Low Temperature Calcite and Dolomite Deformation in a Carbonate-Shale Thrust Fault and the Effect on Porosity

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Large displacements of thrust sheets along narrow shear zones have commonly been attributed to a weak shale layer along the base of these thrusts. Structures within an exposure of the Copper Creek (CC) thrust fault suggest, however, that calcite, introduced as veins adjacent to the fault zone, was weaker than the host shale. Deformation of the calcite further resulted in increased porosity. Thus, fracturing of shale and precipitation of calcite played a critical role in the rheology of this fault zone and the resultant microstructures and porosity of the fault rocks. This study will investigate spatial and temporal variations in fluid flow along strike during the deformation of the CC thrust fault, and how along strike changes in lithologies (e.g., addition of dolomite) and deformation processes influence fluid flow during and after deformation.

The CC fault is located in the foreland fold-and-thrust belt of the southern Appalachians, Tennessee. The CC fault zone is ~2-10 cm thick and accommodated ~15 km displacement. Information gathered from this fault can be applied to other thrust systems that formed under similar conditions (e.g., McConnell fault, Canadian Rockies). At several locations along the strike, I will map lithologies, veins, faults and their cross-cutting relationships across the fault zone, and collect samples for laboratory studies. Optical and scanning electron microscopy will be used to analyze microscale fracture and vein distributions, deformation microstructures, grain size distributions, mineralogy and porosity. This study will contribute to our understanding of the role of faulting in fluid migration in fold-and-thrust faults.