Projektkonferens InfraSweden2030

ClayBind:
Activated clays in future binders for effective and sustainable concrete infrastructures

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INFRA SWEDEN 2030

Med stöd från:
VINNOVA
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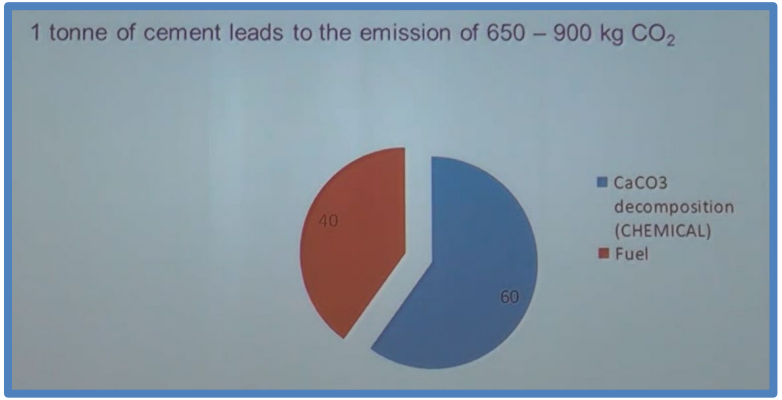
FORMAS
STRATEGISKA INNOVATIONS-PROGRAM

Motivation

- About 5-10% of man-made CO_2 emissions is due to the production of concrete
  → Need to reduce the environmental impact
- Compare to other materials, only concrete can satisfy the increasing demands for infrastructure
- **How can we reduce the CO_2 emissions due to concrete?**
  - Decrease the amount of clinker
  - Use of supplementary cementitious materials (SCMs) with lower environmental impact
  - Most common e.g. fly ash→ importation, not available in near future
  - Slag is available in Sweden → low amount



Clay-bind project

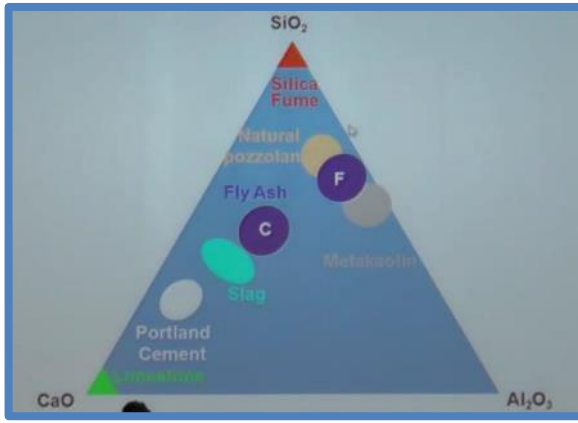
- Which SCM?

→ Look at the different available oxides:

Na_2O, K_2O Too soluble

Fe_2O_3, MgO Too low mobility

CaO, SiO_2, Al_2O_3



→ Considering the availability:

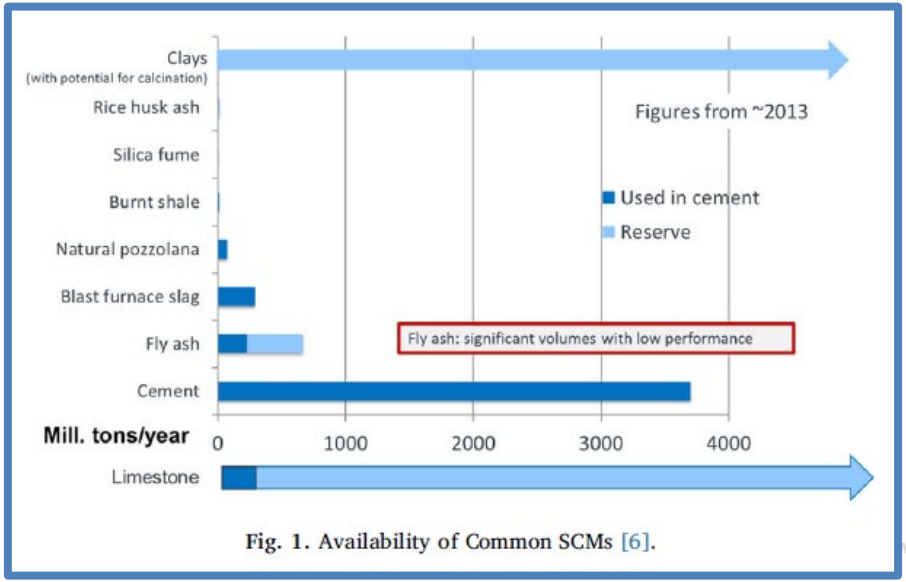


Fig. 1. Availability of Common SCMs [6].

