The Effect of Salt on the Compressibility and Permeability of Mud-Rocks

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ABSTRACT

I am currently exploring how varying the salt content in the pore fluid affects the compressibility and permeability of Boston Blue Clay.

The soil is resedimented to a stress of 0.1MPa. From this parent specimen, sub samples are then taken to stress levels of 1MPa and 10MPa via the constant rate of strain (CRS) apparatus. The resedementation process can be seen in Figure 1 and the CRS device which will be used to bring the specimens to higher stresses, is shown in Figure 2.

The soils were resedimented to salt concentrations of 1, 4, 16, 64 & 256g/l (1,000 – 256,000ppm).

We observe a consistent relationship whereby the higher the salinity, the higher the porosity at a given effective stress. This relationship is shown in figure 3. Increasing the salinity reduces the permeability at a given porosity. This is true for a salinity greater than the in-situ condition. It has also been shown that leaching the in-situ salts from the soil, dramatically alters the soil structure. Both these observations can be seen in figure 4.

Fabric analysis will be performed by UT Austin on the soil at all stress levels and at all salt concentrations to determine the pore structure and

Fig. 1: Resedimentation technique whereby a slurry containing the target soil is incrementally consolidated over a certain timeframe

Fig. 2: Constant Rate of Strain (CRS) cell in which the compressibility characteristics of mudrocks at varying salt contents will be determined at differing stresses

clay alignment in order to better understand how the fabric of a compacting mud rock evolves.

This work will help develop a geomechanical model for mudrocks that will better allow us to predict compaction behavior, pore pressure, and borehole stability at geologic stresses.

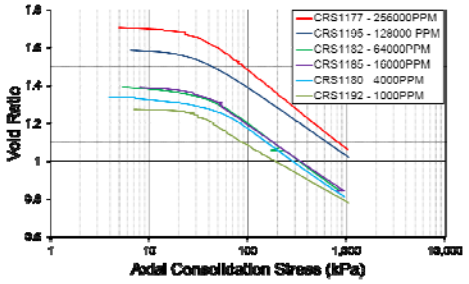

Fig. 3: Relationship between salt concentration and porosity at a given effective stress

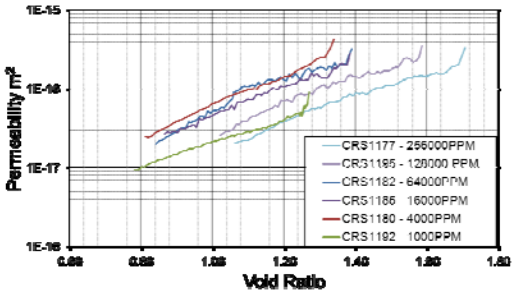

Fig. 4: Relationship between salt concentration and permeability at a given void ratio