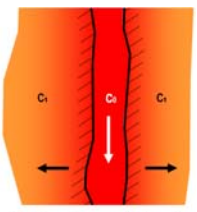
Fracture transport in clay tills – what do we know?

Camilla M. Christiansen

Clay ≠ impermeable membrane

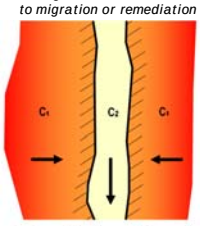
Clay deposits often extensively naturally fractured - Especially basal clay tills (glacial deposit)

1: Early contamination – typically begun in '60s/'70s

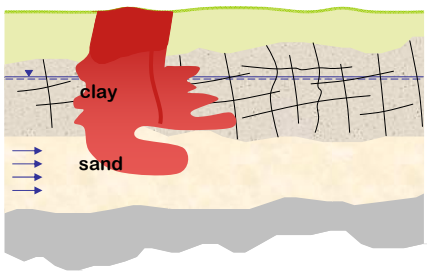


$C_1 < C_0 \Rightarrow$ diffusion into clay matrix

2: Late-time / present day contamination – DNAPL gone from fractures due to migration or remediation



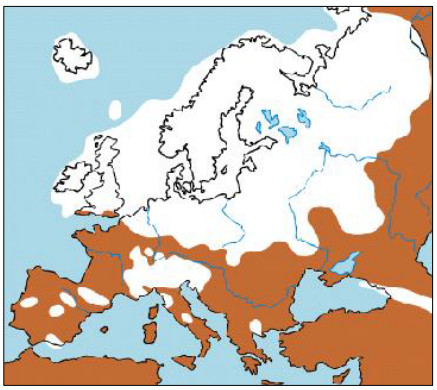
$C_1 > C_2 \Rightarrow$ diffusion out of clay matrix



RAGS *Risk Assessment of Contaminated Sites: From Source Zones to Water Resources*

Glacial sediments cover large parts of Europe and the US…

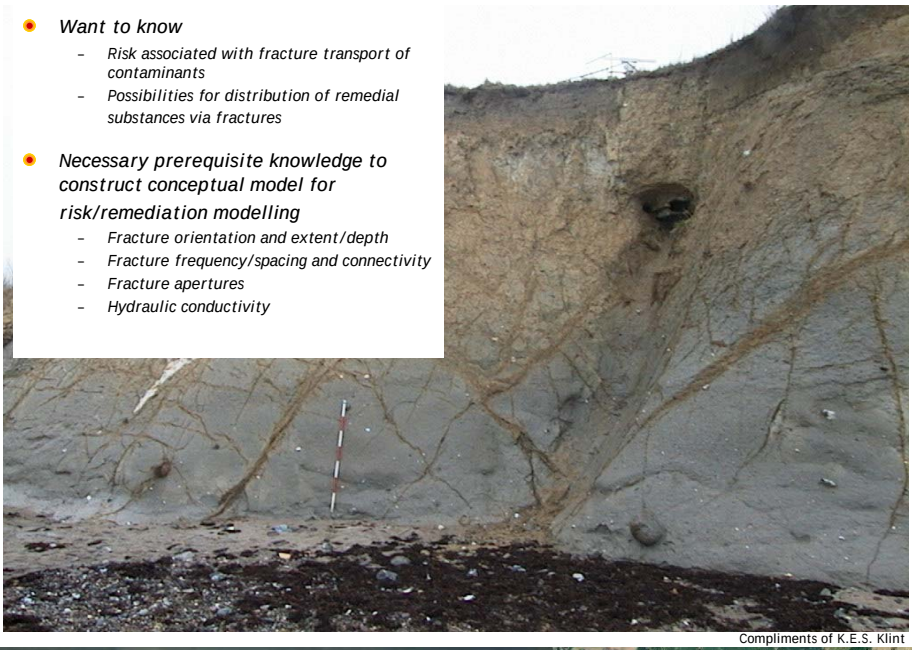
Extent of ice during Pleistocene in Europe



Extent of glacial deposits in the US & Canada

… and a large fraction is clay till

- *Want to know*
  - *Risk associated with fracture transport of contaminants*
  - *Possibilities for distribution of remedial substances via fractures*
- *Necessary prerequisite knowledge to construct conceptual model for risk/remediation modelling*
  - *Fracture orientation and extent/depth*
  - *Fracture frequency/spacing and connectivity*
  - *Fracture apertures*
  - *Hydraulic conductivity*



Compliments of K.E.S. Klint

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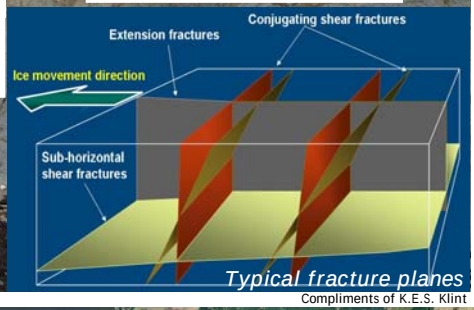
- *Types of fractures in clay till*
  - *Systematic*
    - Glaciotectonic fractures
    - Neotectonic fractures



Typical fracture planes

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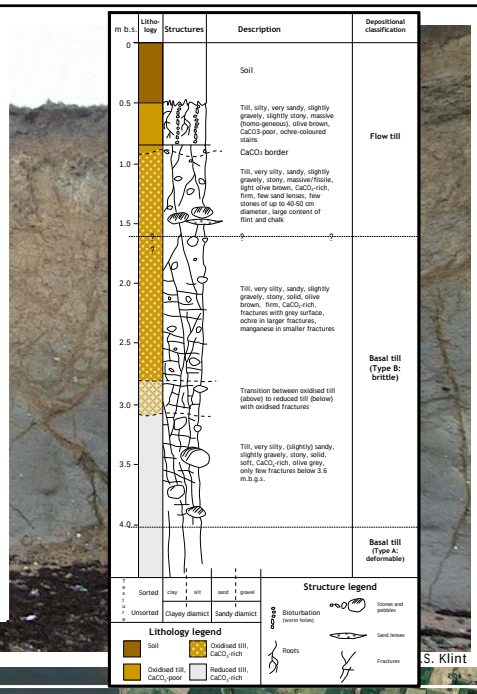
    - Neotectonic fractures
  - *Unsystematic*
    - Biopores (wormholes)
    - Contraction fractures
- *Uncertainties*
  - *Depositional environment*
  - *Postglacial conditions*



S. Klint

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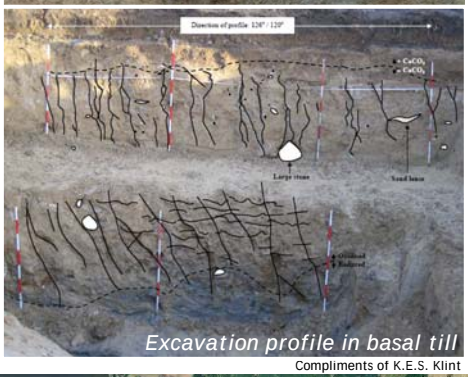
- *Desktop study vs excavation*



Excavation profile in basal till

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