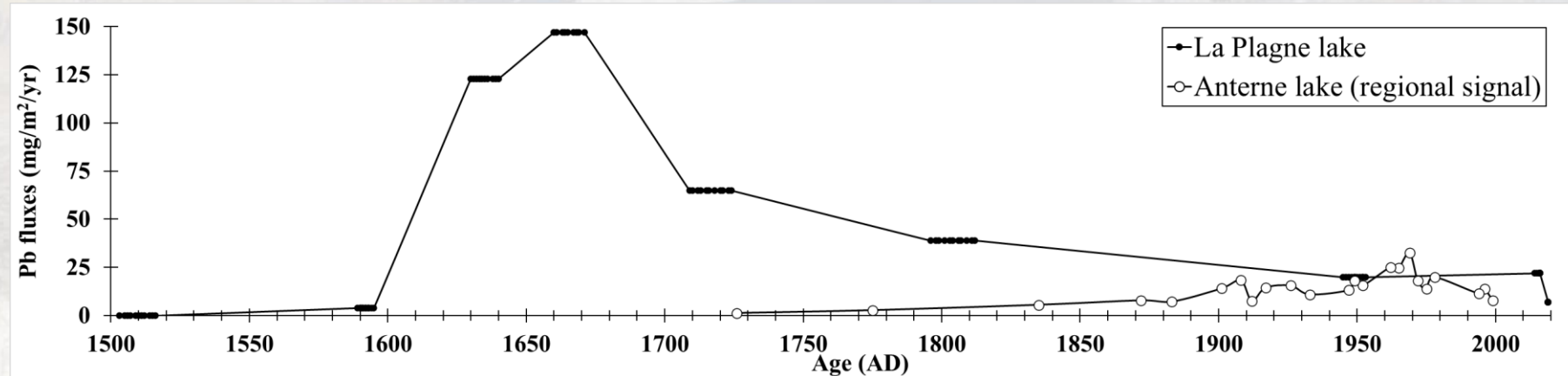
Local atmospheric contamination : Pb fluxes



Pb content (in mg/kg)



Pb_{anthropogenic} fluxes (in mg/m²/yr)



