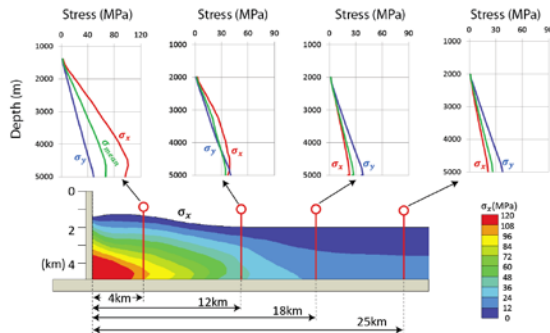


## 06.19: Modeling stress and compaction in thrust belts

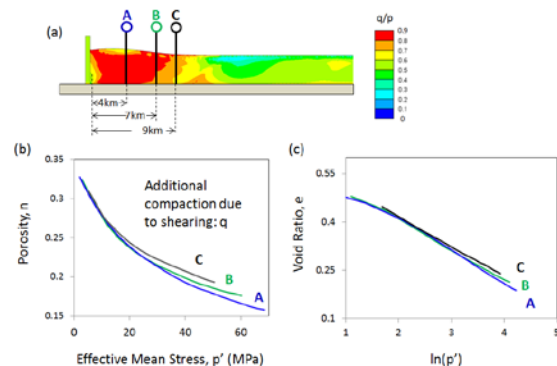
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### ABSTRACT

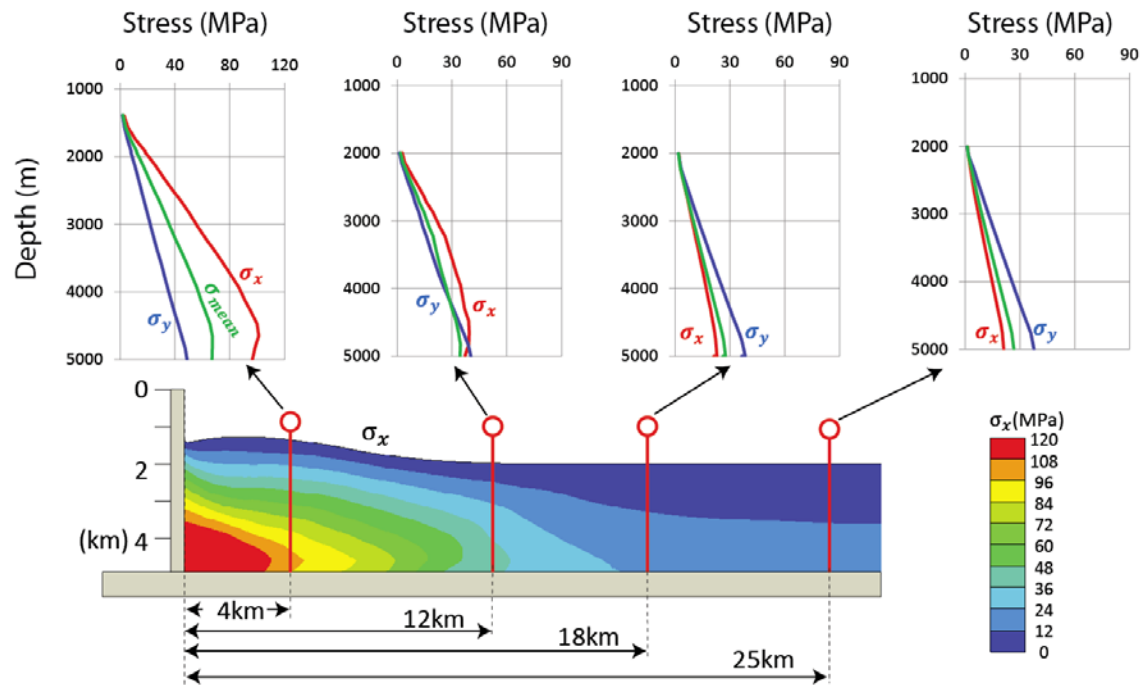
We investigate the stress and compaction evolution in thrust belts system with coupled poro-mechanical model. In this model, a 250km long and 3 km sediment layer overlies a frictional boundary ( $\mu = 0.4$ ). We initialize the model with geostatic stress condition such that the ratio of horizontal stress and vertical stress is 0.6. Then the left boundary of the sediment is subject to a displacement in a constant rate. A taper wedge develops as the model proceeds. Compaction is simulated by Elfen SR3 soil model (a modified version of Cam-Clay model), to characterized the stress and porosity relationships under various mean and deviatoric stress. Through the numerical model, we find: 1) Towards the backstop of a thrust belt, the horizontal stress increase significantly (**Fig.1**) and leads to significant compaction; 2) Besides the mean effective stress, deviatoric stress also has great impact on sediment compaction (**Fig.2**); 3) According to the stress state conditions, thrust belts system can be divided in to three zones: critical state region, transition region, and farfield/geostatic compaction region.