Projektets syfte

The overall **objective of the project** is to:

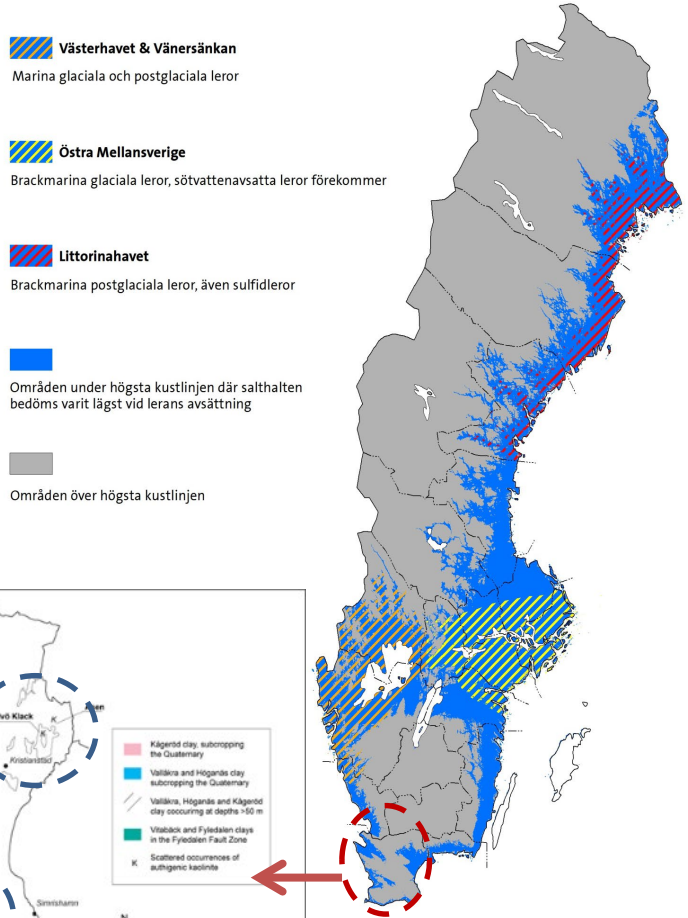
→ Find the best possible way to use **activated clays as a clinker replacement in cement and concrete**

→and by this drastically **reduce greenhouse gas emissions and environmental impact** when constructing **infrastructure buildings** made from concrete.

Step I: Inventory

- Collaboration with SGU (Geological survey of Sweden)

- **2 main types:**
  - 1) Glacial/postglacial clays: East and West coasts
  - 2) Sedimentary marine clays: Skåne
    - The Höganäs clay has been quarried at Margreteberg
    - The Vallåkra clays: ceramic purposes and refractory tiles and bricks
    - The Fyledal-Vitabäck: ceramic purposes
    - Some areas are not quarried yet (environmental issues have to be solved first)

