Compression Behavior of Smectitic vs. Illitic mudrocks

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ABSTRACT

Predicting pore pressure (overpressure) is important for geophysical interpretation and deep borehole design. One of the possible mechanisms for overpressure development in deep basins is the transformation of smectite to illite. My research aims to look at the relationship between smectite-to-illite transformation and overpressure generation.

Two sets of experimental programs were conducted on GoM-EI material to see the effect of smectite-to-illite transformation. All experiments were performed at 3 mol/L KCl. In experimental program A (loaded & cooked), the original mudrock was compressed to 5MPa; heated to 200C for 30 days; cooled to room temperature; and reloaded to 100MPa. In experimental program B (cooked in slurry then loaded), the original mudrock was cooked in a slurry at 250C for 18 days; resedimented and then compressed to 100MPa.

From CRS tests, the cooked in slurry material sits at a higher porosity than the other two. Although the shape of compression curves are different, the compressibility of three mudrocks are similar at a given porosity. After transformation (yellow and purple curves) the material has a higher permeability at the same porosity. In addition, we find the rate of creep increases in high temperature. This may be caused by a combination of creep and mineral conversion.

CLICK ON IMAGE FOR LARGER VIEW

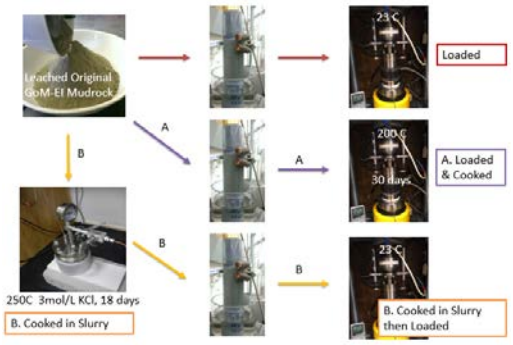

Fig 1: Procedures for CRS test sample preparation.

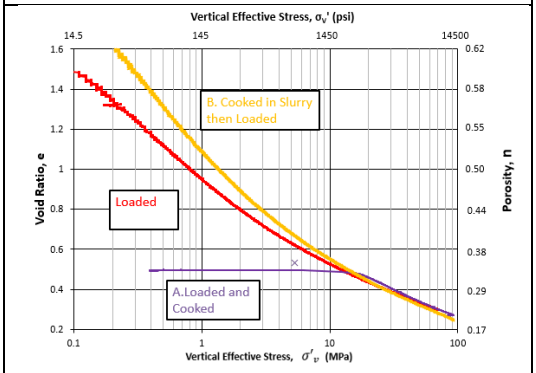

Fig 2: Compression Curves for program A (loaded & cooked), program B (cooked in slurry then loaded) and the original GoM-EI mudrock.

