

09.14: The evolution of pressure and stress in suture mudrocks

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ABSTRACT

We use drained and transient evolutionary models to study stress and pressure in suturing mudrocks. We show that sediments along a suture are weak and highly sheared, because of significant extensional strains and high overpressures (Figure 1). We also show that extensional strains associated with the suture closing prevent volume compression and porosity decrease. As a result, seismic velocity along a closed suture is expected to be lower than in mudrocks outside the suture, with equivalent overburden (Figure 2). We further illustrate that a dissipation path is established along the suture. Once the suture closes, overpressure increases in the deeper, basal sediments. In contrast, overpressure remains low in the upper, open part of the suture, allowing compression and porosity decrease. Least principal stress inside the suture is low, leading to a narrow drilling window. We built this transient evolutionary model with Elfen, and model sediments as a poro-elastoplastic material. Permeability properties are calibrated based on our in-house experimental program on Eugene Island material.

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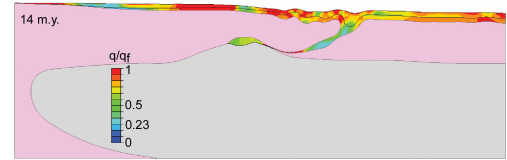


Figure 1: Contour plot showing the ratio of shear stress, q , to shear strength, q_f , of suturing mudrocks (transient model). Values close to 1 (warm colors) illustrate that sediments are on or very close to shear failure.

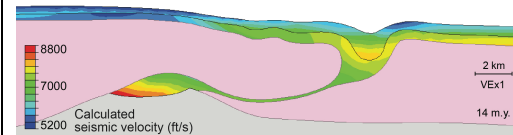


Figure 2: Contour plot showing seismic velocities (calculated from model porosity) for suture mudrocks (drained model). Seismic velocity along closed part of suture is less than for mudrocks outside suture, with equivalent overburden.

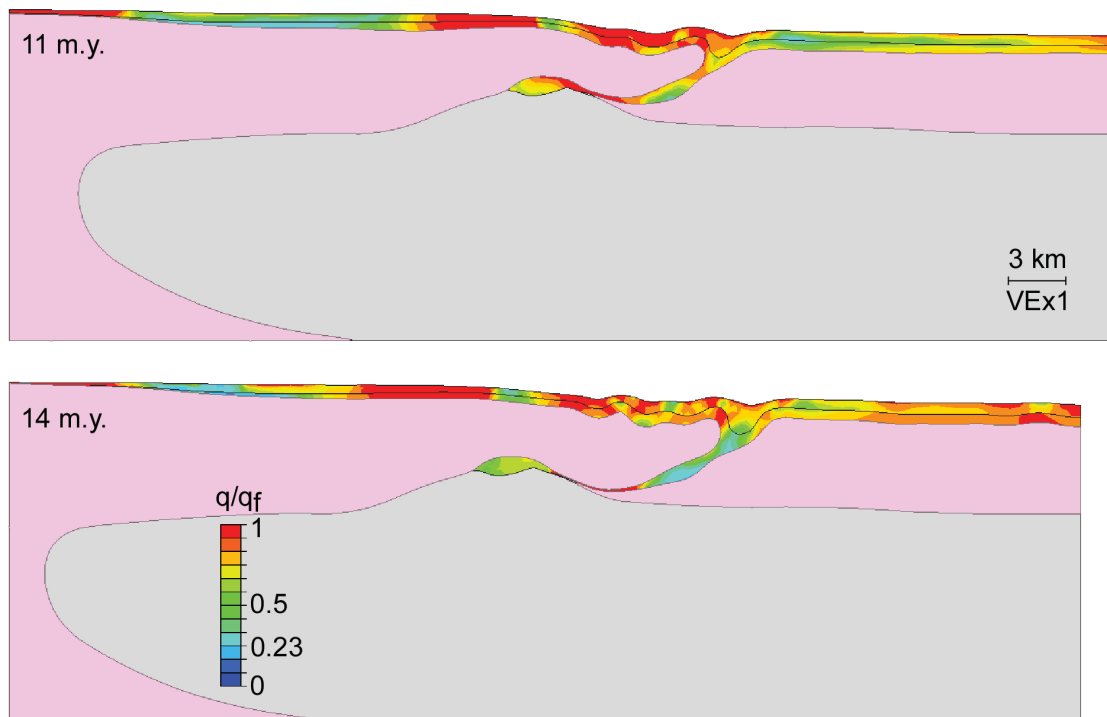


Figure 1: Contour plot showing the ratio of shear stress, q , to shear strength, q_f , of suturing mudrocks, for 2 stages of the system evolution (transient model). Values close to 1 (warm colors) illustrate that sediments are on or very close to shear failure.

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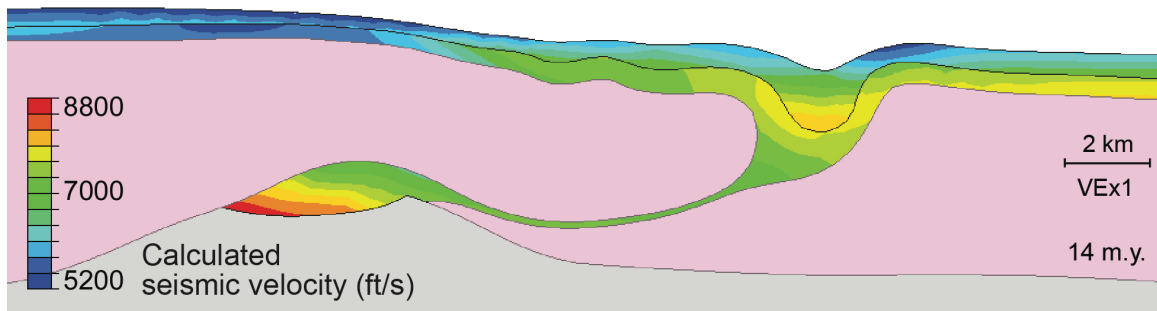


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