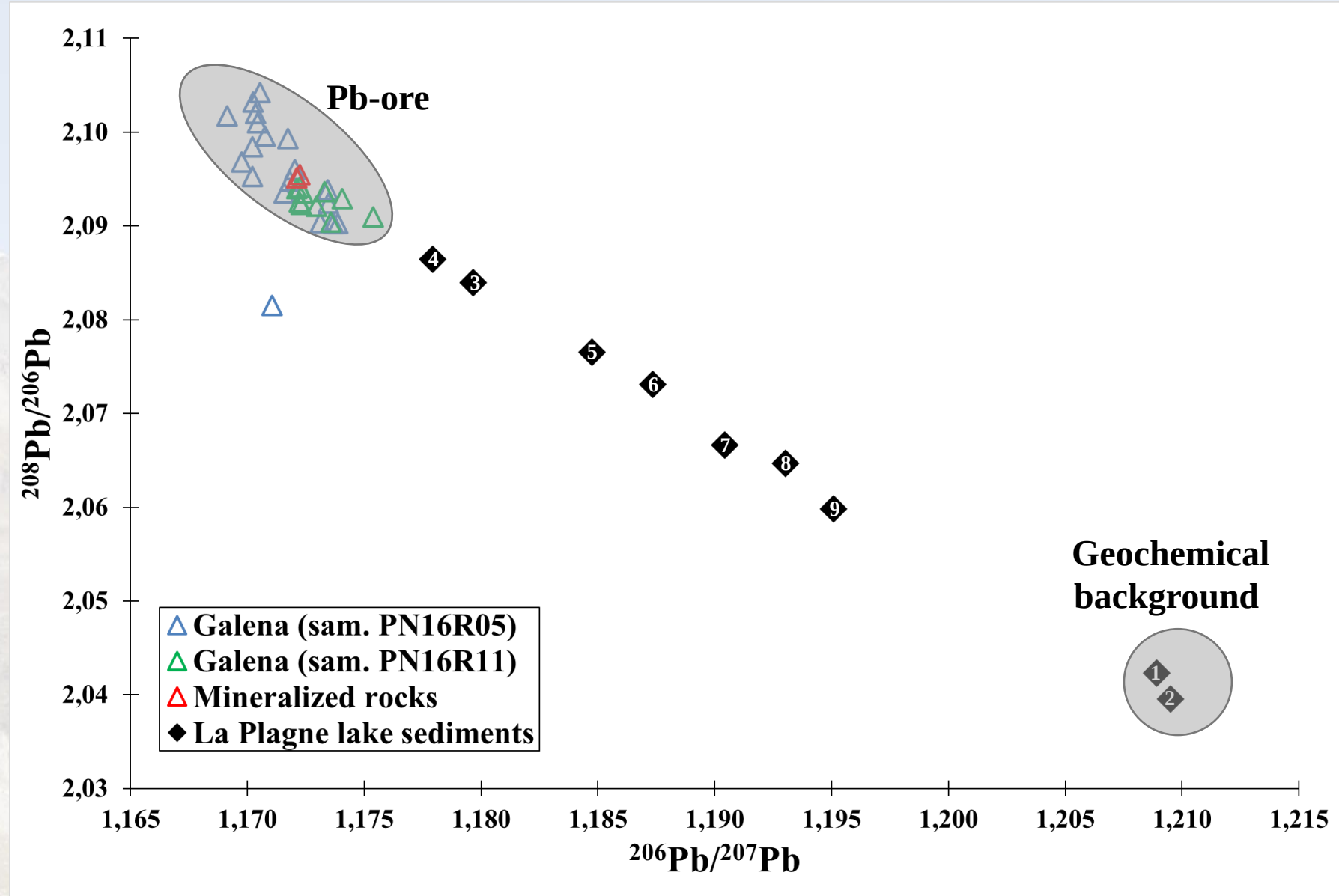
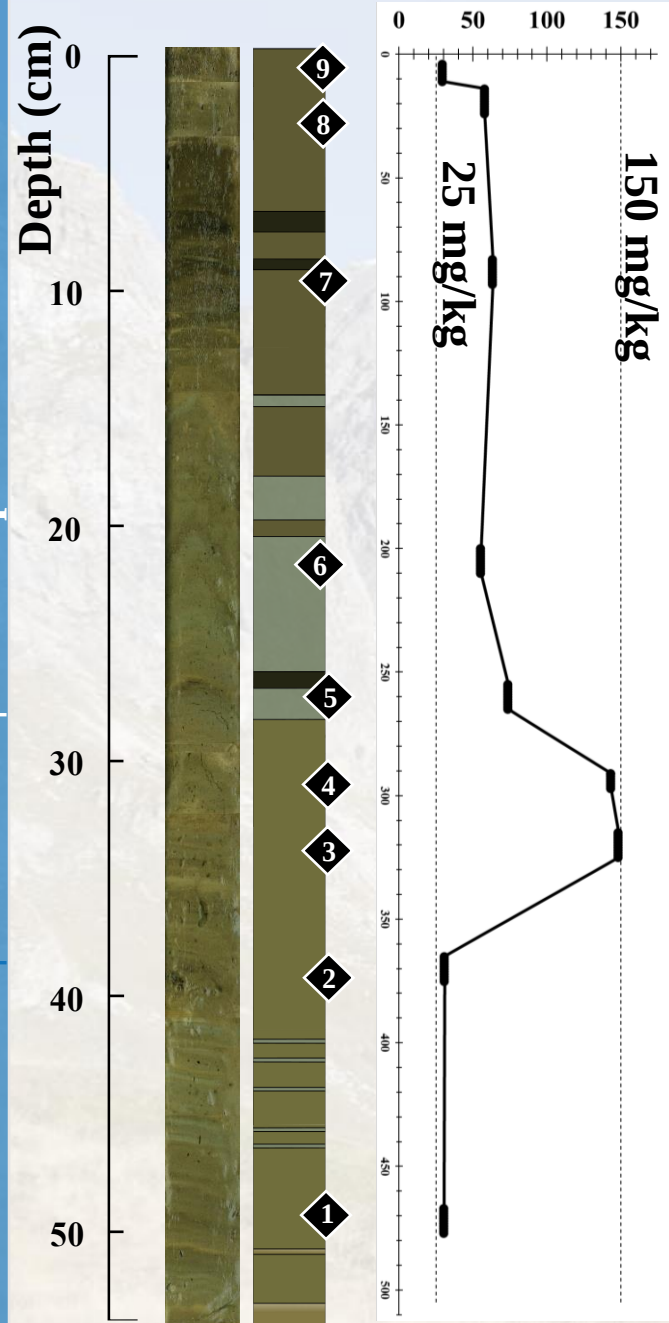
$$Pb_{anth} \text{ flux} = D \times SR \times Pb_{anth}$$

