

Projektkonferens InfraSweden2030

ClayBind:

Activated clays in future binders for effective and sustainable concrete infrastructures

Gilles Plusquellec, [Emilie L'Hôpital](#), Arezou Babaahmadi, Urs Mueller



**INFRA
SWEDEN 2030**

Med stöd från:



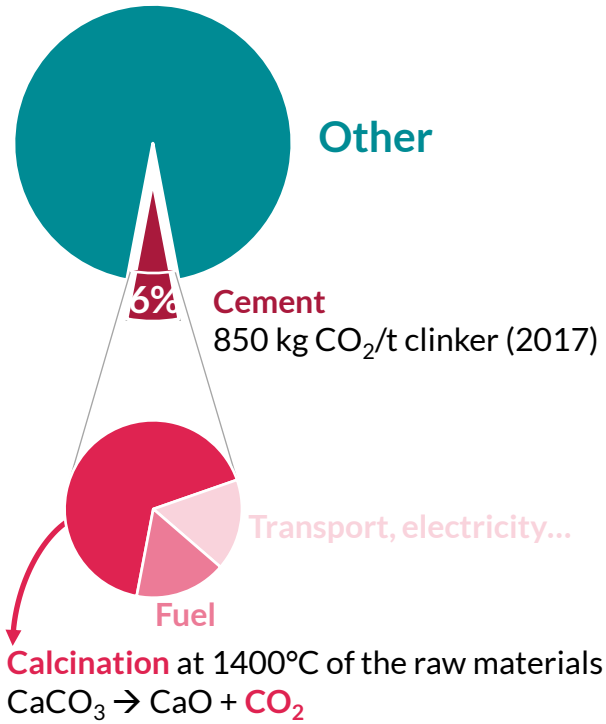
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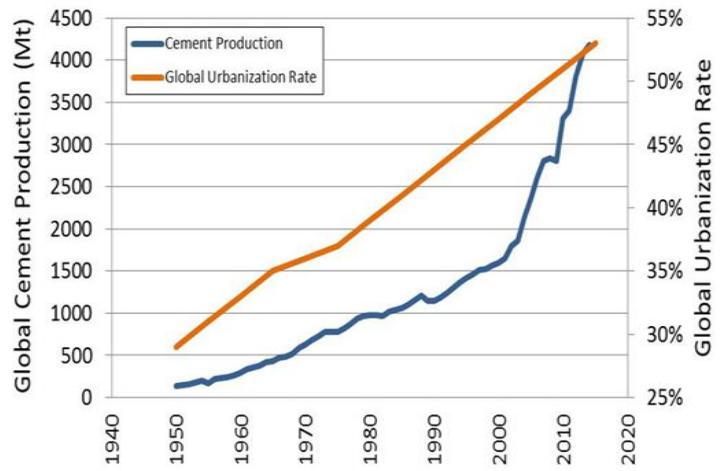
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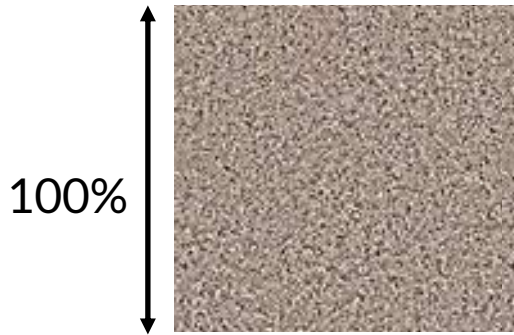
① Because of the biggest challenge humanity is facing: Climate change



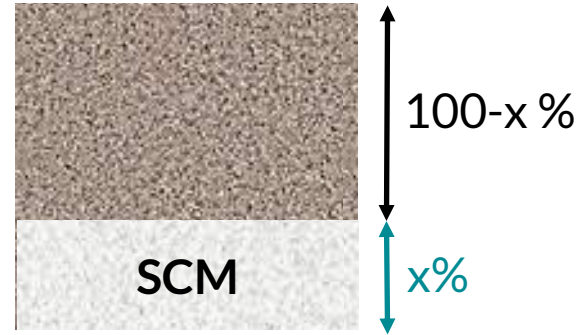
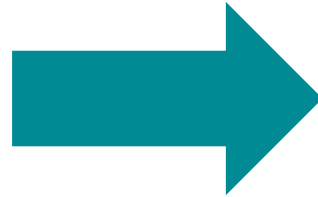
Increasing demand for construction material



② One Solution: Partial substitution of cement with **Supplementary Cementitious Materials (SCM)**



Cement



Use of SCM
= less cement used
= **less CO₂ produced**

3

The limited availability of supplementary cementitious materials in Sweden

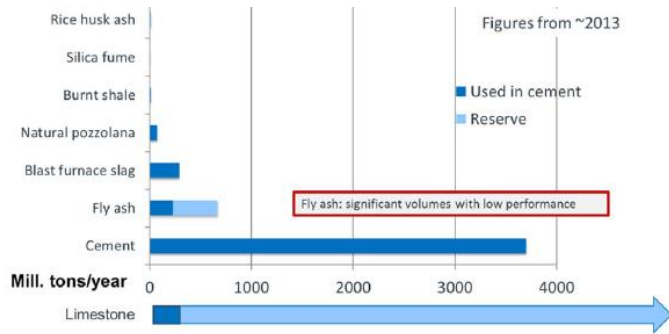


Fig. 1. Availability of Common SCMs [6].

