08. 08： Mechanics of fold-and-thrust belt systems based on geomechanical modeling

Baiyuan Gao, The University of Texas at Austin

ABSTRACT

We use forward geomechanical models and apply poro-elasto-plastic soil mechanics to investigate the stress and compression behaviors in fold-and-thrust belt systems (Fig.1). We find the shear-enhanced compression accounts for about 33% porosity decrease during tectonic loading. Caution is required when drilling through the major fault plane (decollement) because the fracture gradient in the hanging wall is close to the overburden whereas it suddenly becomes much lower in the footwall (Fig.2). As the basal friction increases, the sediment porosity in the footwall decreases whereas the porosity in the hanging wall is not affected.

CLICK ON IMAGE FOR LARGER VIEW

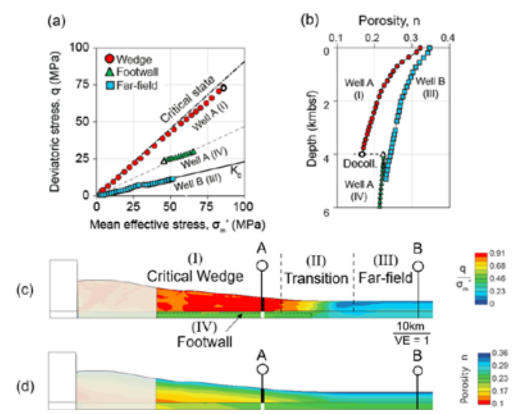

Fig 1: Stress and compression distribution in a fold-and-thrust belt.