D : dry density
SR: sedimentation rate

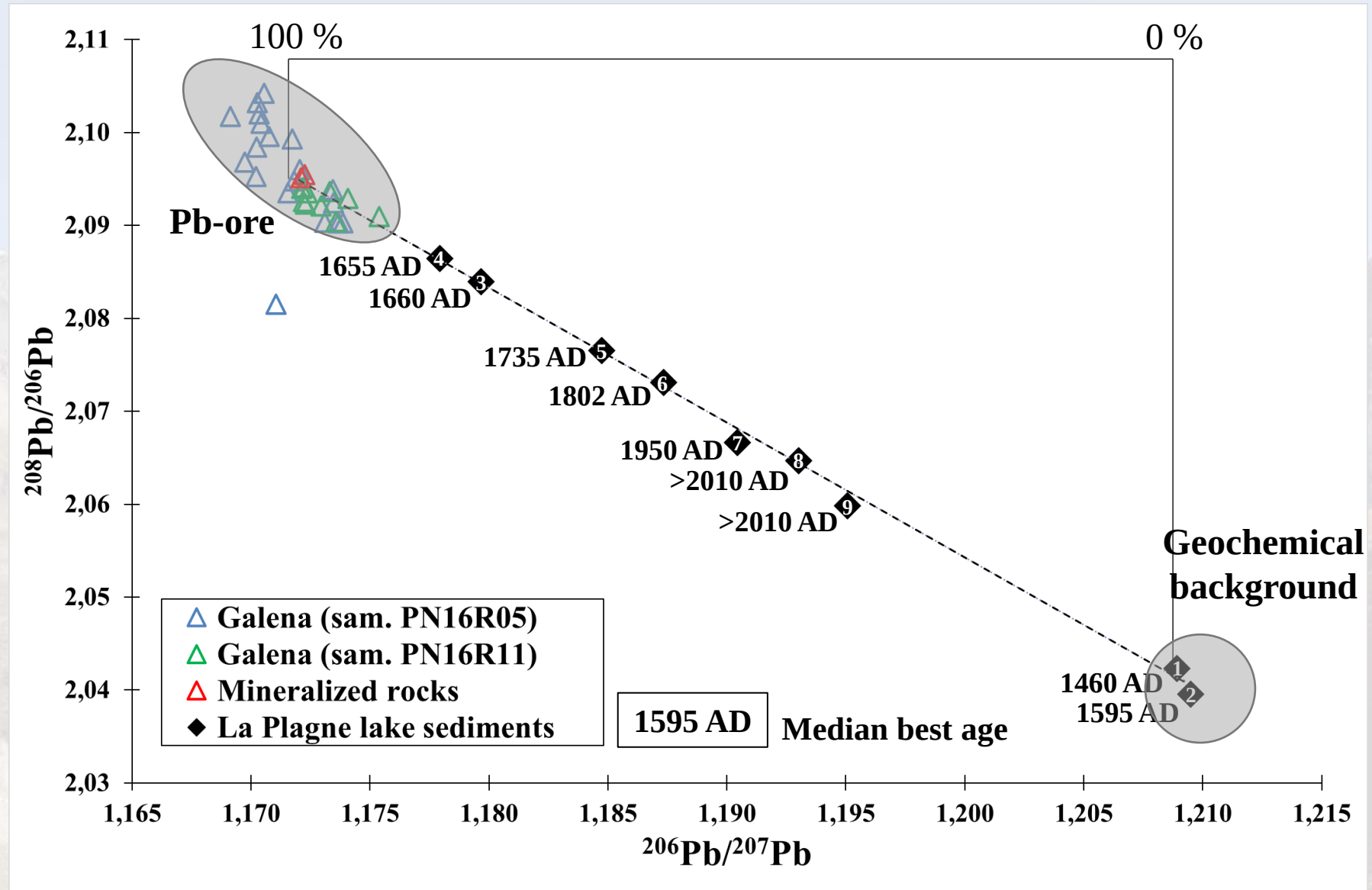
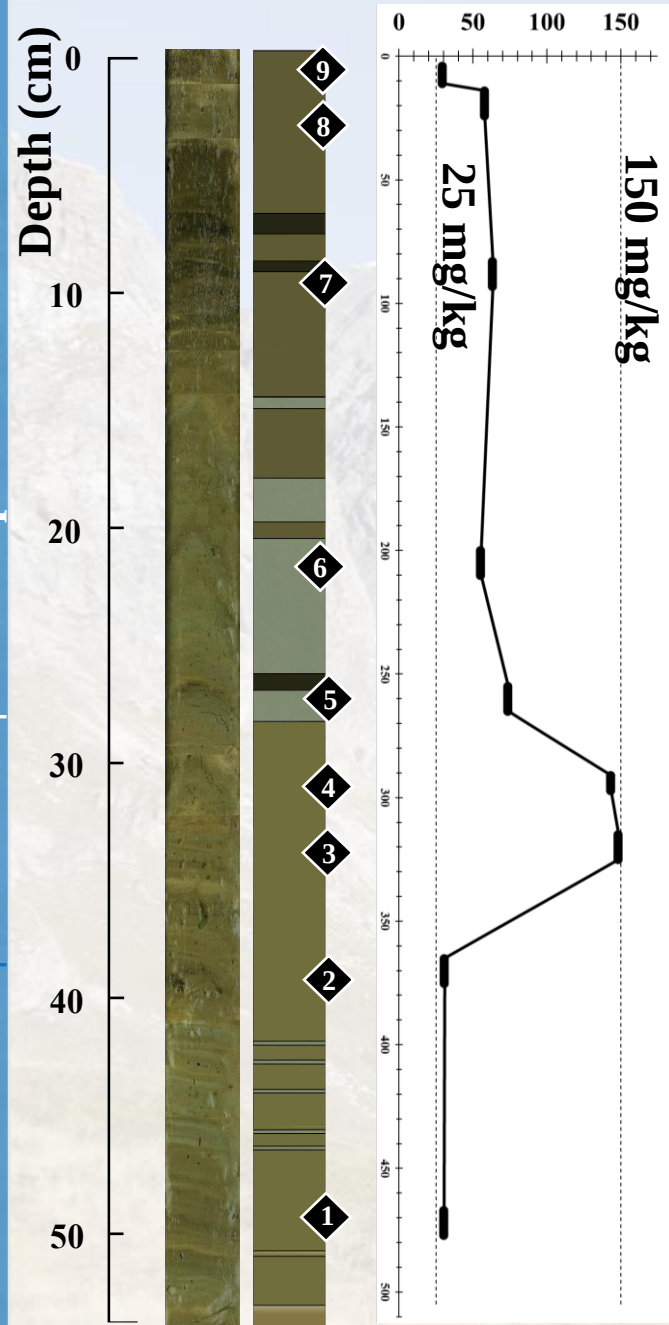
Up to 5 times increase in Pb fluxes compare to recent period

