13.22: Modeling Sandstone Injections as Hydraulic Fractures

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ABSTRACT

We model sandstone injections as hydraulic fractures aiming to understand whether the injection style (dikes vs. sills) records changes in the far-field in-situ stresses, or whether it reflects local stress perturbations caused by the injections themselves. Preliminary results indicate that the injection geometry is controlled by stress changes induced by nearby injections. We find that below a minimum distance between two neighboring fractures, one fracture dominates and the second gets arrested. The longer fracture increases the horizontal stress in the sediments between the two fractures and above the arrested fracture. The sub horizontal maximum principal stress supports the weight of the overburden, which results in a decrease in vertical stress in the sediments between the fractures (Fig. 1). This local stress change enables the propagation of a sill from the arrested fracture. We also discuss a preliminary model of a fracture that propagates to the seafloor. We show the development of a dendritic fracture system at shallow depths (Fig. 2). We build our models at Rockfield's TGR. We inject water and allow no leak-offs. A Rankine tensile failure criterion combined with local remeshing around the tip enables the propagation of the fractures.

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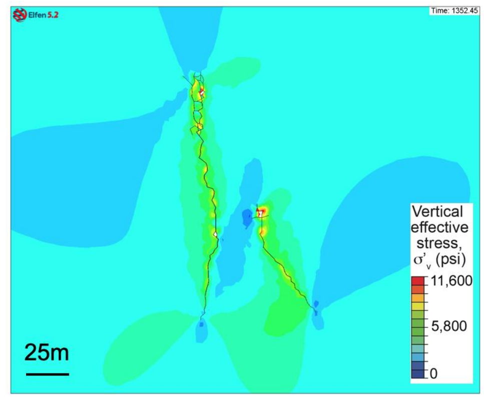


Figure 1: Vertical effective stress, σ'_v, in sediments with a system of two vertical fractures. The vertical stress decreases in the space between the fractures because of the increase in horizontal stress caused by the longer fracture.

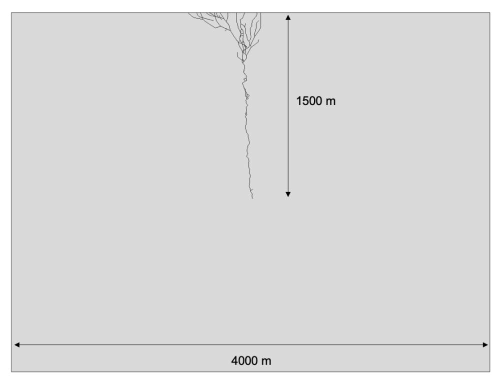
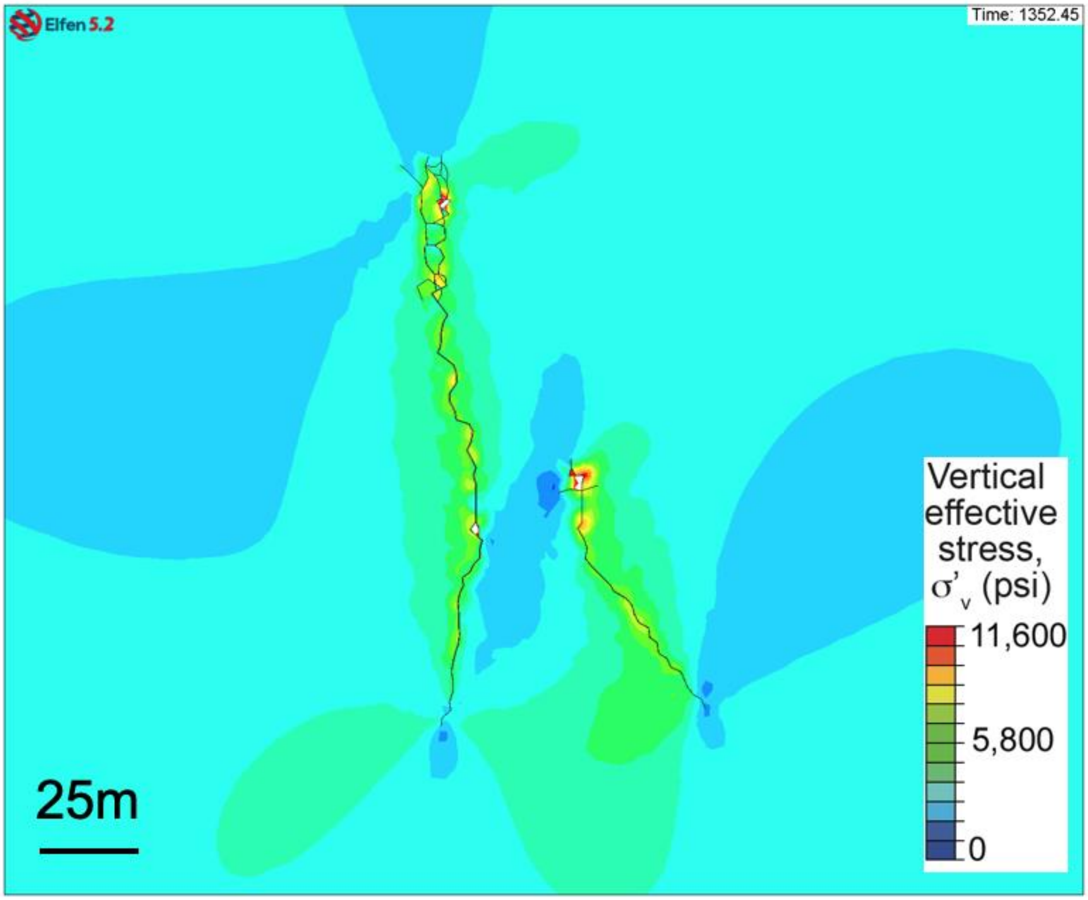