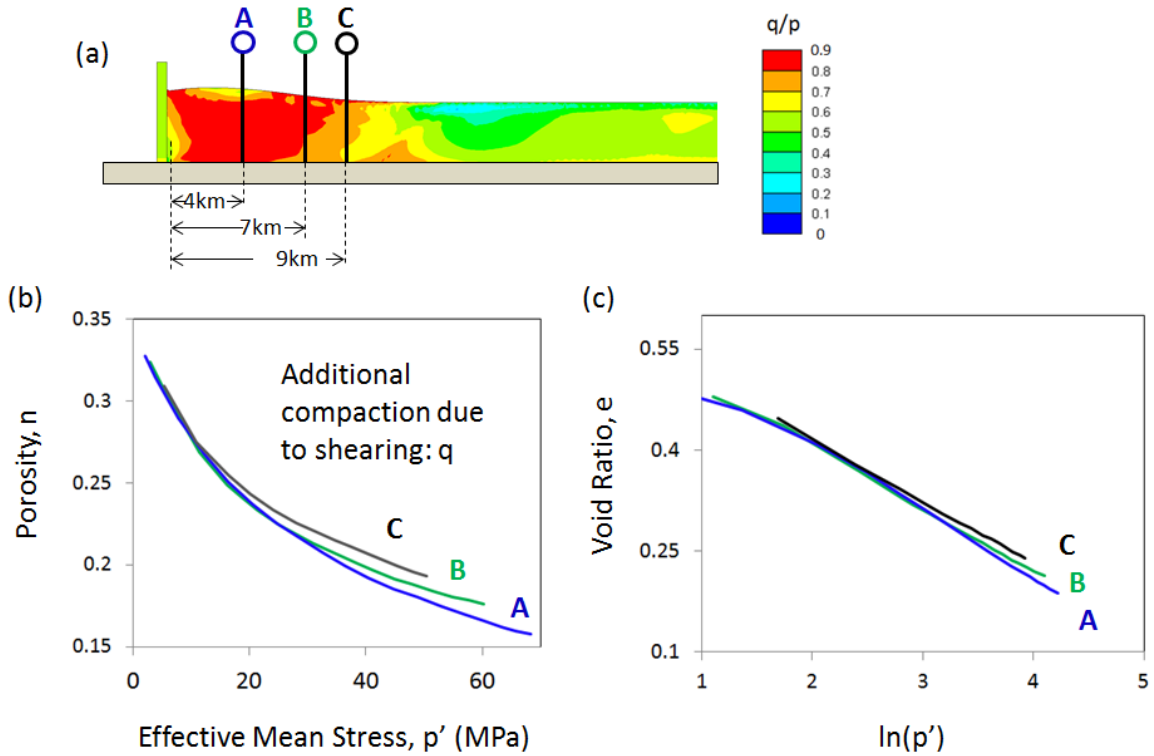
**Figure 1:** Stress condition across a numerical thrust belt. 4 pseudo-wells are presented and they are located at a distance of 4km, 12km, 18km, and 25km to the left wall. On the stress plots, the red lines, blue lines, and green lines represent the horizontal stress, vertical stress, and mean stress, respectively. The color contour graph represents the magnitude of the horizontal stress.



**Figure 2:** Compaction condition at various stress condition. (a) The stress condition within a thrust belt. The larger the  $q/p$  ratio (warmer color), the higher the relative deviatoric stress to the mean stress. (b) Porosity vs. effective mean stress. When mean stress is the same, sediment with the greatest deviatoric stress ( $q$ ) has the lowest porosity. (c)  $\ln(p')$  vs. void ratio.



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