Bentonite homogenization: laboratory tests to answer open questions related to the German disposal concept in claystone

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Current concept of a German repository in clay rock

Ongoing German R&D project AnSichT

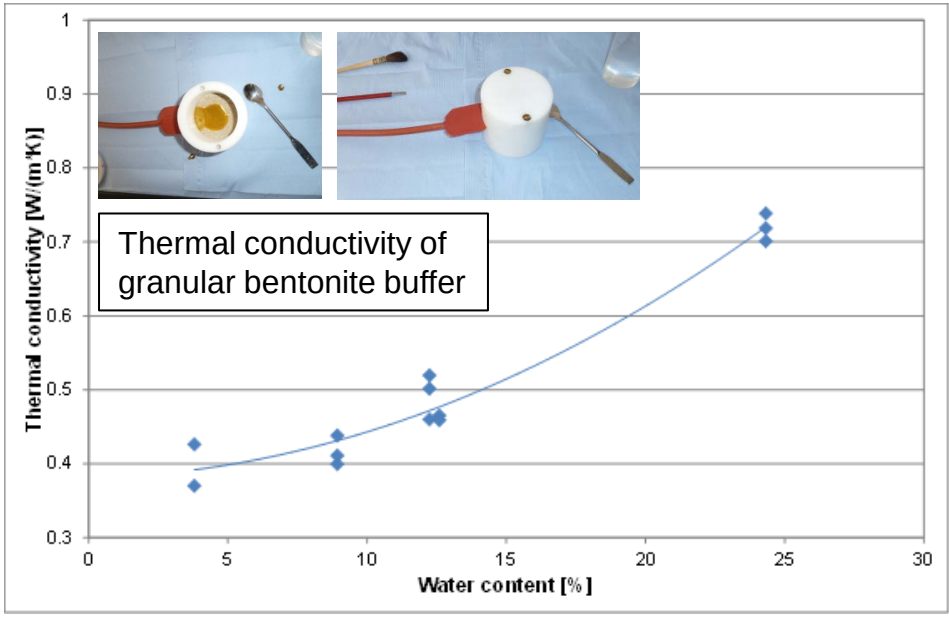
- Development of a FEP catalogue and a disposal and closure concept for a potential HLW / SF repository in clay rock

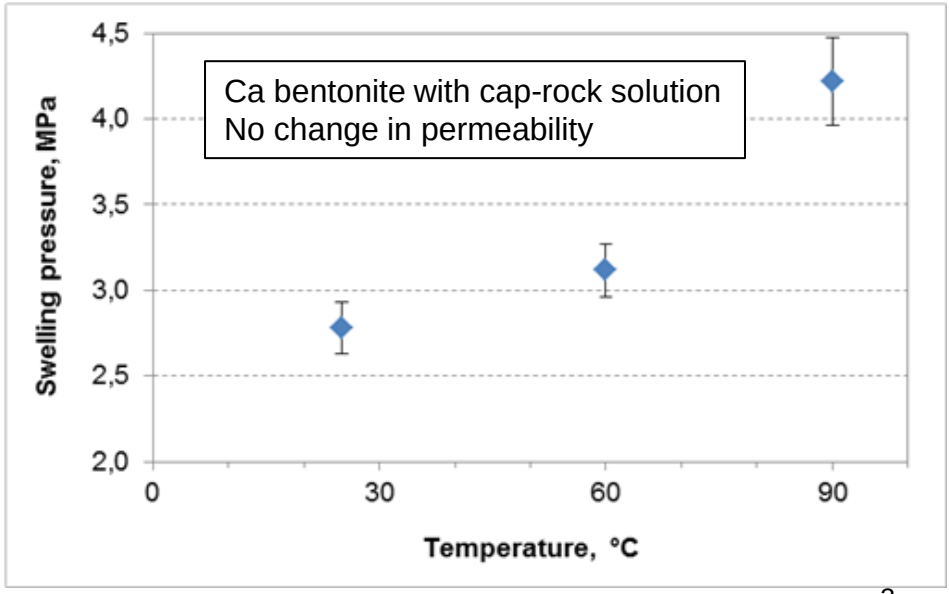
- Different disposal concepts for two different site models
  - North Germany: Lower Cretaceous, high pore water salinity (150 g/l), disposal in vertical boreholes drilled from access galleries
  - South Germany: Opalinus clay, low salinity of pore water (<23 g/l), disposal in galleries

- Both concepts: Bentonite/clay bearing buffer (pellets and blocks) exposed to temperatures **up to 150 °C**

Recent work of GRS with relation to buffer materials

- **PEBS project**
  - Thermal characterization of bentonite blocks and pellets and of granular sand-bentonite mixture
  - HE-E in-situ heater test
- **SB project** (Self-Sealing Barriers of Sand/Bentonite Mixtures in a Clay Repository)
- **Kollorado / CFM project**
  - Modelling of bentonite erosion and colloid-facilitated radionuclide transport
- **UMB project**
  - Transformation mechanisms for bentonite barriers





Open questions related to buffer homogenization

- **Bentonite cementation** as a consequence of interaction with pore solution
  - Piping, pore clogging, dependence on temperature?

- **Buffer erosion** along engineering voids, resulting from colloid formation

- **Hydraulic behaviour** of the buffer during and after resaturation, compared to design performance

The questions are not specific to the German concept, but the high temperatures and high salinities are.

Laboratory programme to resolve the questions

Lab tests to be designed and performed (ideas existing)

- At elevated temperature up to 150 °C (with corresponding fluid pressure to maintain a liquid phase, in accordance with expected repository evolution)
- With low and high salinity pore water, up to 150 g/l
- With Ca- and Na-bentonites to study different swellling behaviour

Aim of experiments

- Quantify erosion due to colloid formation and related permeability change under varying conditions
- Study the effect of pellet size on permeability and heterogeneity of the bentonite after resaturation

Integration of the experimental programme into a joint project on buffer homogenization would be favoured