

Predicting Mudrock Permeability and Compressibility from Liquid Limit

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ABSTRACT

We show that the permeability-porosity relationship for a mudrock as well as its compression behavior (porosity vs. effective stress) can be correlated to liquid limit. Liquid limit is an easily measured material property that can be determined from highly disturbed samples and reflects the clay mineralogy and clay fraction of a mudrock. The permeability and compression behavior of a variety of resedimented mudrocks (Figures 1 and 2 respectively) is examined over a range of porosities from 0.20 to 0.75 and effective stresses up to 40 MPa. At a given porosity, mudrock permeability varies over 3 – 5 orders of magnitude (Figure 1). The permeabilities predicted using our correlations all fall within ± 5 times the measured values and most fall within ± 3 times the measured values.

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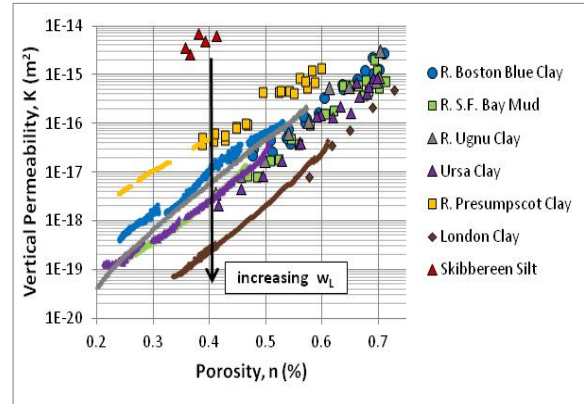


Fig. 1: Permeability-porosity relationships for 7 resedimented mudrocks. At a given porosity, permeability varies over 3 – 5 orders of magnitude. There is a strong correlation between the permeability of a mudrock and its liquid limit (w_L).

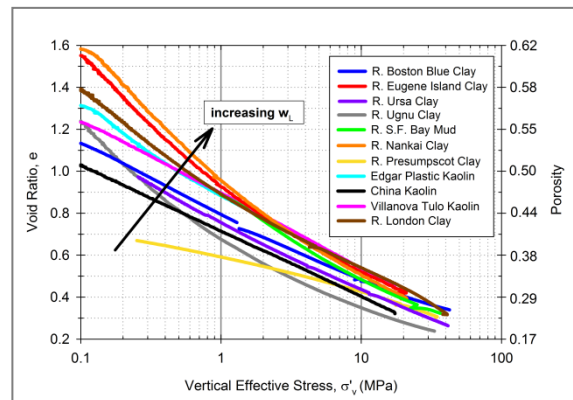


Fig. 2: The compression behavior of resedimented mudrocks. Mudrocks with higher liquid limits (w_L) have a greater void ratio/porosity at low stresses which then reduces more rapidly with increasing effective stress, i.e. they have a higher compressibility. At high stresses the virgin compression lines of mudrocks tend to converge.