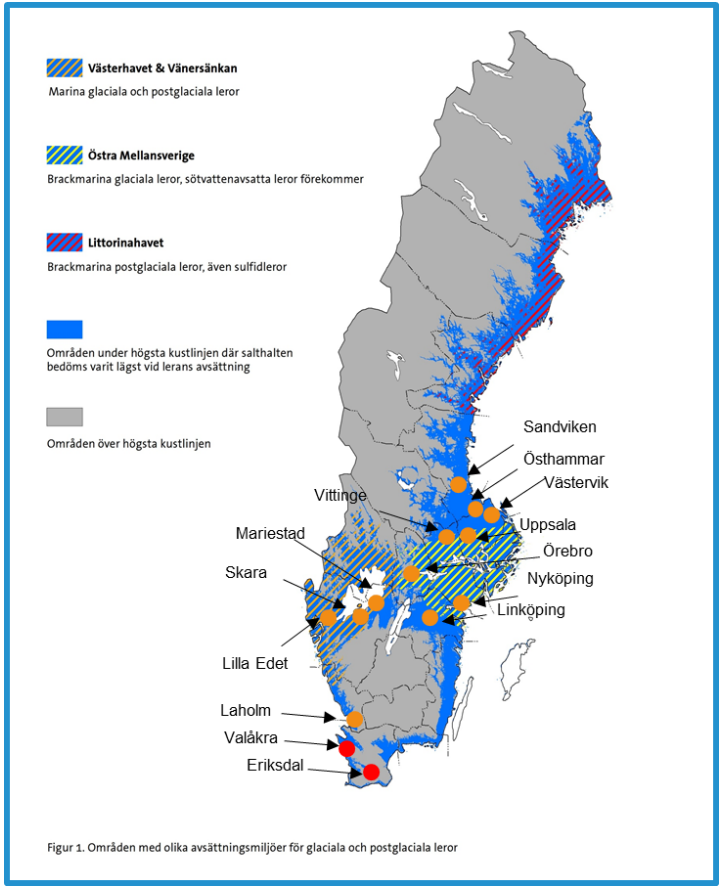


Step II: Sampling

- Glacial and post-glacial clays: 12 different locations:
  (samples were received from SGU archive in small quantities)
  - nordväst om Västervik
  - Nyköping
  - Östhammar
  - norr om Uppsala
  - Örebro
  - Linköping
  - Lilla Edet
  - Vittinge I Uppland
  - Mariestad
  - Laholm
  - Sandviken
  - Skara

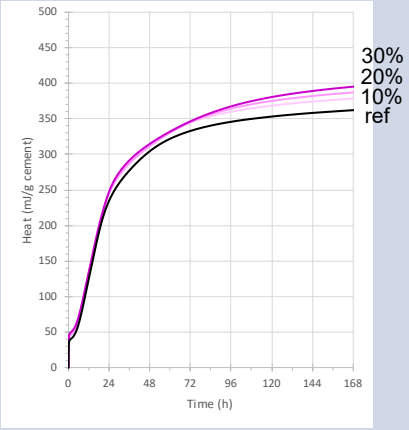
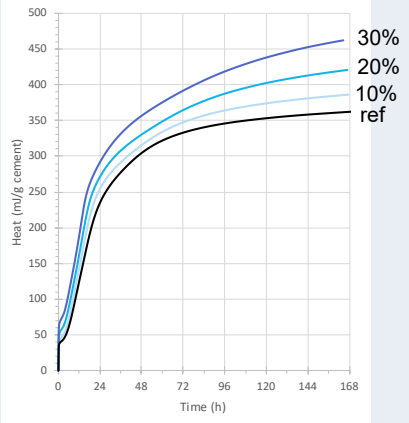
- Two different Sedimentary clays were also chosen and extracted:
  - Fyledalslera- Eriksdal
  - Vallåkralera – Vallåkra Norra Borgen

Foton från Fyleverkens övergivna täkt i Eriksdal. Fotona visar Fyledalslerans undre delar och kontakt mot underliggande Glassand. Spaden markerar provtagningspunkt.(SGU)



Figur 1. Områden med olika avsättningsmiljöer för glaciala och postglaciala leror

Vad är projektets tre viktigaste resultat?

Clay type	1) Characterisation	2) Pozzolanicity	3) Reaction with cement
Glacial/postglacial	- Illite - Smectite - **Kaolinite** → *Easy to activate by heating*	Limited	
Sedimentary	- **Kaolinite** - **Smectite** } *Easy to activate by heating*	Good	

Viktiga lärdomar från projektet

- Clays do exist in Sweden with promising potentials to be used as SCM.
- The Swedish clays are characterized and needed temperatures and conditions for calcination is concluded.
- Activation is best successful on kaolinitic clays.

Communication:

- Results were presented at ICCC2019.
- A journal publication is under consideration.

Future plans:

- Mix design
- Standards and regulations
- The problems with sample uptake and landsstyrelse should be taken care of ! How? Suggestions
- Durability of clay containing binders