

Proposal for a master's thesis:

## **Preparation and characterization of a synthetic saponite**

### **Background**

SKB is developing a method for final disposal of spent nuclear fuel. This method is called KBS-3 and is based on three protective barriers: copper canisters, bentonite clay and the Swedish bedrock.

Down in the tunnels of the Spent Fuel Repository the copper canisters will be embedded in bentonite clay. The clay acts as a buffer and protects the canister against corrosion attack and minor rock movements.

Bentonite is a natural raw material available in large quantities in many places on earth. Bentonite mainly consists of the clay mineral montmorillonite, which provides the unique hydraulic and mechanical properties. Another clay mineral with similar properties is saponite. The availability of natural saponite is limited compared to montmorillonite. SKB is however interested in learning more about the properties of saponite. One possibility is then to study synthetic saponite. The purpose of this project is to develop and test a method for synthesizing saponite, and to characterize the material produced.

### **Activities**

#### **Literature study**

Literature search of methods to produce synthetic saponite. The aim should be to find a method that is simple, quick and can produce relatively large amounts of saponite.

#### **Synthesis**

Based on the literature search, one or two methods to be tested in the laboratory are selected. The aim is to produce a sufficient amount of material to conduct a characterization and a test of the hydro-mechanical properties.

#### **Characterization**

Perform a Check that the material is indeed saponite. The idea is that this should be done with X-ray Diffraction (XRD) analysis and / or infrared spectroscopy, although other analysis methods may be of interest. The characterization should be accompanied by a determination of the material's ion exchange capacity.

#### **Testing the hydro-mechanical properties**

For a buffer material in the nuclear fuel repository, the hydro-mechanical properties are very important. Therefore, if possible, the determination of the material's swelling pressure and hydraulic conductivity should be included.

#### **Reporting**

This should include a written as well as an oral presentation.

#### **Conditions**

The work should mainly be performed at the Materials Science Laboratory at Äspö HRL north of Oskarshamn, Sweden. This means that the driver's license and access to a car is a necessity. Dr Daniel

Svensson ([daniel.svensson@skb.se](mailto:daniel.svensson@skb.se)) will be the supervisor at SKB. Contact persons at SKB are also Patrik Sellin ([patrik.sellin@skb.se](mailto:patrik.sellin@skb.se)) and Peter Wikberg ([peter.wikberg@skb.se](mailto:peter.wikberg@skb.se)).

Part of the work will be also be performed in collaboration with Jocelyne Brendlé ([Jocelyne.brendle@uha.fr](mailto:Jocelyne.brendle@uha.fr)) at the Institut de Science des Matériaux de Mulhouse, UMR-CNRS 7361, 3b rue A. Werner, 68093 Mulhouse Cedex, France