08.02: Pore pressure beneath advancing salt sheets

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ABSTRACT

We use transient evolutionary models to couple sedimentation, salt flow and porous fluid flow in salt systems. We show that high overpressures develop beneath an advancing salt sheet (Figure 1). These high overpressures result in low effective stress and therefore low sediment strength. At the same time, pedestal subsidence causes a downward basin deformation that decreases the horizontal stress and increases the differential stress subsalt. As a result, at the time salt emplacement, a significant mudrock volume below salt is at or very close to failure (Figure 2). Furthermore, we show that high pore pressures, together with a decreasing least principal stress, lead to a very narrow drilling window subsalt, during active salt emplacement. However, subsalt pressures eventually decrease because of dissipation, as well as basin deformation. We built this transient evolutionary model with Elfen, and model sediments as a poro-elastoplastic material. Consolidation properties are calibrated based on our in-house experimental program on Eugene Island material.

CLICK ON IMAGE FOR LARGER VIEW

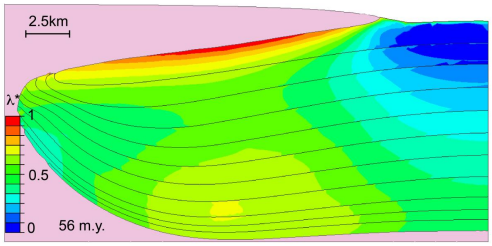

Figure 1: Normalized overpressures developing beneath an advancing salt sheet.

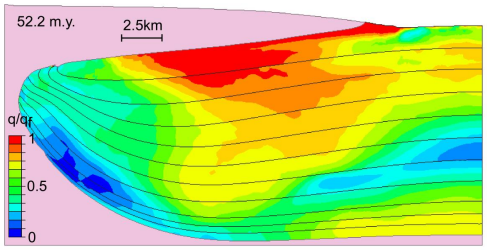

Figure 2: Contour plot showing the ratio of shear stress, q, to shear strength, q_f, of subsalt mudrocks. Values close to 1 (warm colors) illustrate that sediments are on or very close to shear failure.

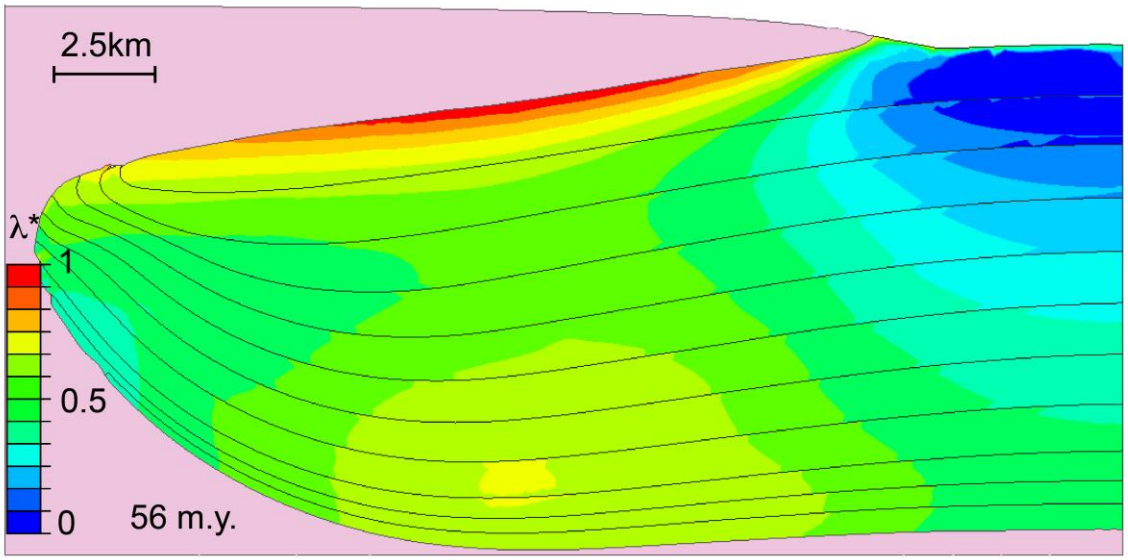

Figure 1: Normalized overpressures developing below an advancing salt sheet. $\lambda^* = \frac{u-u_h}{\sigma_v-u_h}$, where u is the pore pressure, u_h the hydrostatic pore pressure and σ_v the overburden.

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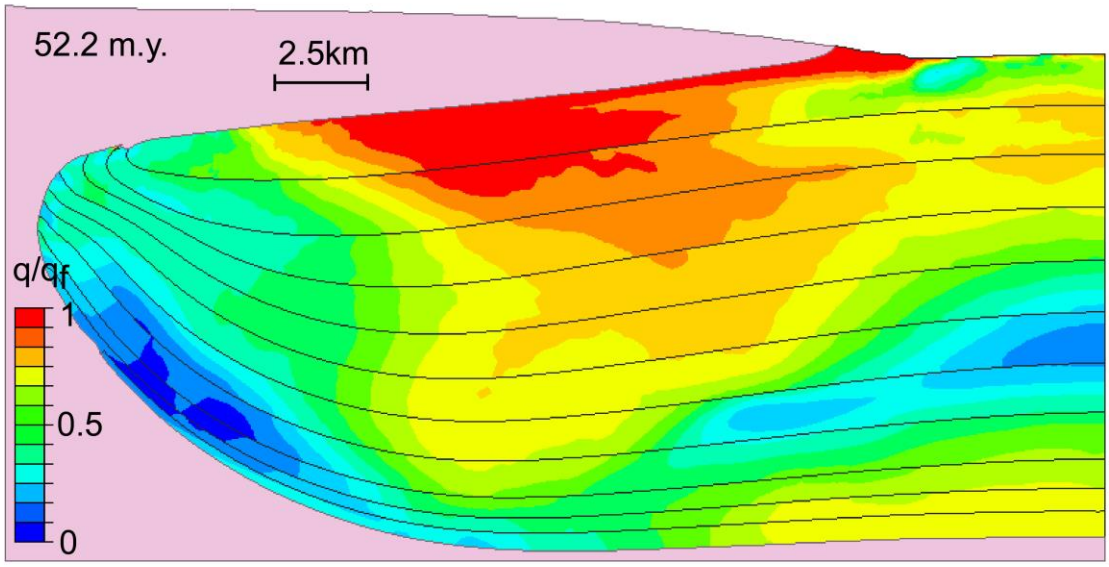

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