Lake sediments Pb isotopes

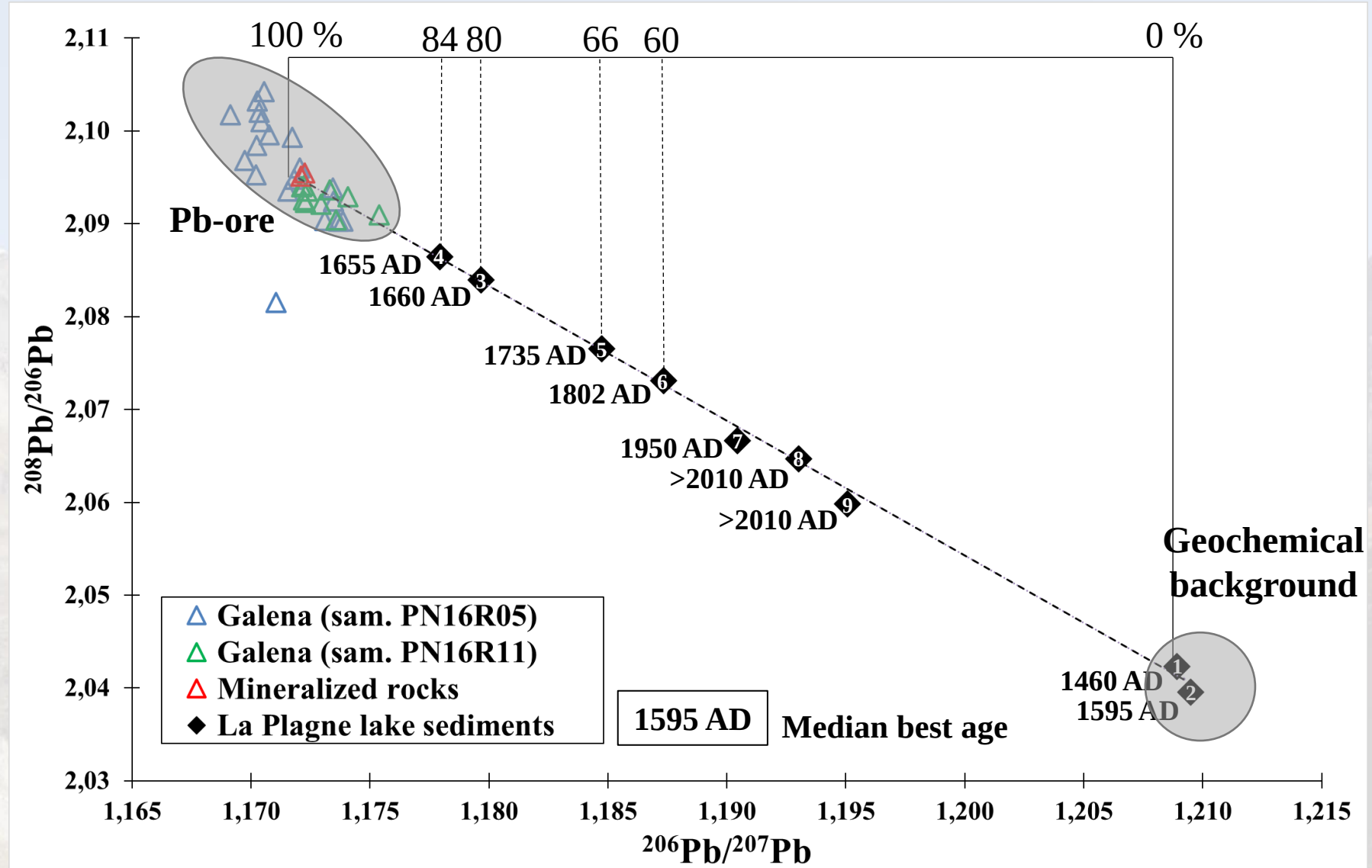
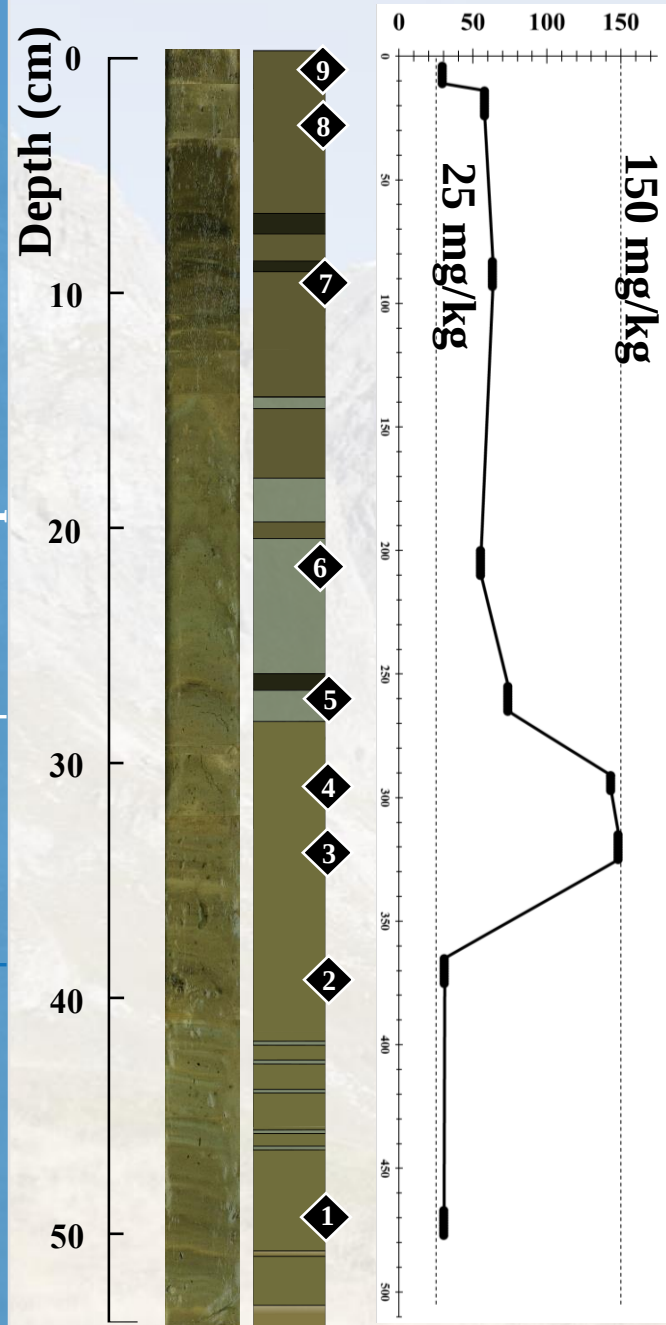
Pb contamination | Pb Fluxes | Pb isotopes



