# Salinity Dependence of Compressibility and Permeability in Smectitic Mudrocks

*Brian Fahy, Massachusetts Institute of Technology*


## ABSTRACT

The compression behavior and the permeability behavior of Eugene Island Gulf of Mexico resedimented mudrocks is impacted by the pore fluid salinity. Resedimented mudrocks with lower salinity have a higher initial void ratio (surface porosity) and they compress more for a given change in stress than mudrocks with higher salinity (Fig. 1). Mudrocks with a lower initial salinity have a lower permeability than mudrocks with high initial salinity (Fig. 2). This effect is large at low stress and small at high stresses. At high stresses, the stress level has a greater impact on the mechanical behavior than the pore fluid salinity. Tests were conducted on resedimented natural Eugene Island mudrock (GOM EI) and leached GOM EI. Leaching of the natural salts out of the soil and then resedimenting with various pore fluid salinities returns the soil to similar permeability to that of the natural soil at the same salinity.

The rate of consolidation increases with increasing salinity, with the rates for all salt contents converging at high stress (40MPa).

Tests were carried out using the Constant Rate of Strain (CRS) device to stresses of 40MPa with 2 tests to 100MPa.

$K_0$ consolidated undrained shear testing on GOM EI in triaxial testing equipment shows a general trend


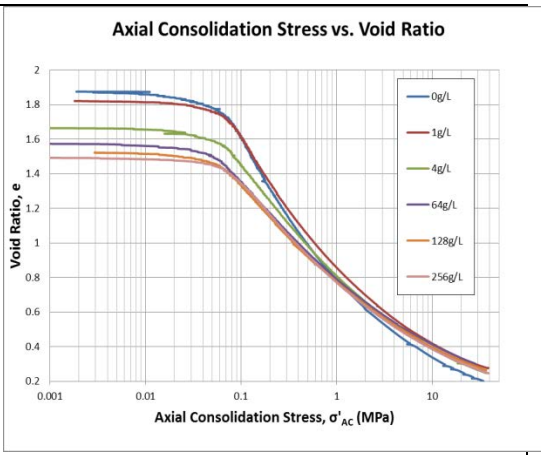


**Fig. 1**: Compression behavior of natural GOM EI over a wide range of pore fluid salinities.

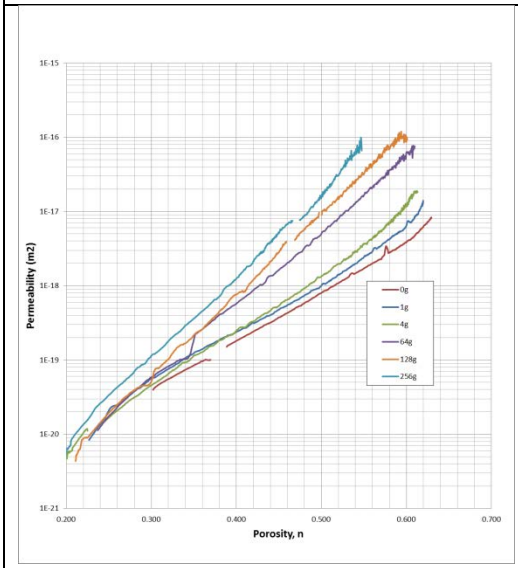


**Fig. 2**: Permeability of natural GOM EI over a wide range of pore fluid salinities

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| of decreasing shear strength and friction angle with increasing confining stress. Varying the pore fluid salinity of the soil resulted in no definitive trend in strength as a function of pore fluid salinity. GOM EI with pore fluid salinities of 4, 64, and 256g/L were $K_0$ consolidated and then sheared in compression. Consolidation stresses ranged from 0.4 – 10MPa.<br>The history and evolution of pore fluid salinities in GOM EI as it undergoes burial does not have an impact on its strength characteristics.<br><br>**CLICK ON IMAGE FOR LARGER VIEW** | |

