Comparison of Permeability and Compression Models to Intact Samples from the Ursa Basin

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ABSTRACT

In situ mudrock permeability is predicted from porosity and liquid limit (w_L) (Fig. 1). 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. Our model is calibrated using data from a wide variety of resedimented mudrocks. Two separate data sets of permeability measurements taken on intact core from the Ursa Basin are compared against the model predictions. The permeabilities predicted using our model all fall within ±5 times the measured values.

The compressibility of intact samples is also shown to be a function of w_L, with higher w_L samples displaying a greater compressibility. A similar trend is seen across a wide range of resedimented mudrocks (Fig. 2).

Our approach provides the potential to rapidly and inexpensively predict permeability and compressibility in situ from liquid limit measurements performed on disturbed borehole material, such as cuttings.

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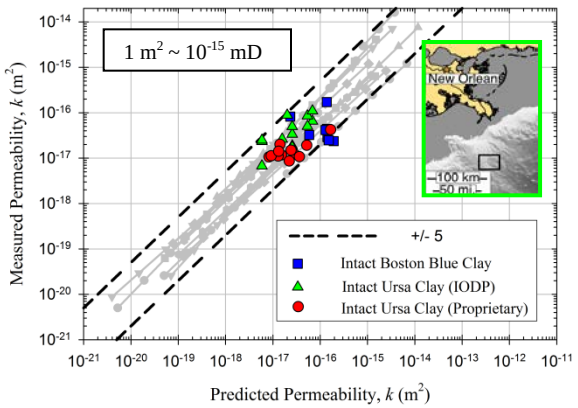


Fig. 1: A comparison of measured permeabilities of intact mudrock samples against those predicted using our model. The model is calibrated using data from resedimented mudrocks (resedimented data shown in grey in the background).

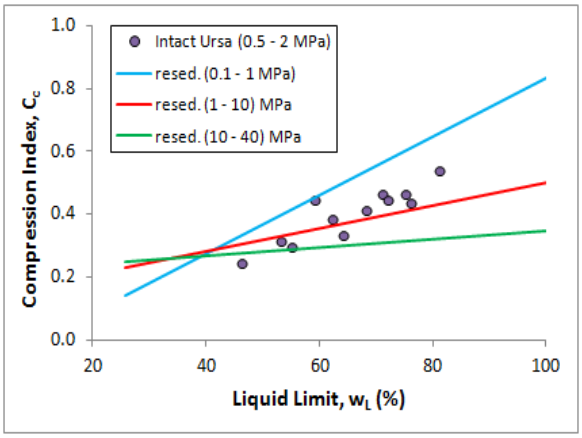
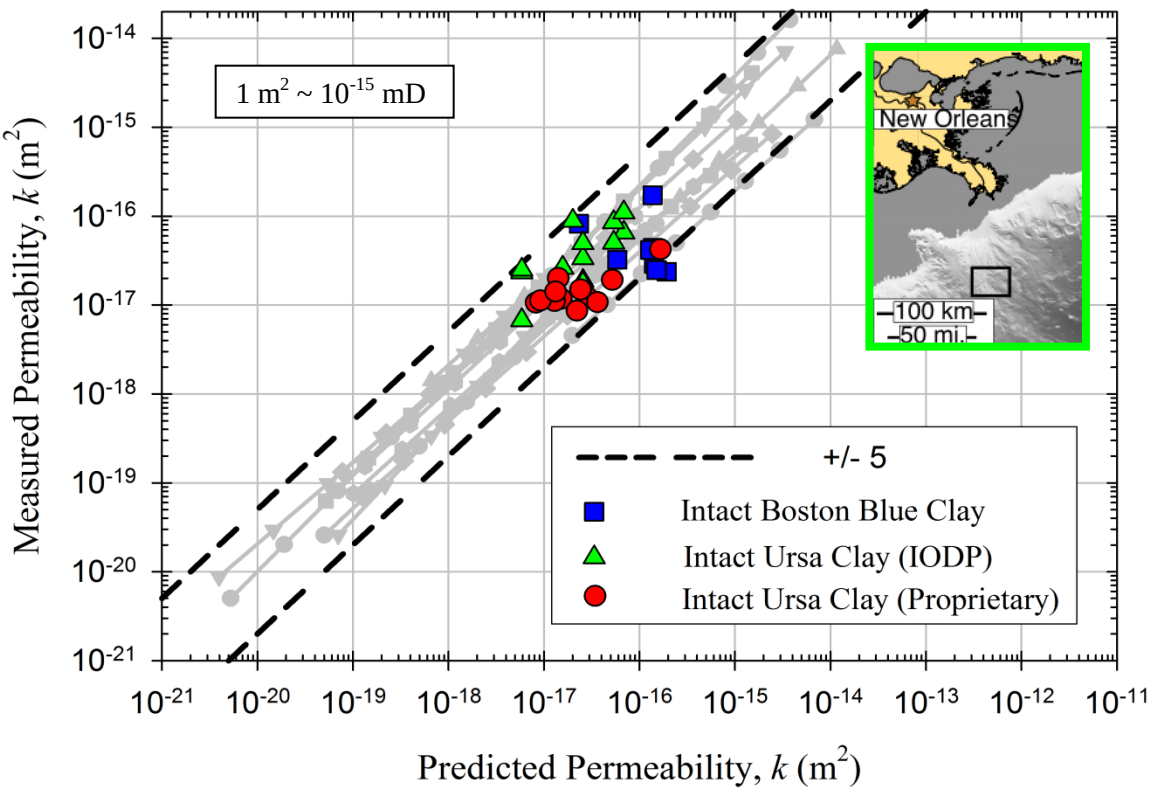


