The fabric and compaction in Gulf of Mexico mudstones

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ABSTRACT

We use core material to illuminate the micro-scale fabric of clay-rich mudstones during compaction in shallow buried sediments cored as part of Integrated Ocean Drilling Program Expedition 308, Ursa Basin, Gulf of Mexico. This study is the first step in developing a comprehensive model for understanding the anisotropic behavior of mudstones. Mudstones of consistent composition, grain size and gamma-ray log response decrease in porosity from 80% at the mudline to 37% at 600m of vertical burial at Ursa. We use Argon-ion milled surfaces to image this pore evolution over a vertical effective stress range of 0.26 to 5.19 MPa. We find an elongation of the pore shape and quantify the preferential loss of large pores, primarily associated with larger grains, and decrease in mean pore size over this stress range. This soil fabric change is accompanied by a small clay mineral preferred orientation increase, also a function of effective stress, which we document in the shallow section for the first time.

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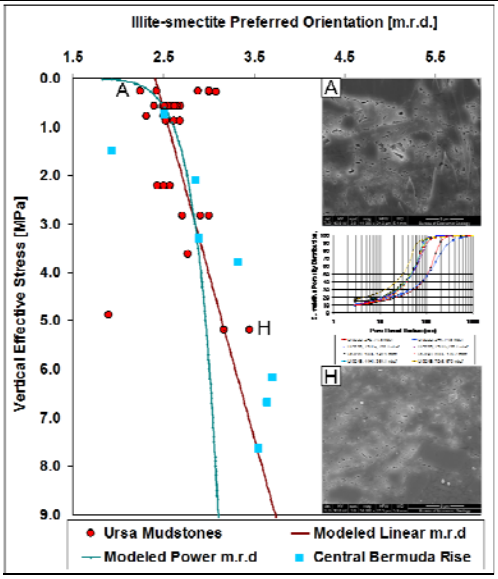
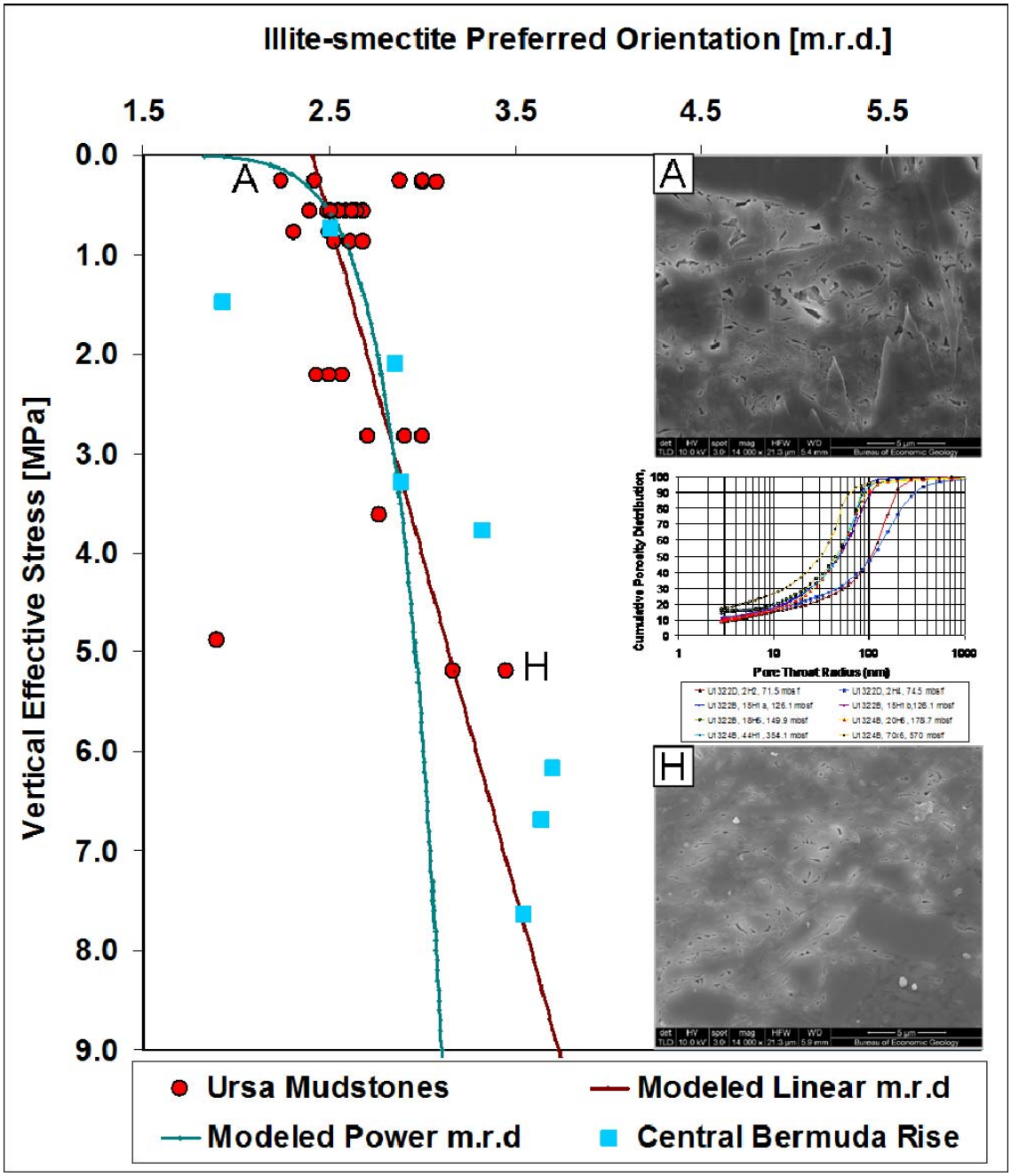


Fig. 1: Illite-smectite preferred orientation of Ursa mudstones as a function of vertical effective stress (we compare with unpublished Central Bermuda Rise data, Matenaar, 2002). Secondary electron images on Argon-ion milled surfaces document pore evolution. Mercury injection data show systematic pore throat evolution with increasing vertical effective stress.



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