Back

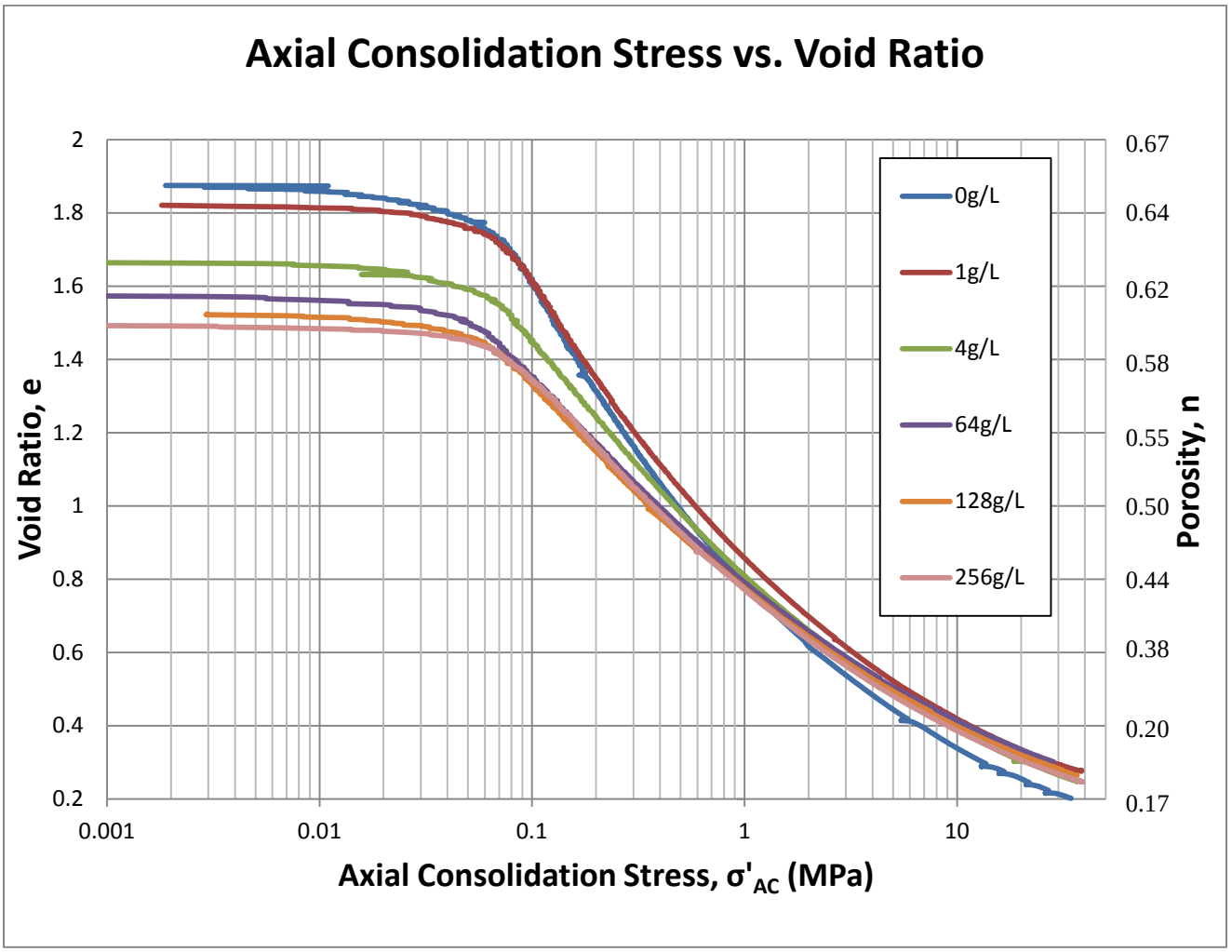


**Fig. 1**: Compression behavior of natural GOM EI with pore fluid salinities ranging from distilled water up to 256g/L. Compressibility decreases with increasing salt content. At high stresses (40MPa), all soils have similar void ratio regardless of salt content.