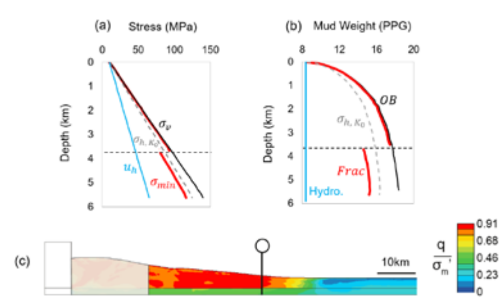

Fig 2: Stress and fracture gradient across decollement

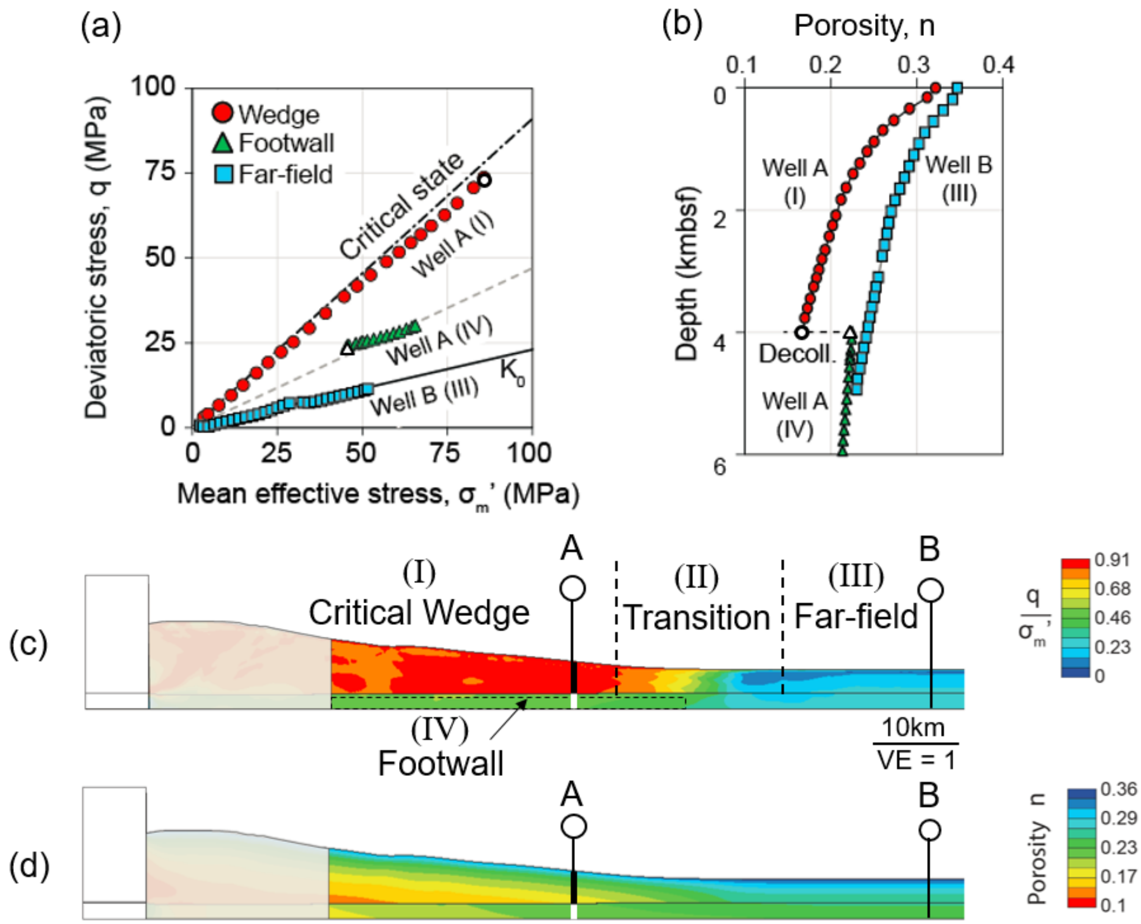

Fig. 1: (a) Mean and deviatoric stress along profile A (red circles: (I) wedge regime; green triangles: (IV) Footwall regime) and along far field profile B (cyan squares: (III) far-field regime). (b) Porosity along profiles A and B (depth referring to km below seafloor). Red circles: along well A in the wedge (I). Green triangles: along profile A in footwall (IV). Cyan squares: along profile B in far-field regime (III). (c) Relative-shear-stress-ratio distribution. Relative shear stress is consistent in the wedge (0.91), the footwall (0.47) and the far-field (0.23). (d) Porosity distribution.

Back

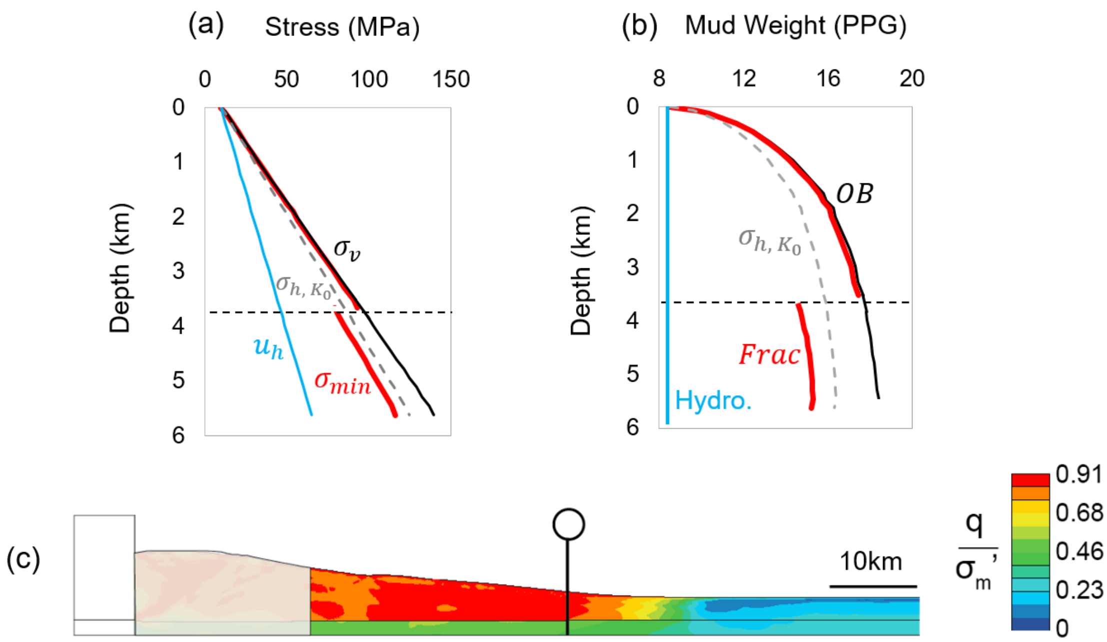

Fig. 2: (a) Stress plot along the extracted vertical profile in Fig.2c. Cyan line: hydrostatic pressure; black line: overburden stress; red line: least principal stress from geomechanical model; grey dashed line: least principal stress predicted from traditional method assuming $\mathrm{K}_0 = 0.8$. (b) Mud weight plot. Black line: overburden pressure gradient; red line: fracture gradient converted from the least principal stress in Fig.2a (red line); grey dashed line: fracture gradient predicted from K_0 assumption method. (c) Relative shear stress ratio distribution.

[Back]