In Situ bentonites: describing repository relevant processes

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Bentonite will be used in many radioactive waste disposal repository concepts. Most bentonites are quarried from surficial deposits and these have been investigated in detail in order to develop conceptual models for various processes expected to occur during repository evolution. However, especially in the case of deep geological disposal (few hundreds to 1000 m depths), bentonite based materials will be subjected to natural hydrostatic pressures. Saturation process dictates the type and rate of many geochemical processes taking place in the bentonite. Full saturation is assumed in most reposioty designs as a long-term condition for the bentonite. However, the period before full saturation can be very long when the decay heat of the waste affects near-field conditions, especially in cases where the host rock is relatively dry.

Highly compacted bentonite, pellets and bentonite mixtures (all potential EBS materials) have different properties (e.g. density, porosity, hydraulic and thermal conductivity). Compositional variation (smectite content vs. accessory minerals) can also be found in *in situ* bentonites (at large depth range). By looking at these bentonite occurrences at repository relevant depth some open questions can be answered:

1. What is the natural saturation state of bentonites and how it varies as a function of local geology?
2. Natural bentonites seem to be closed/half closed systems – what implications does this have on the mixing tank type of safety assessment?
3. Are safety case assumptions too conservative? And can furher studies help in conceptualisation of bentonite-water processes so that they would be more realistic?

For repository projects realistic assessment is not only safety relevant but also allows optimisation of, for example, waste package spacing. This is especialy important to those programmes (such as in Japan) where the repository ‘footprint’ has to be purchased as closer spacing of canisters could cut this significant cost drastically.