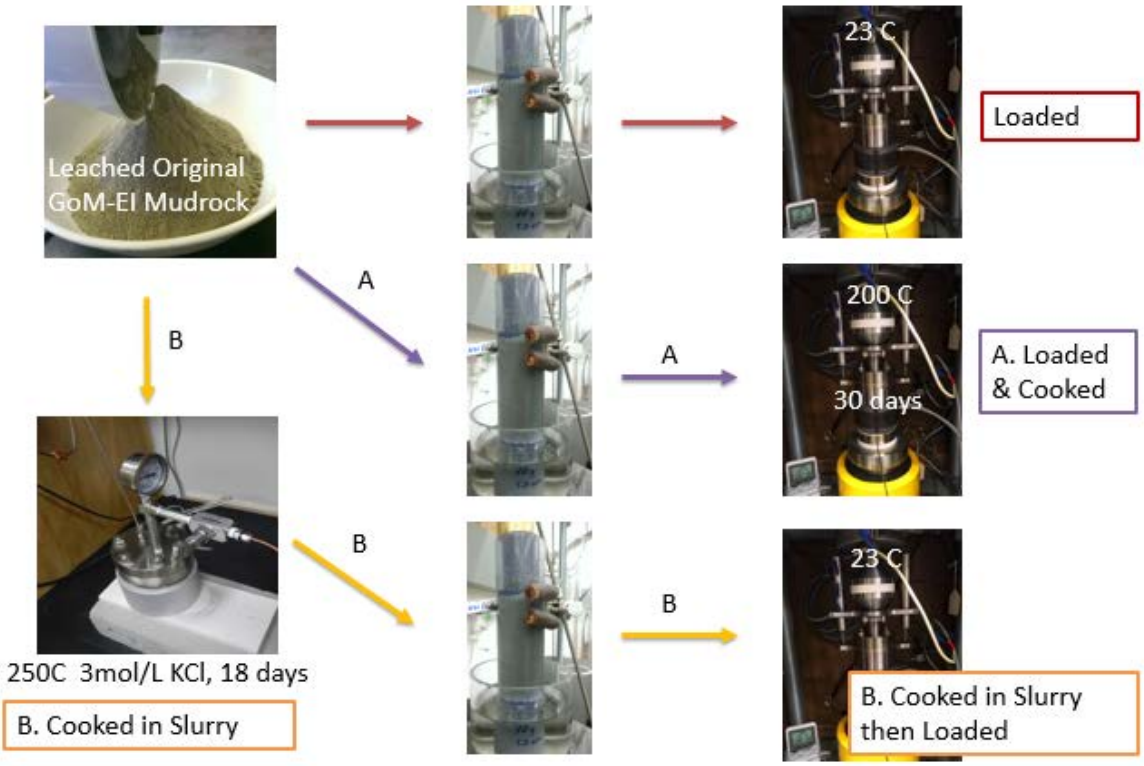

Fig. 1: Procedures for CRS test sample preparation. Two sets of experimental programs were conducted to see the effect of smectite-to-illite transformation. In experimental program A (loaded & cooked), original GoM-EI mudrock was compressed then hold stress at 5MPa; heated to 200C for 30 days with 3 mol/L KCl pore fluid; cooled down to room temperature and reloaded to 100MPa. In experimental program B (cooked in slurry then loaded), the original GoM-EI material(loaded) was cooked in slurry at 250C for 18 days with 3 mol/L KCl; resedimented and then compressed to 100MPa.

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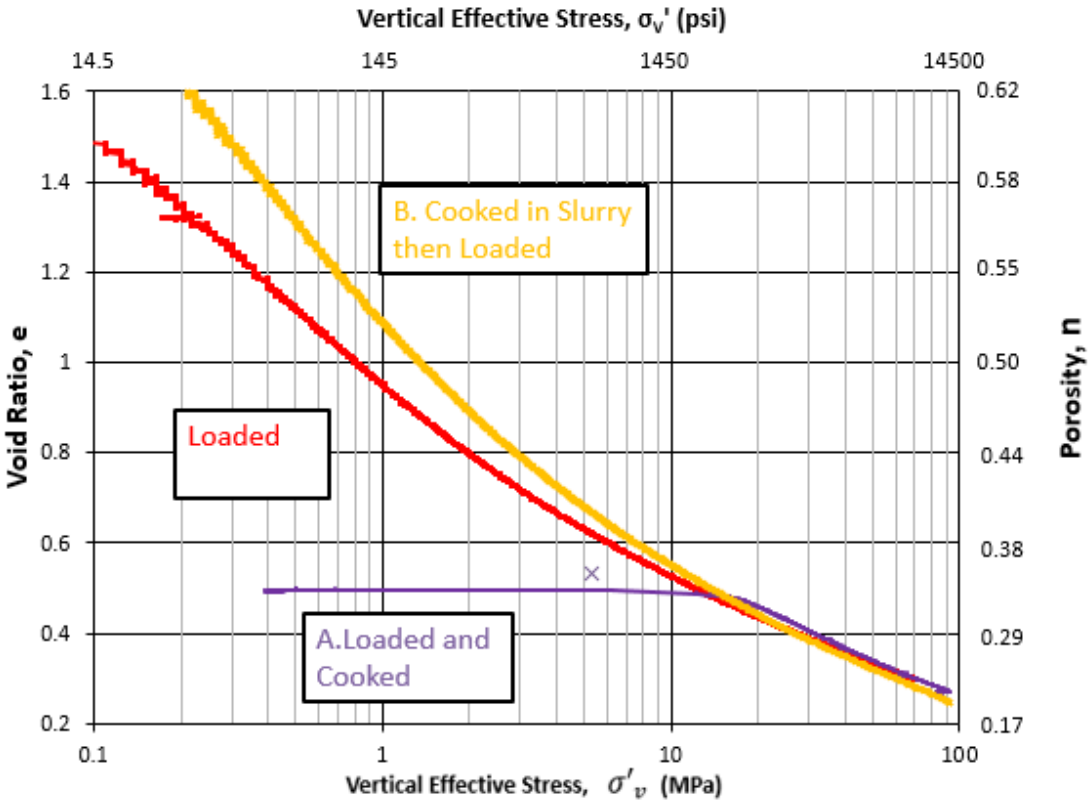

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