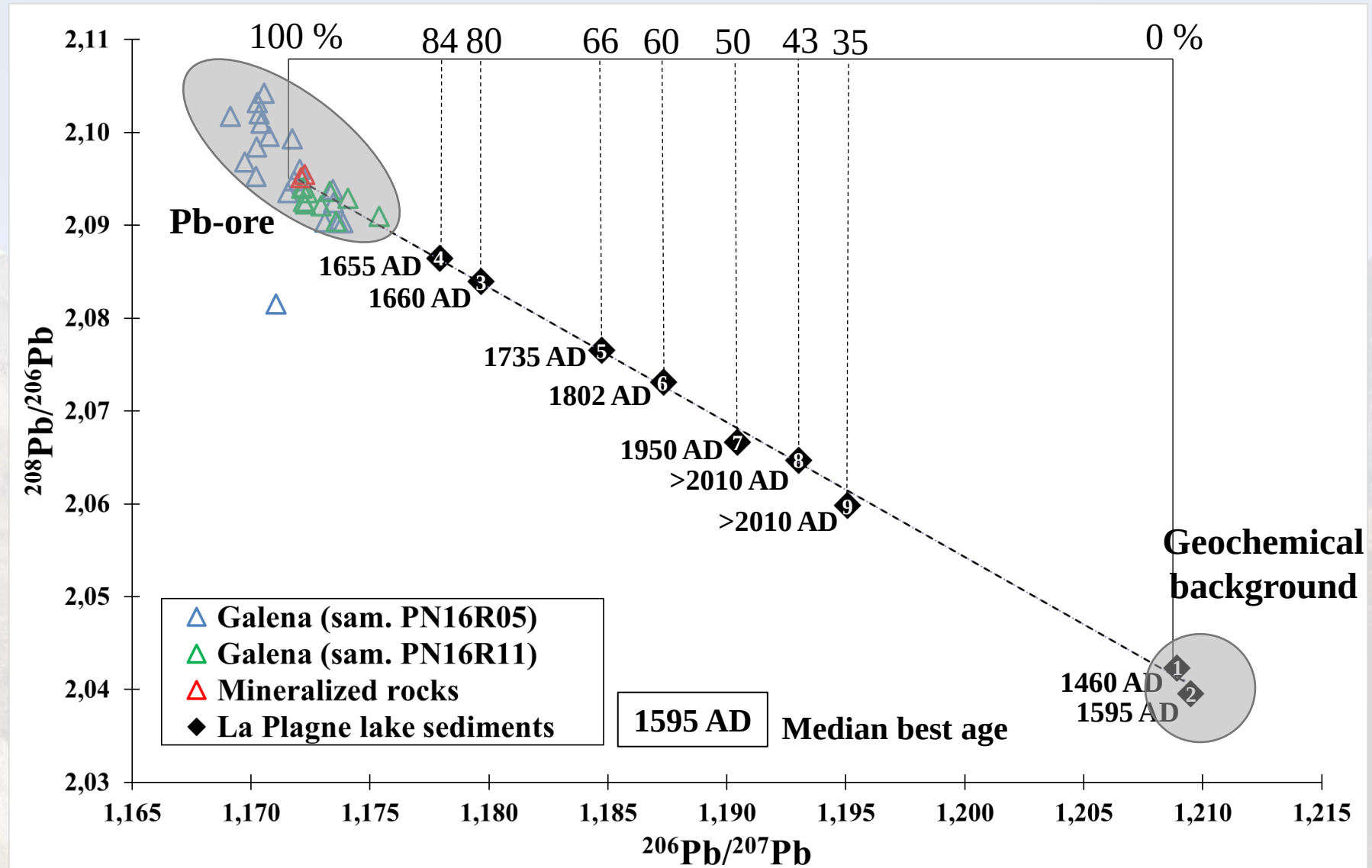
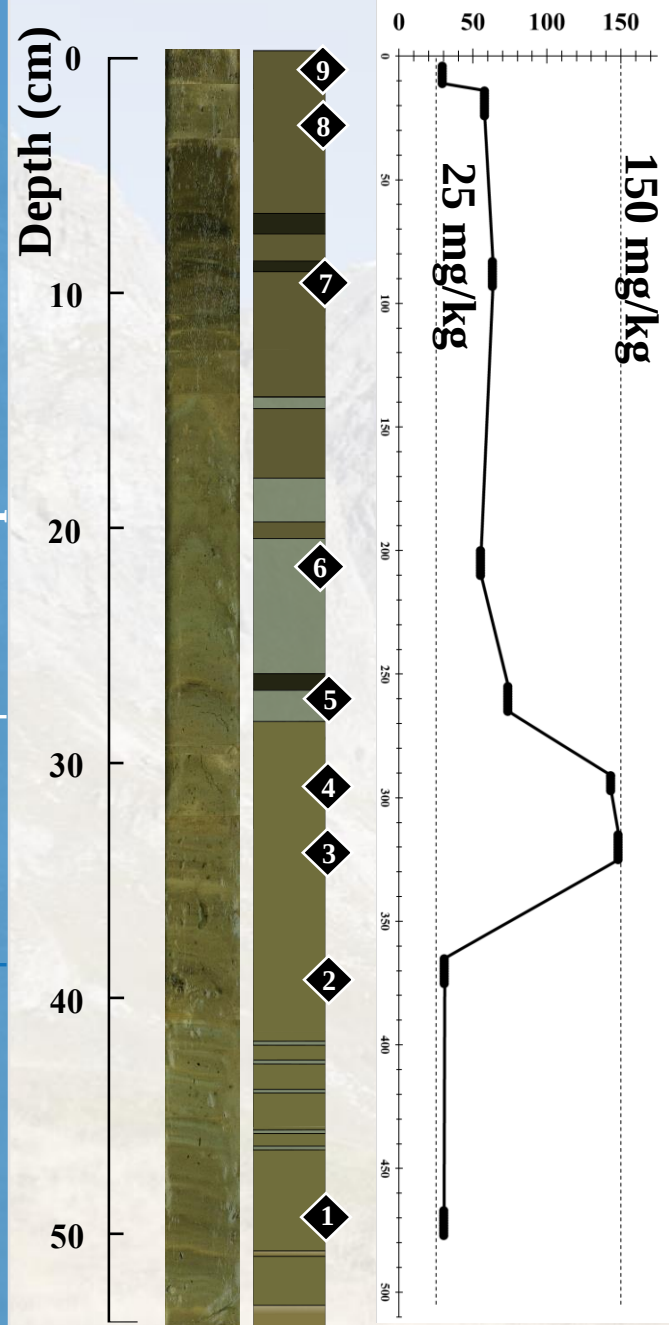
Lake sediments Pb isotopes