Fig. 2: Compression indices of intact Ursa mudrock samples as a function of w_L. Samples with higher w_L are more compressible. For comparison, the average compressibilities of various resedimented mudrocks as a function of w_L are shown for different stress levels.



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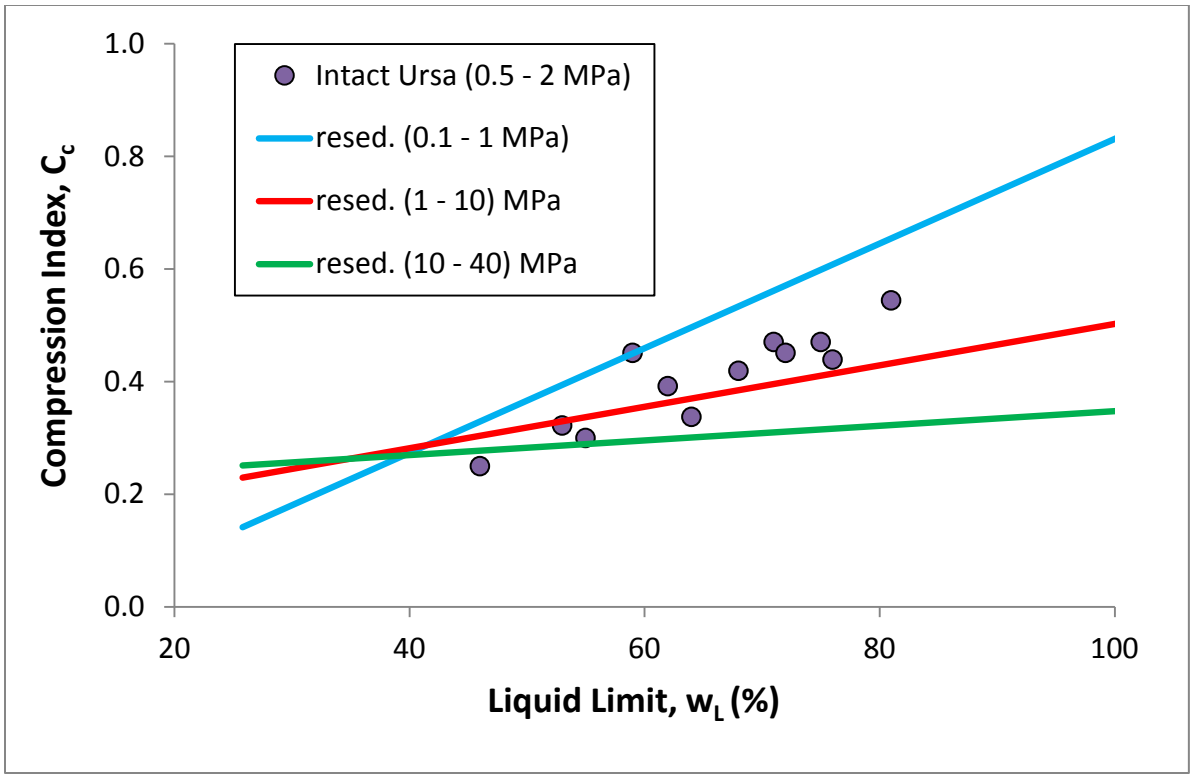

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