The Nature and Role of Fluids and Fluid Flow in Structurally Heterogeneous Environments

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Fluid flow and transport in subsurface environments dominated by fracture permeability are influenced greatly by such factors as weathering and denudation, geologic structure and fabric, *in-situ* stress conditions, mode of deformation, lithology, diagenesis, and fluid temperatures and chemistry. In more homogeneous rock environments, fracture permeability generally decreases with depth as lithostatic stresses increase and weathering decreases. However, in more heterogeneous environments, such as fold and thrust belts, fracture permeability and preferential flow pathways are more highly dependent upon the degree of deformation and the nature of pore pressures that existed during episodes of active tectonism.

Structurally complex geologic environments provide a unique opportunity to investigate hydrogeologic and hydrogeophysical conditions at a wide range of scales and fracture conditions. Structurally controlled fracture parameters including density of fracture networks, orientations, aperture, roughness and response to in situ stress changes can vary greatly on the basis of the proximity to individual major faults or folds. Access to these large-scale structural features can provide important understanding of the nature and style of deformation. For example, the lack of melting due to shear heating during fault motion can suggest the presence of high pore pressures during deformation. The control of fluid movement in relation to fault induced fractures is critically important in our understanding of deep regional flow and aquifer compartmentalization.

Studies aimed at investigating fracture compressibility and connectivity in different deformational environments using strain meters and push-pull and dipole flow tests could be used to evaluate storage and conductivity in each structurally unique environment. This in turn will profoundly enhance our understanding of flow and transport in these complex yet ubiquitous environments.