14.15: Overview of UT GeoFluids creep efforts

Maria A. Nikolinakou, Research Scientist

The University of Texas at Austin, Bureau of Economic Geology

ABSTRACT

We review the role of creep in compaction and overconsolidation, and its practical implications for drilling and exploration. Mudrocks may lie in different compaction curves, depending on loading rate, because creep causes additional compaction (Fig. 1). In addition, the in-situ stress is lower than the stress on the normal compaction curve (yield stress) measured in the lab for the same porosity. This overconsolidation has the following consequences: a) the in-situ stress state lies inside the yield surface and mudrocks will behave elastically upon unloading, explaining why elastic borehole-stability models perform well (Fig. 2); b) mudrock strength in the lab is higher than expected from the in-situ stress state. We emphasize that deformation and strength depend on loading rates, hence inputs into exploration workflows should account for loading rates and operation timescales.

CLICK ON IMAGE FOR LARGER VIEW

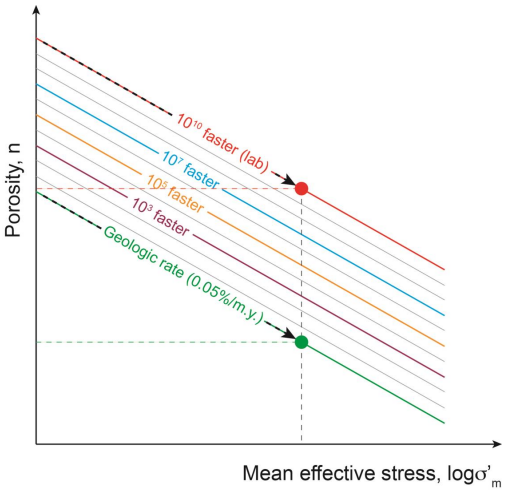

Figure 1: Different compaction rates lead to different porosities (equivalent isochrone framework).

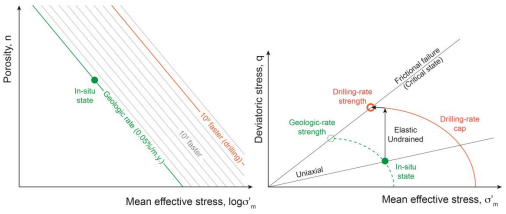

Figure 2: The in-situ stress state lies inside the yield surface corresponding to drilling loading rates, because the loading rate during drilling is several orders of magnitude faster than the geologic loading rate. As a result, the mudrock response during drilling is mainly elastic and its undrained strength much higher than expected from the in-situ stress state.

