Sliding, Tank-Tread and the Chicken-Egg Problem: Finite-Element Modeling of Feedback Between Overpressures and Salt-Sheet Advance

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ABSTRACT

We study the advance of a salt sheet over poro-elastic sediments and show that the contact properties, the topography of the salt and also the presence of overpressures in the sediments affect the dominant mechanism of salt advance. Both base shear and frontal rolling may be present during salt emplacement, with sliding being more typical of the salt toe, and rolling of the rear. If no overpressures are present, base-salt sliding will eventually deactivate and frontal rolling will dominate. However, excess pore pressures may be present, due to a rapid salt emplacement over sediments with low coefficient of dissipation. In such cases, the effective stress within the sediments does not increase despite accumulation of material caused by the salt advance, and consequently the shear resistance remains low. As a result, sliding becomes the dominant mechanism of salt advance. Thin, rapidly emplaced salt sheets may hence indicate the presence of overpressures and low effective stresses immediately below the salt body.

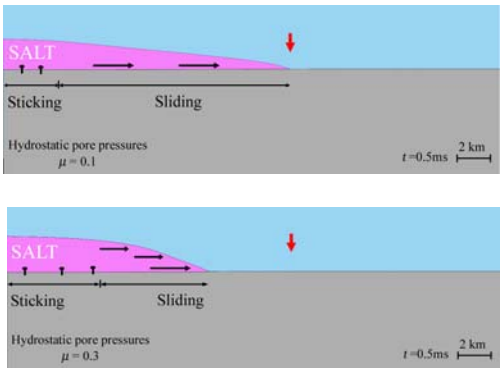


Fig. 1: Both base shear and frontal rolling may be present during salt advance. Which mechanism will dominate depends on the contact friction, the topography of the salt and also the presence of overpressures.

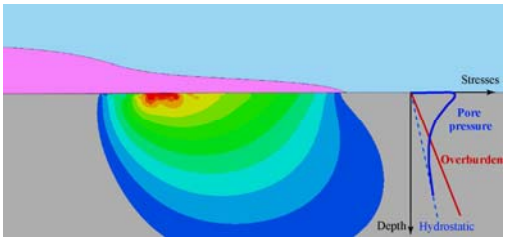
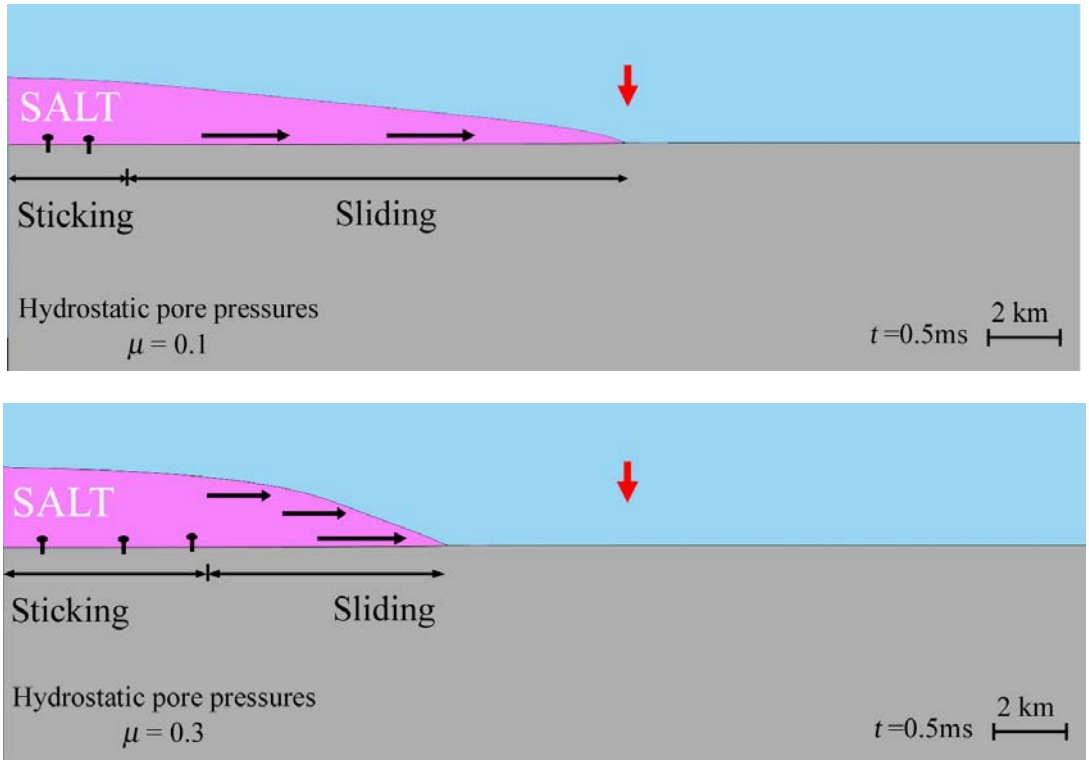


Fig. 2: Thin, rapidly emplaced salt sheets may indicate the presence of overpressures. In this case, the effective stress and hence the shear resistance of the sediments remain low, and sliding becomes the dominant mechanism of salt advance.



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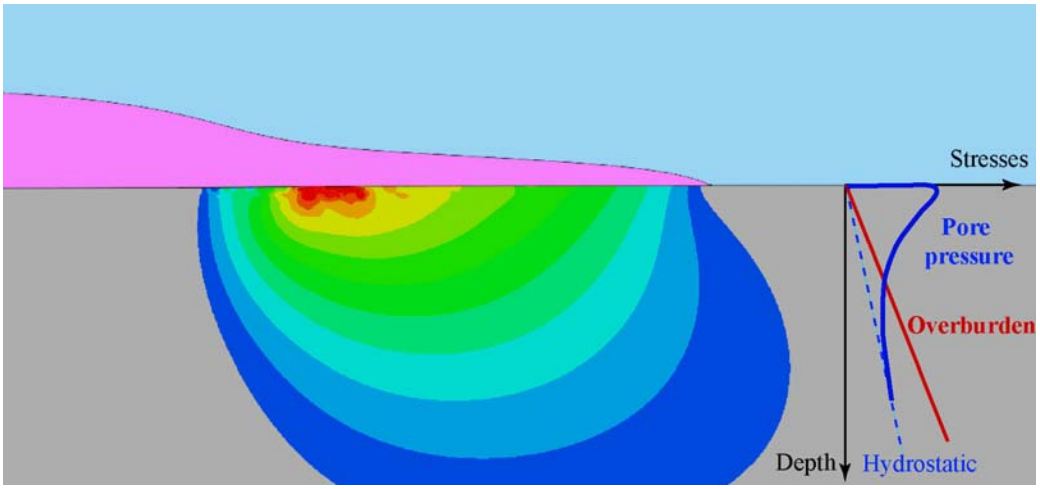

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