Lake sediments Pb isotopes



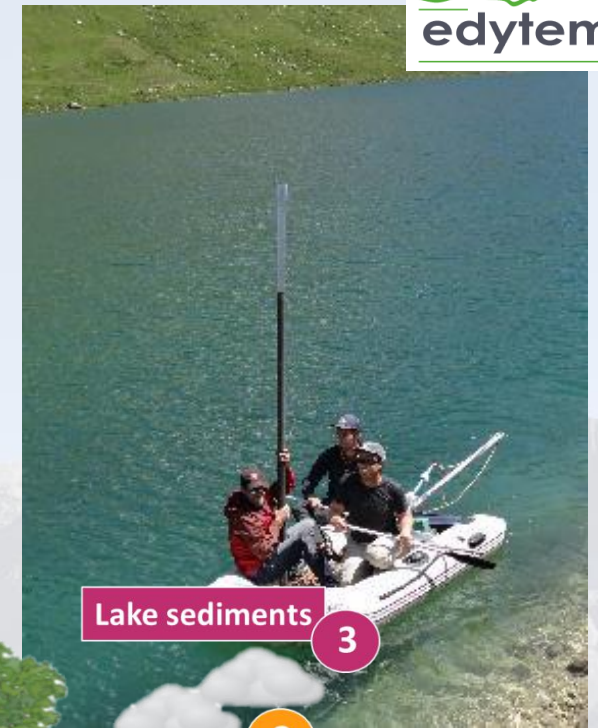
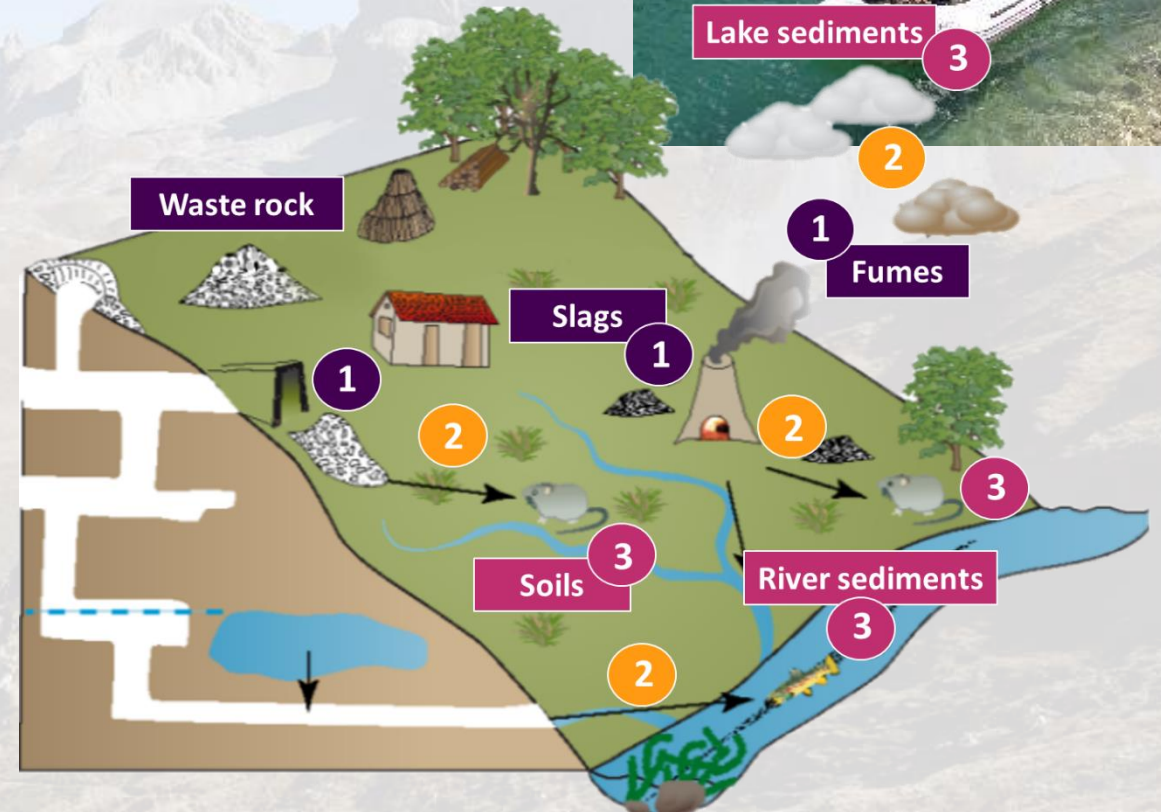
Lake sediments Pb isotopes



