Salt-base geometry: Predicting exiting stress

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ABSTRACT

We study the geometry of salt base and make a first order estimation of shear below salt and of the change in least principal stress when exiting salt. We use forward finite element geomechanical modeling and examine three case studies: thin roof and regional shortening, multiple roof layers and regional shortening, and episodic sedimentation and shortening. We show that the stress state is nearly hydrostatic near the feeder and in areas encompassed by salt (steep-ramp to flat-base transitions), and that shear increases along ramps with decreasing salt thickness (Fig. 1). We also show that the amount of differential stress can be linked to the expected decrease in least principal stress when exiting salt: the maximum principal stress immediately below salt is dictated by the salt stress, and therefore high shear stresses imply a high differential between maximum and minimum stress, hence a drop in least principal when exiting salt (along ramps; Fig. 2). In contrast, we expect a small change in least principal stress in areas encompassed by salt (steep-ramp to flat-base transitions; Fig. 2). These observations can help identify favorable areas for drilling.

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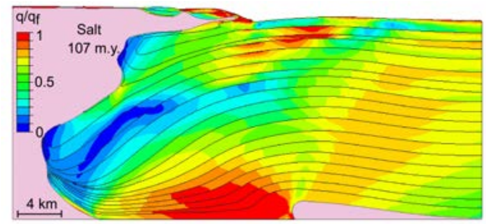


Figure 1: Shear stress normalized by shear strength (for the same mean effective stress) in mudrocks; final stage of an evolutionary model of a salt system with two stages of salt-sheet advance separated by a stage of salt inflation. Shear is low near steep-ramp to flat-base transitions and increases along ramps with decreasing salt thickness.

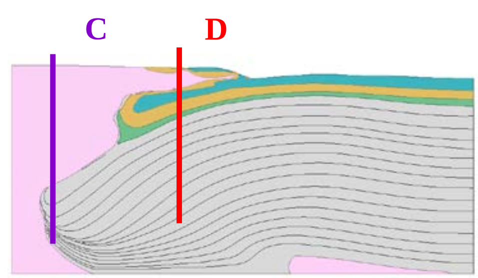
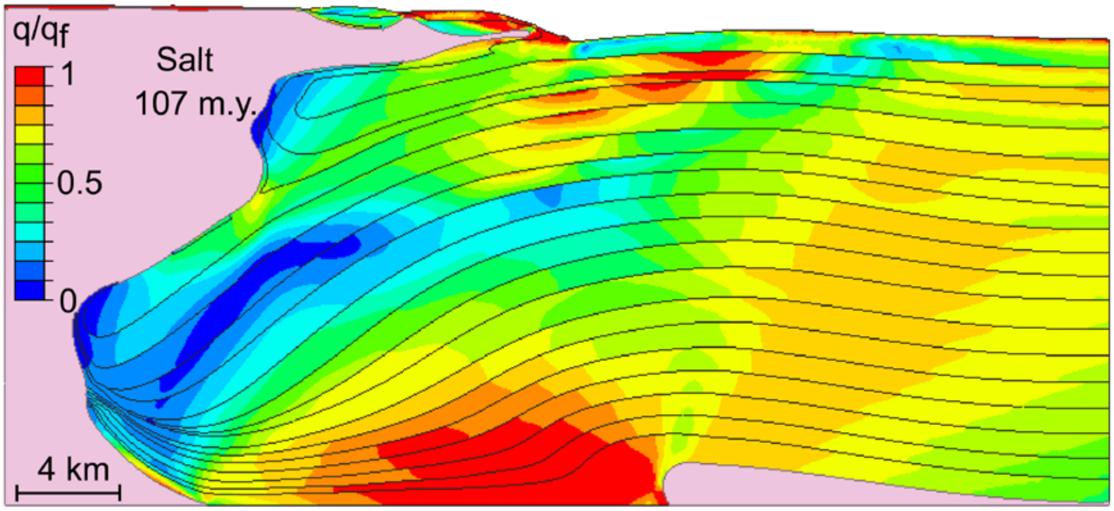