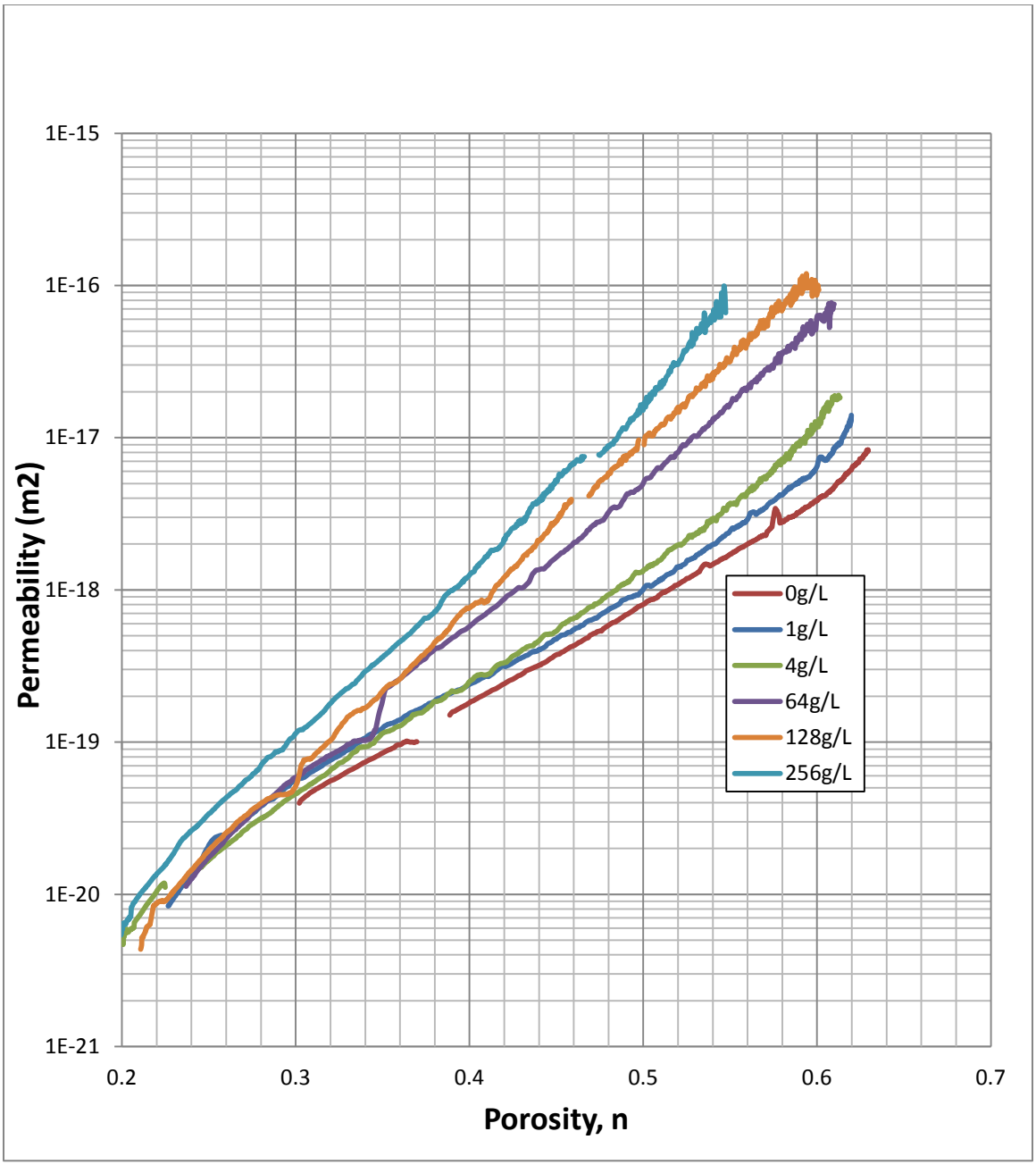


**Fig. 2**: Permeability of natural GOM EI with pore fluid salinities ranging from distilled water up to 256g/L. At low stress permeability increases with increase salt content. As porosity decreases, the permeability behavior for a wide range of salt contents converges resulting in similar permeability at a porosity of 0.25.

Back