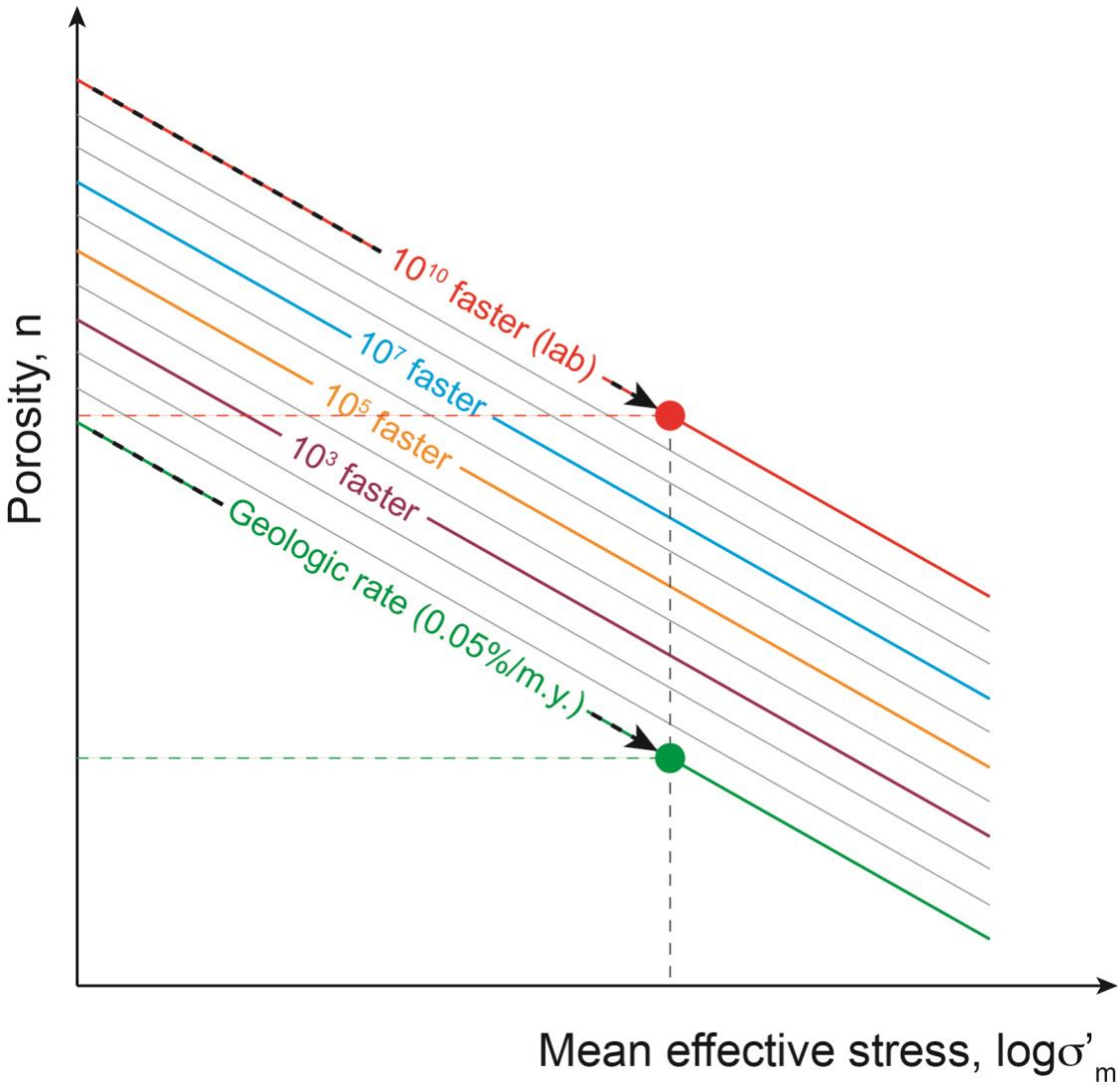

Figure 1: Different compaction rates lead to different porosities (equivalent isochrone framework).

Back

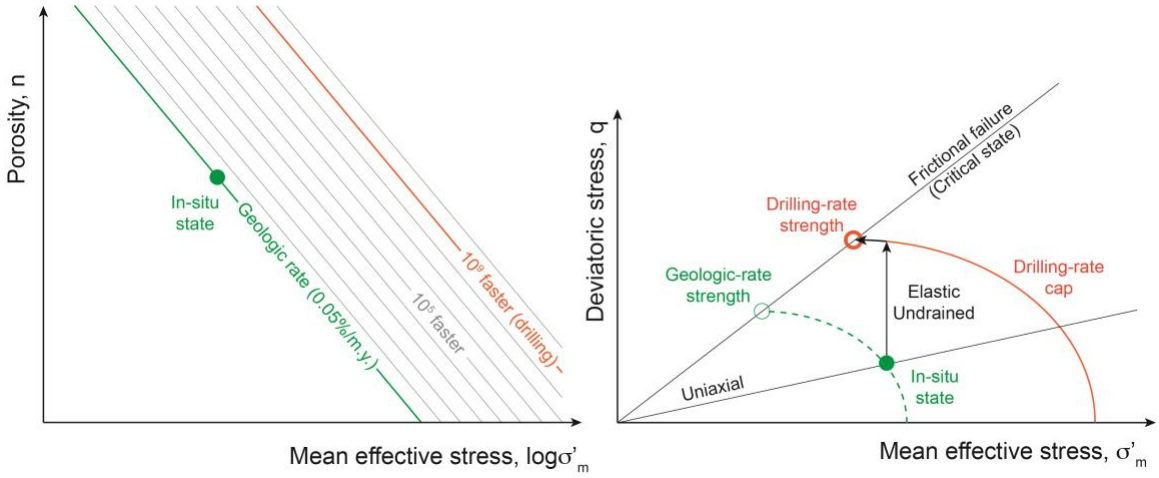

Figure 2: The in-situ stress state lies inside the yield surface corresponding to drilling loading rates, because the loading rate during drilling is several orders of magnitude faster than the geologic loading rate. As a result, the mudrock response during drilling is mainly elastic and its undrained strength much higher than expected from the in-situ stress state.

Back