Figure 2: Least principal stress profiles a) near the feeder and b) through the front of the salt sheet. In areas encompassed by salt (steep-ramp to flat-base transitions) there is little shear (Fig. 1) and a small change in least principal stress. Below ramps there is a drop in least principal stress in accordance with the increased differential stress (Fig. 1)



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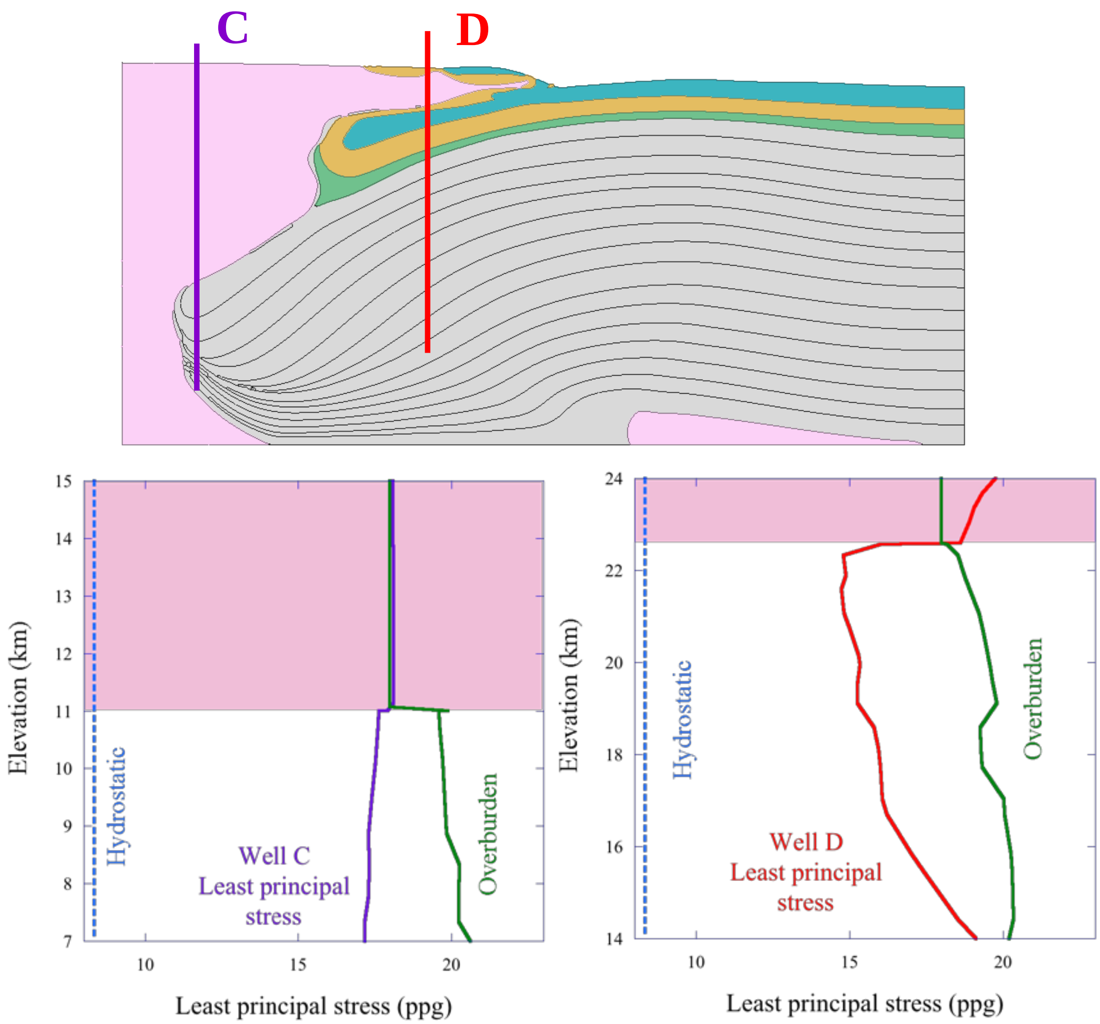

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