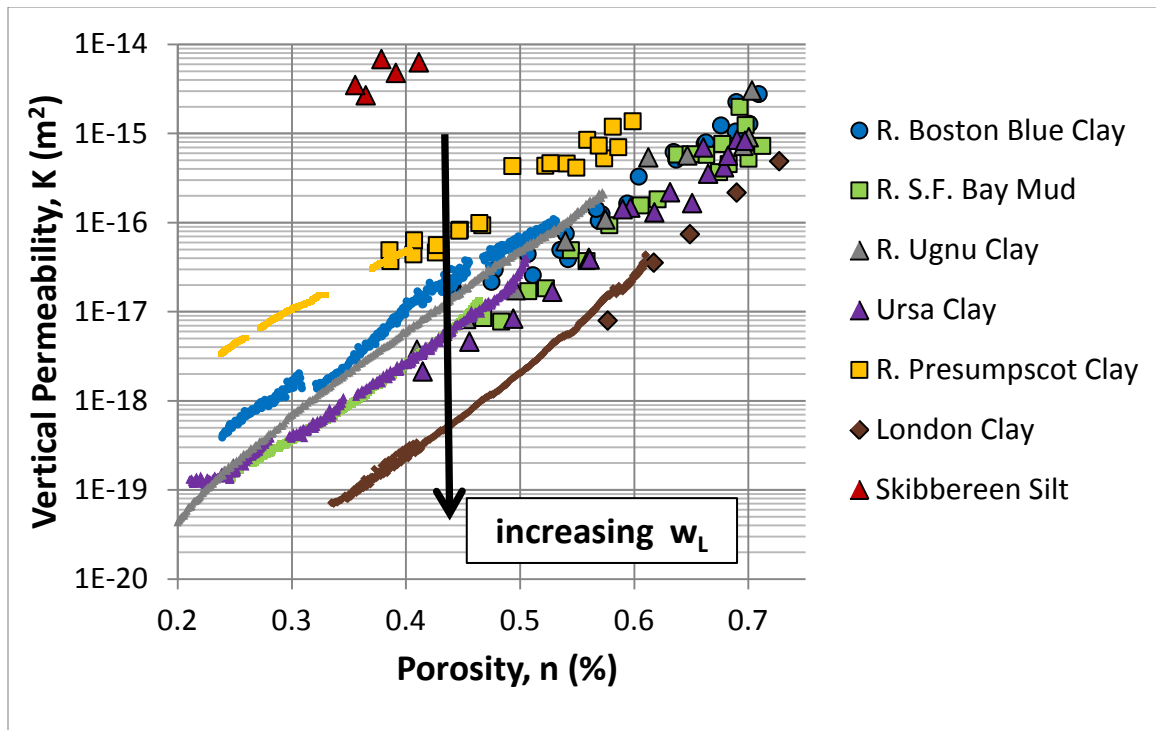


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[Back](#)

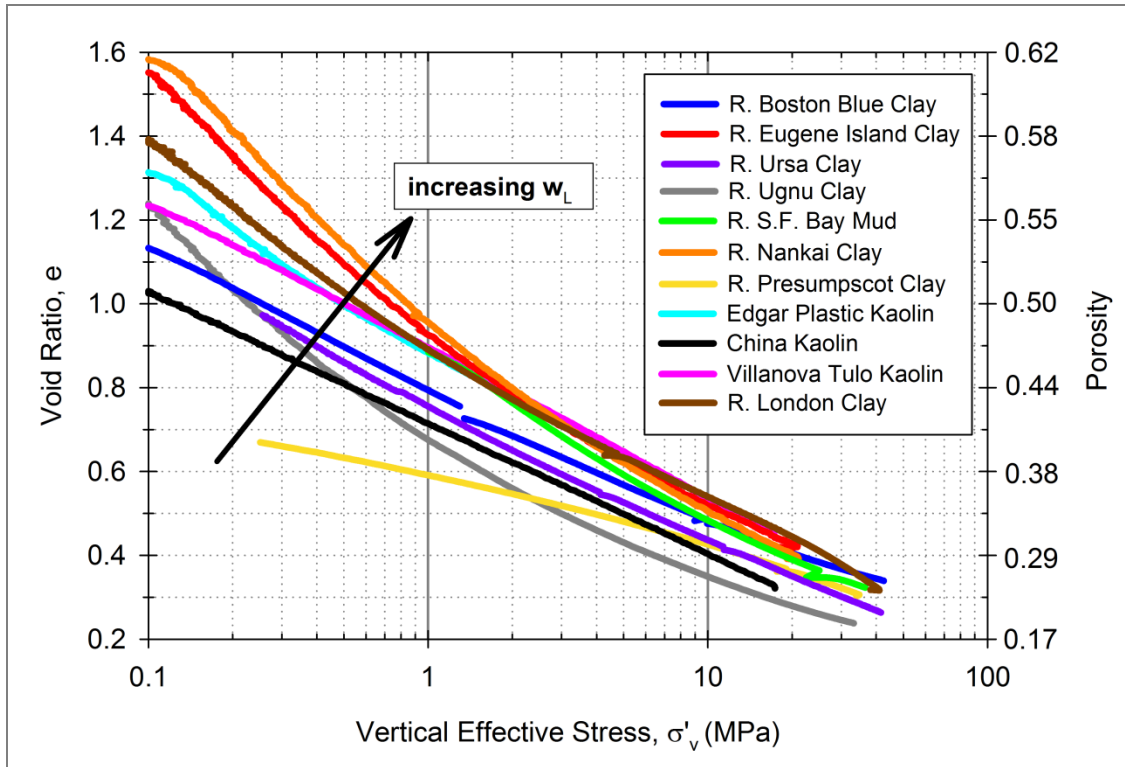


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[Back](#)