- **Coal combustion fly ashes:**
 - not locally produced
 - need to be imported from abroad
- **Ground granulated blast furnace slags:**
 - low and varying amounts (depending on the production in the Swedish blast furnaces)

③ The limited availability of supplementary cementitious materials in Sweden

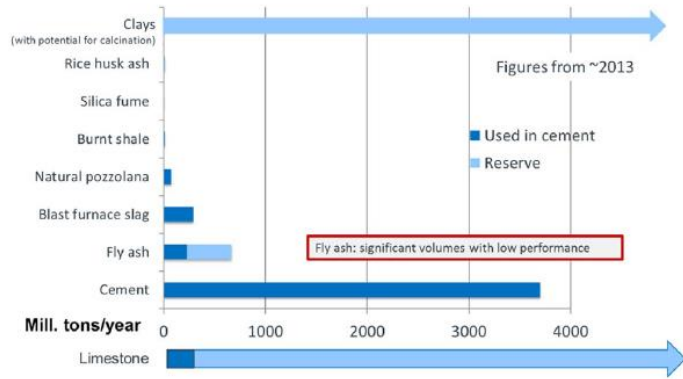


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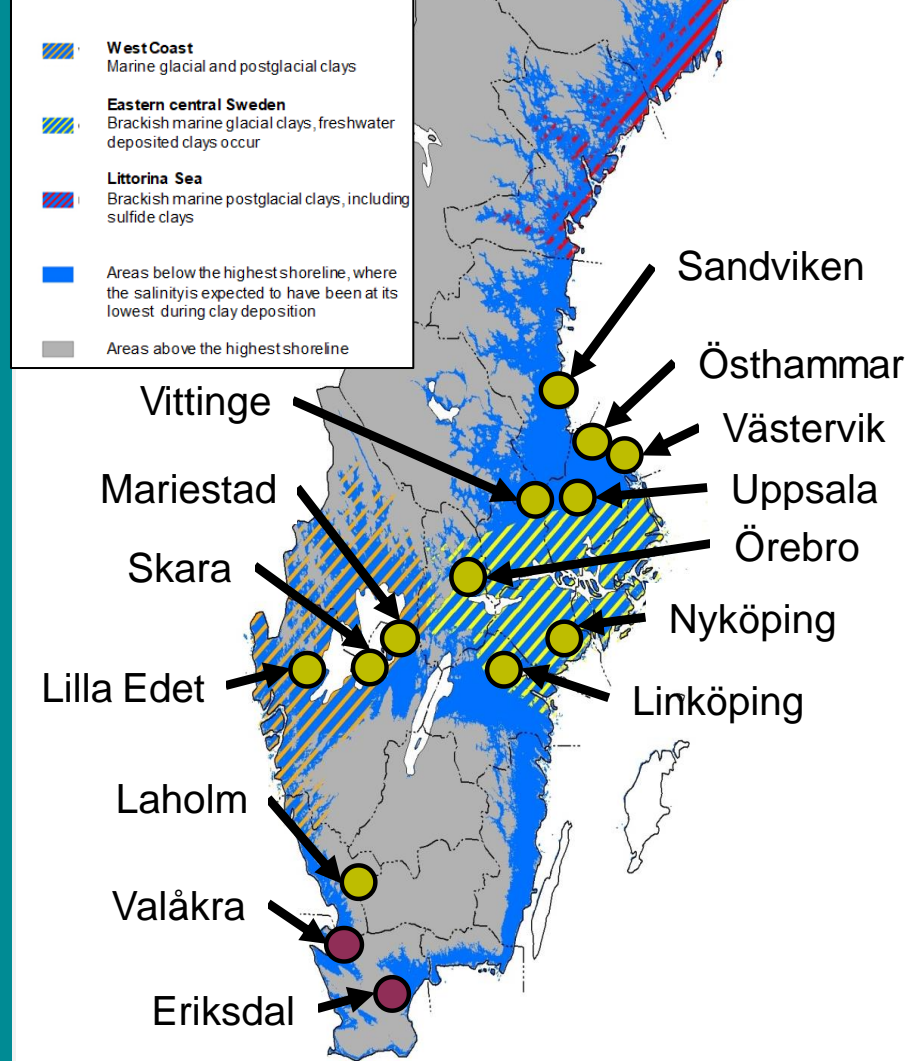
Clays natural pozzolan

