

Analysis of Calcite-Filled Faults in Carbonate Strata, Balcones Trend near Waco, Texas

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Small-displacement normal faults with three dimensional exposures in the Lehigh Cement Quarry feature calcite and shale-smear fabrics. Proposed thesis research to study these well-exposed fabrics will yield useful insights related to fault seals in the subsurface that are typically too small for typical seismic data sets. Normal faults in Cretaceous Austin Chalk are exposed in the quarry walls and floor, along which there are well-formed calcite fibers and sparry calcite. Field work will yield a detailed GIS dataset of the quarry, based on recent aerial photographs. The faulted portions of the quarry walls will be photographed, and the faults will be mapped on rectified photomosaics to yield detailed kinematic/spatial descriptions of the exposed faults. Oriented specimens of the calcite within the faults will be collected for petrographic analysis intended to develop a detailed description of the calcite fabric in the fault. This analysis will concentrate on fabric that provides kinematic information about fault movement, and on developing an initial characterization of any mechanical twins that are observed. Analysis of any mechanical twins in the calcite will constrain the magnitude, temperature, and perhaps direction of deformation along the fault. Isotopic analyses of calcite within the faults will constrain the temperature of crystallization and provide information about the origin of the solution from which the calcite crystallized. Parts of the quarry have faults that have a net slip of <3 m, evinced by shear striae and correlative sequences of limestones interbedded with thin shaly marls across the fault. Faults in other parts of the quarry feature limestone in fault contact with shaly marl, where the sense of slip must be inferred from fault fabric or subtle drag features. This latter configuration provides interesting examples of how fault seals may develop in the subsurface.