Figure 2: Vertical fracture propagating to the seafloor, developing a dendritic system in shallow depths.



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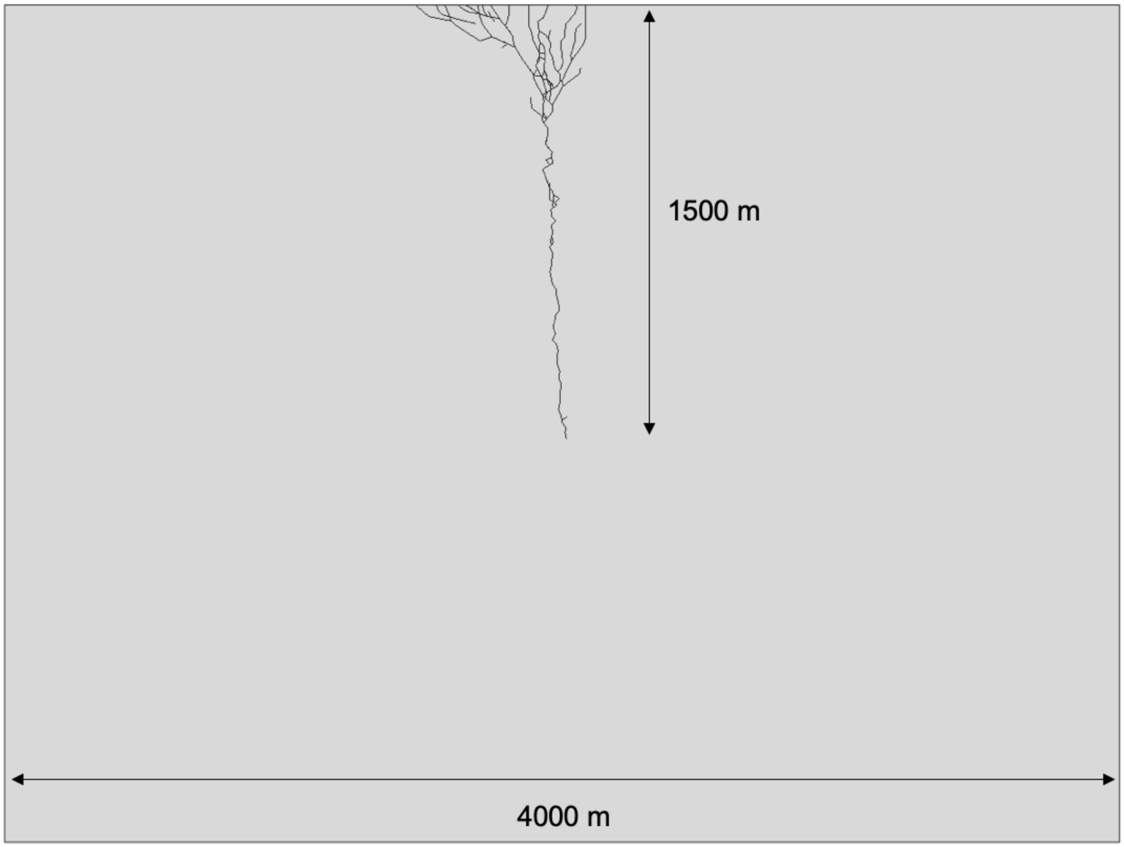

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