- Available in Sweden
- Large amount
- Economically viable

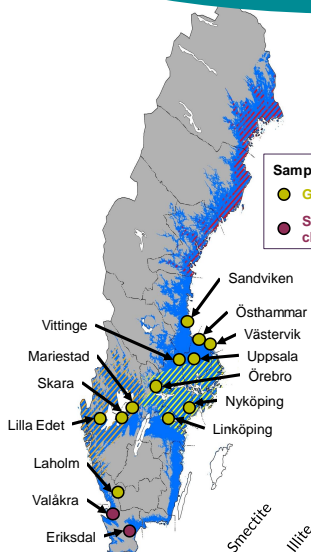


= Good candidate

Can we use the Swedish clays?

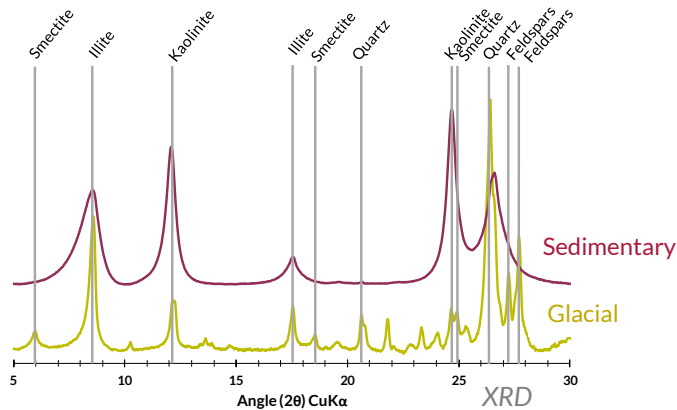


Activation of the Swedish clays



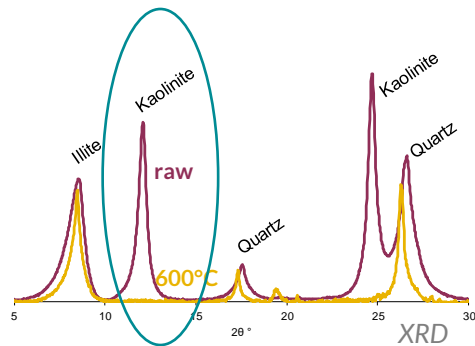
Sample uptake
 ● Glacial clays
 ● Sedimentary clays

Different mineralogy



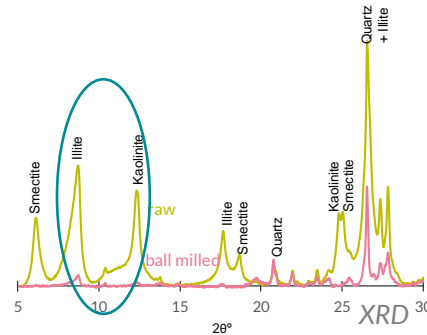
Different activation method

Calcination
 Temperature optimisation



Suitable for kaolinitic clays

Grinding
 Protocol optimisation



Suitable illitic clays

Success of the activation

Next step: behaviour in cement

What happen when activated clays are mixed with cement?