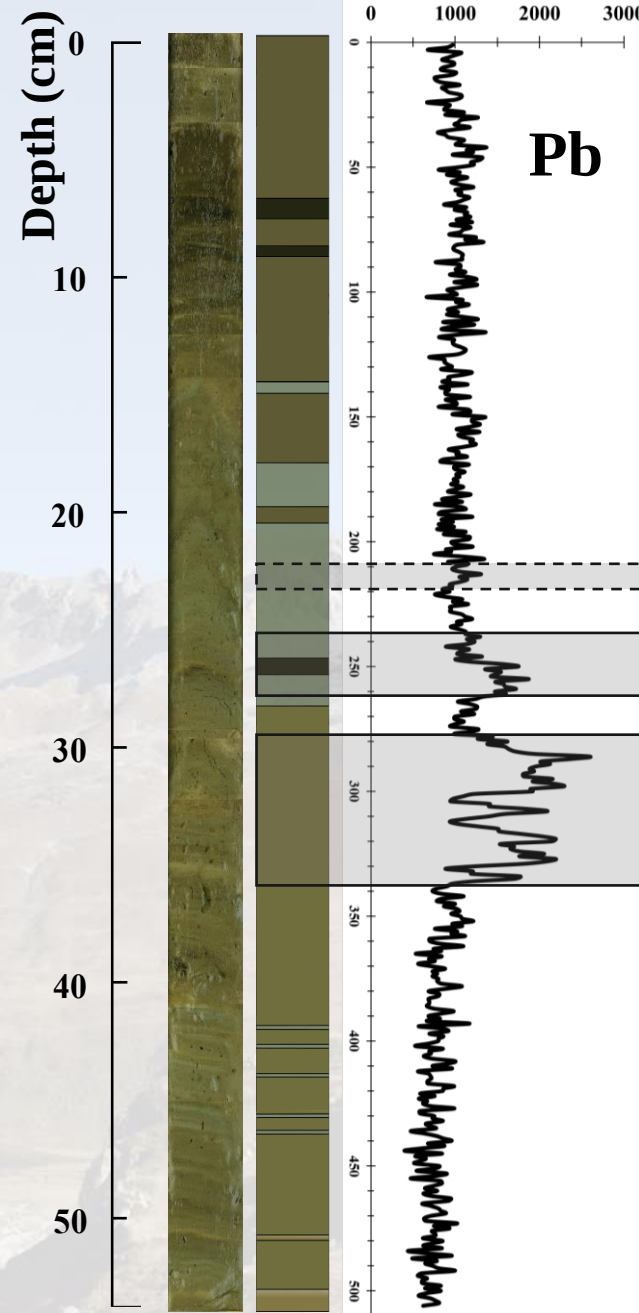
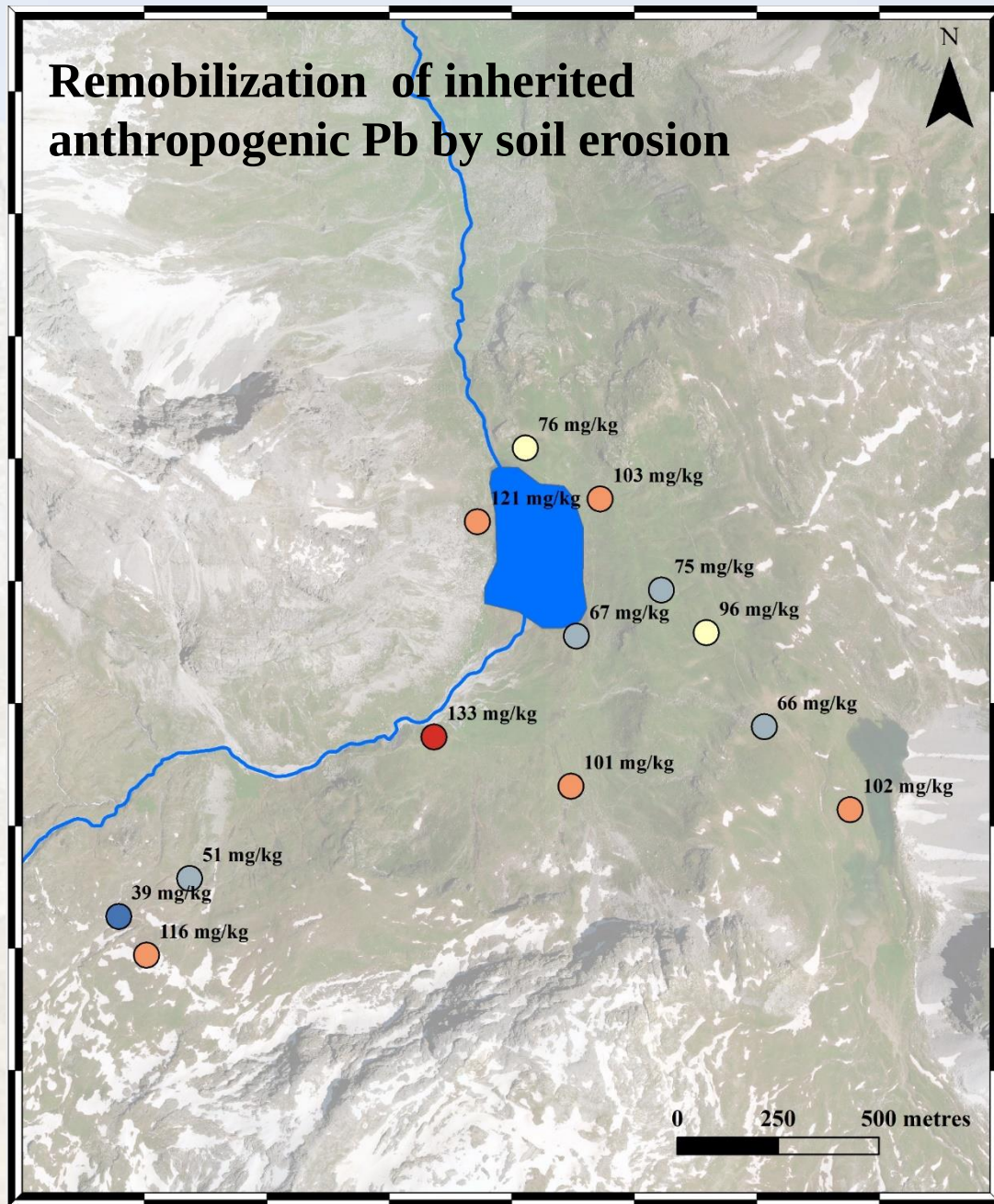
Take home messages

