06.02: Salt dome to salt sheet with concurrent sedimentation

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ABSTRACT

We study the stress changes associated with the evolution of a salt dome into a salt sheet with concurrent sedimentation. We show that the orientation of principal stresses within the basin is controlled by the relative changes in a) the weight of the overburden – which increases because of the emplaced sheet – and b) the salt stress – which increases because the salt dome keeps rising, owing to the ongoing sedimentation (Figure 1). Our results highlight a difficult drilling environment below salt, as we calculate high shear near the dome wall and under the advancing sheet (base ramp). Even though the final state of stress is characterized by low differential stress values, we show that the formation might be fractured during the earlier stages of the dome-to-sheet evolution (Figure 2). We built this axisymmetric model within the large-strain Finite Element program Elfen. We model the salt as solid visco-plastic, with the Munson & Dawson (1979) model and the sediments as poro-elastoplastic, with a generalized MCC model (SR3, in Elfen).

CLICK ON IMAGE FOR LARGER VIEW

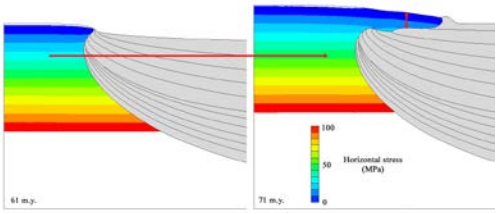


Figure 1: Stresses in the basin are controlled by the weight of the overburden (vertical) and the pressure from the salt (horizontal). The salt stress increases because the dome is rising; the overburden stress increases because of the emplaced sheet. The relative change in these values might change the direction of the maximum stress from horizontal to vertical.

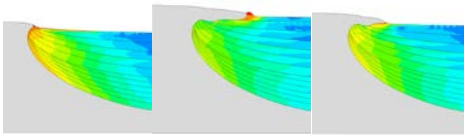
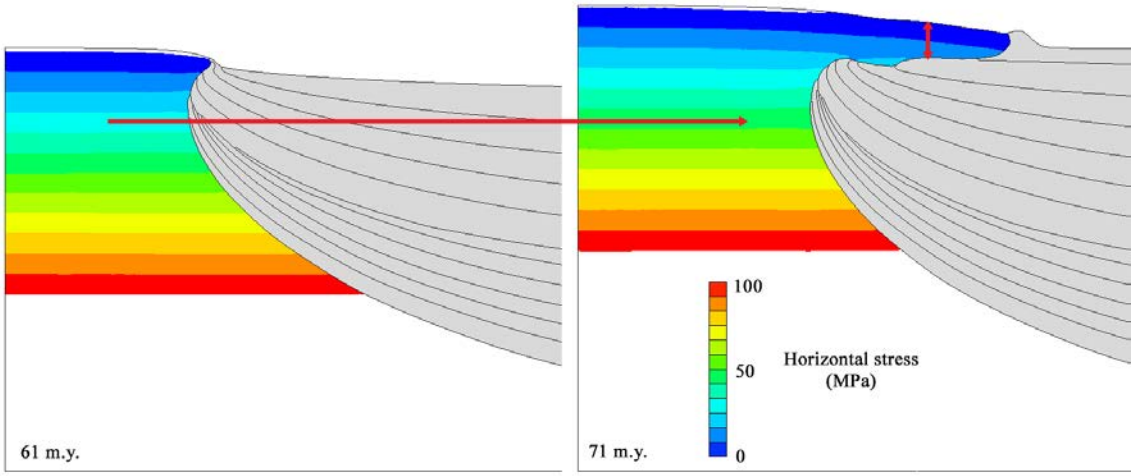


Figure 2: High shear stresses are predicted near dome wall and under advancing sheet (base ramp). Final state of stress is misleading, because differential stresses are lower than previous stages, and formation might already be fractured.



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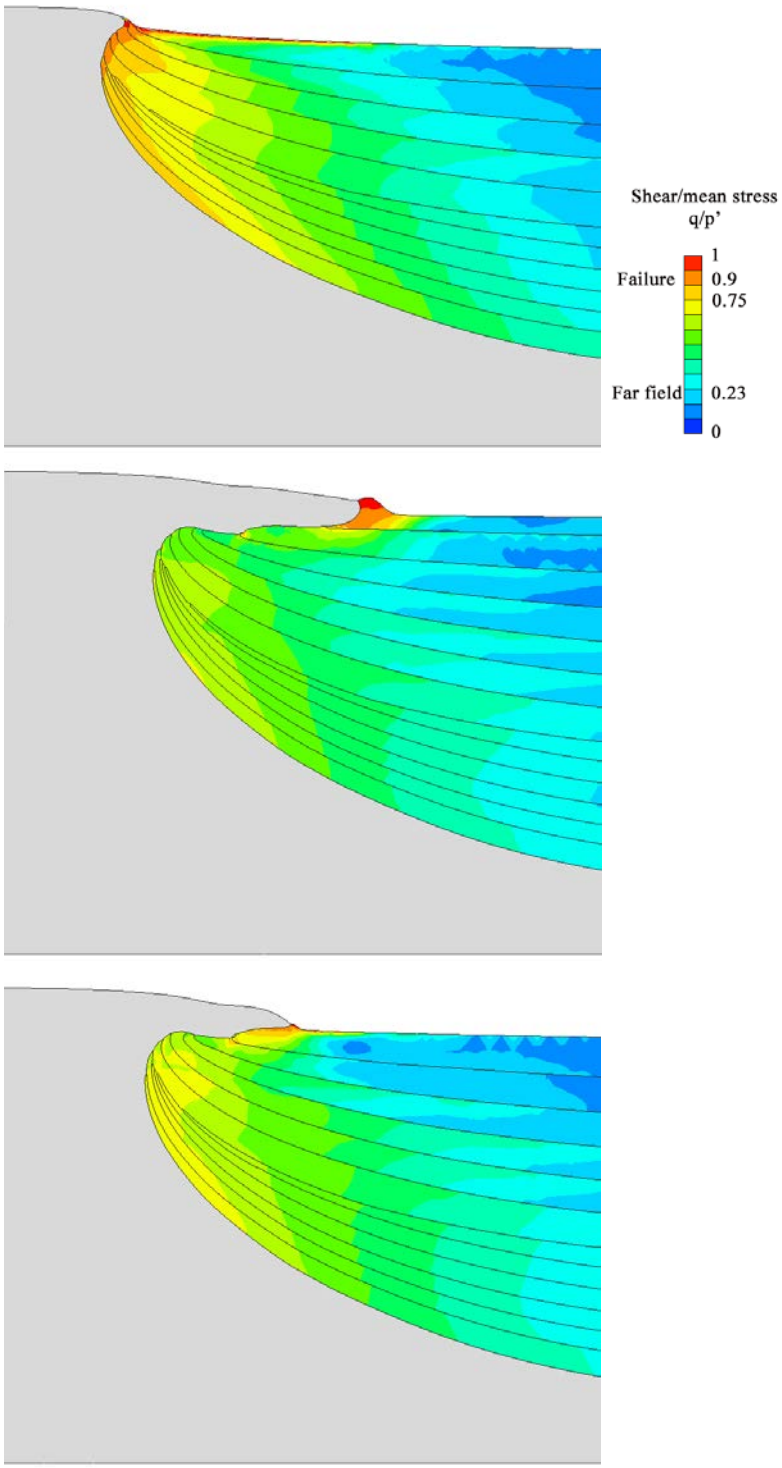

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