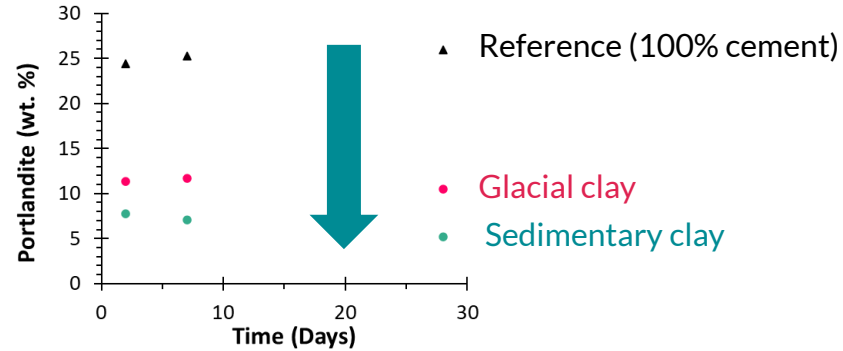
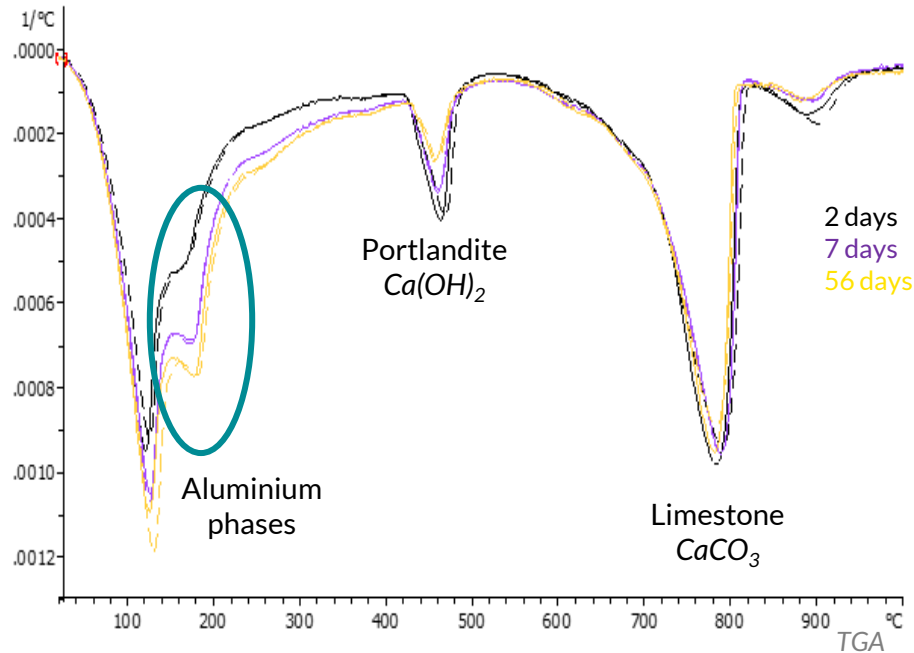


Studied mixes:

- 55% cement
- 30% activate clay
- 15% limestone (used for chemical stabilisation of aluminate phase)

45% of substitution

Clay impact on cement chemistry

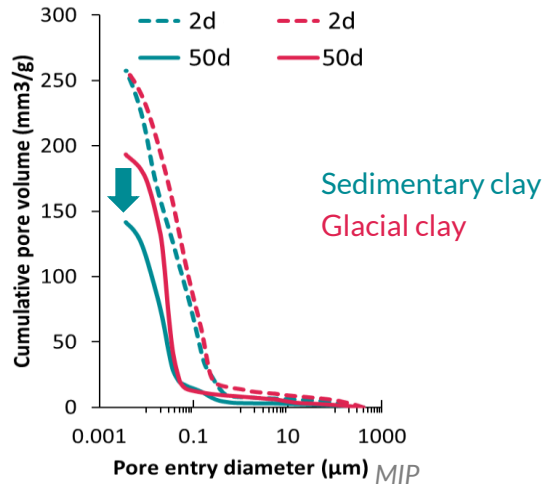


Portlandite consumption

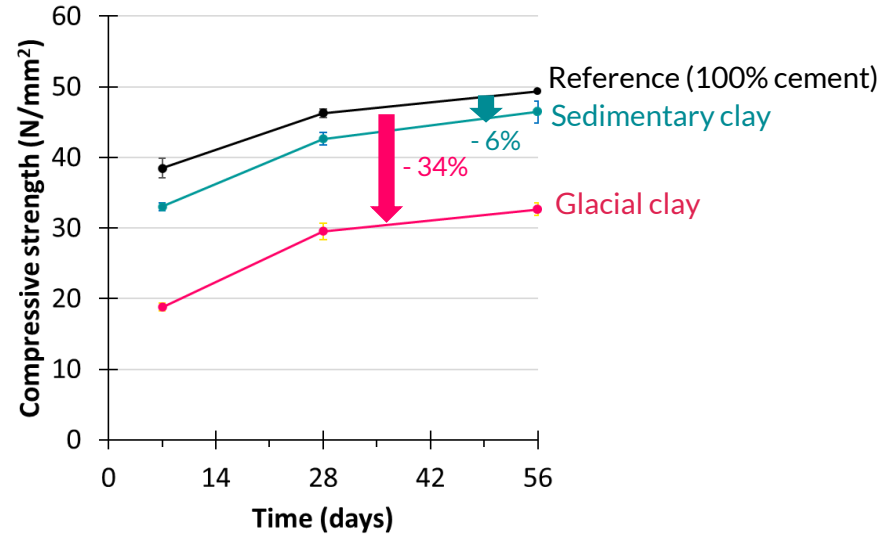
= reaction clay

= precipitation of aluminate hydrate

Clay impact on cement pore structure and strength development



Reduction of the pore entry diameter
= reduce diffusion



Promising results

- Reminder 45% substitution
- Improvement of the mix design possible

Thanks

Conclusion

- **Use of activated clay for a more sustainable infrastructure**
- **Two types of clay are available in Sweden, and to each one corresponds an optimal activation method**
- **Development of concrete containing clay is starting in Sweden, with a needed follow up on durability**

Emilie L'Hôpital

Emilie.lhopital@ri.se