- La Plagne lake recorded the fumes emitted during smelting at Peisey-Nancroix
- Pb fluxes are more than 100 times greater during smelting
- Topsoil erosion contribute to Pb remobilization for more than 200 hundred years (since mine closure)

⇔ **Long-term mining legacy**
and TMs remobilization



Perspectives



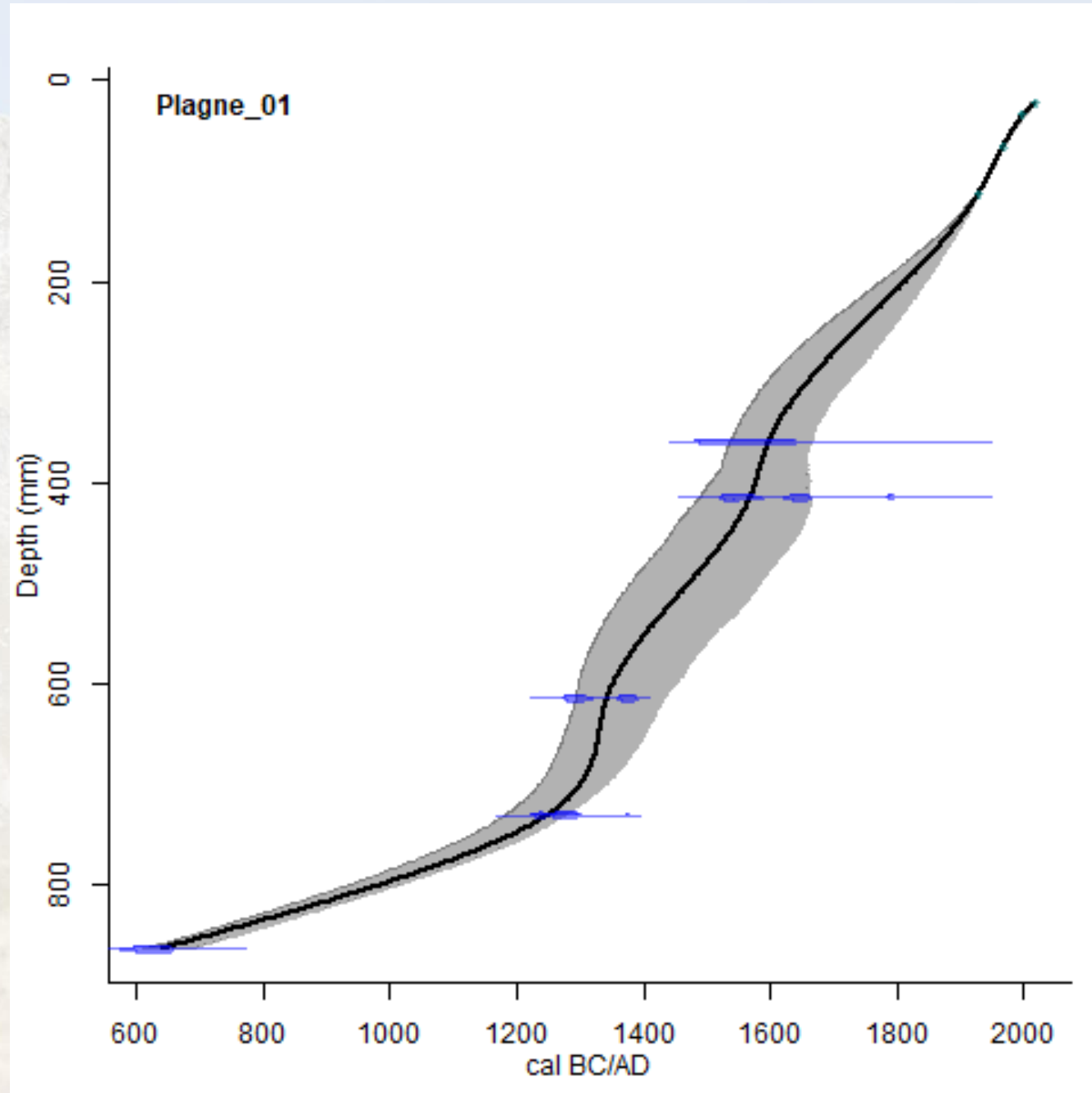
Higher resolution sampling:

- Connect Pb emission periods (Pb peaks) to historical archives
- Compare Pb fluxes and isotopic ratios with changes in metallurgical techniques

Any comments , questions ?

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La Plagne lake



Annexes: Pb isotopes of soil watershed

