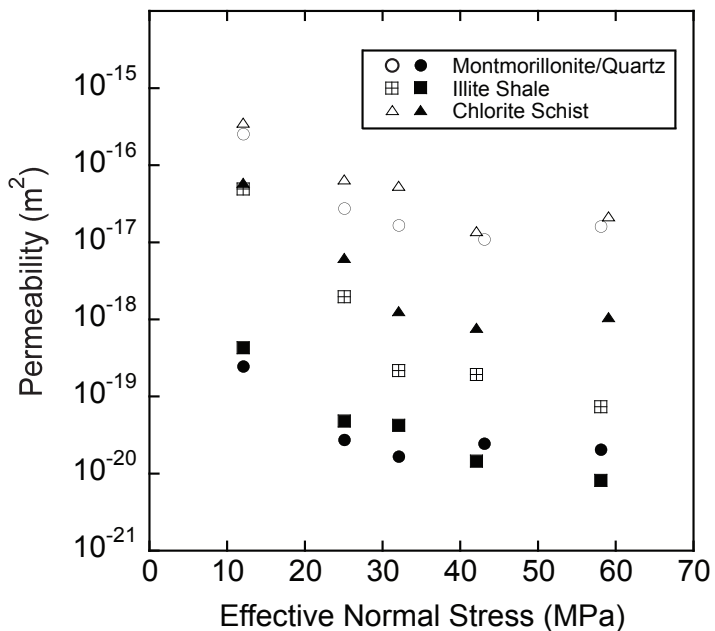
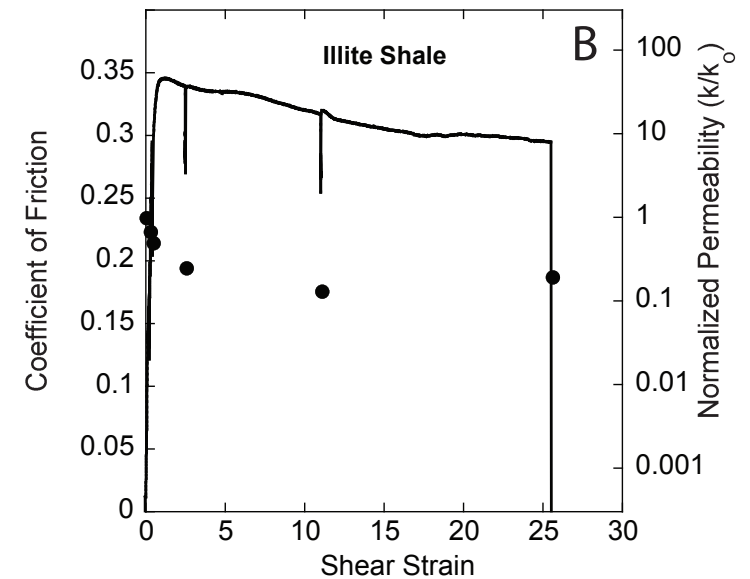
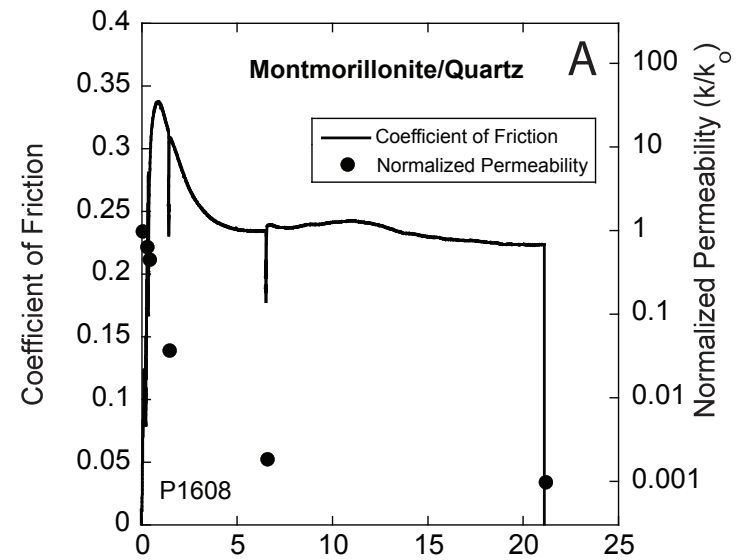


**Intact Natural Mudstones:** Exhibit strong permeability reduction as a function of effective stress (above). There is no systematic difference in permeability with increased in situ sample depth or smectite to illite transformation; increased depth of samples is shown by colors from red (shallowest) to yellow - green - purple - brown (deepest).



**Experimentally Sheared Samples:** Permeability as a function of normal stress for 3 experimentally sheared synthetic gouge mixtures (left). Permeability was measured before (open symbols) and after (filled symbols) shearing. We find that shearing decreases permeability to a larger extent than effective normal stress, though both are important.



**Experimentally Sheared Samples, Effects of Shear Strain:** Our results show that the major decrease in permeability of experimental fault zones occurs after shear strains of ~3-5. This correlates with attainment of residual shear strength in the layer, indicating indirectly that the reduction in permeability is associated with fabric development and clay mineral alignment.