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The project presently underway examines the mechanical and chemical processes of brittle deformation and quartz cementation in the context of burial compaction (Frio Formation, Gulf of Mexico Basin and Mount Simon Formation, Illinois Basin) and fault gouge deformation of sandstones (Pennsylvanian sandstones, eastern Kentucky). The addendum concerns the later deformation scenario, namely sandstones deformed in a fault gouge. Breathitt and Lee Group quartzose sandstones have been collected from the Pine Mountain overthrust and also from undeformed regions adjacent to the fault in eastern Kentucky. The fault gouge has been characterized, using cathodoluminescence imaging, featuring highly comminuted grains with pervasive cementation between broken particles. Cathodoluminescence is the key method applied in this study because only with this technique can detrital quartz and quartz cement be discerned.

Quantifying the amount of quartz cement within deformed grains (intragranular quartz cement) allows for determining the amount of intergranular volume lost due to extensive brittle deformation. Conventional point counting does not include intragranular quartz cement in intergranular volume calculations. Calculating volume of intragranular quartz cement in a fault gouge allows the calculation of a numerical value for the amount of intergranular volume lost by brittle deformation. Intergranular volume also is calculated for the undeformed sandstone suite. It will also be interesting to compare the relative abundance of intergranular versus intragranular quartz cement between deformed and undeformed sandstones.

Along with IGV comparisons of deformed and undeformed sandstones, volumetric calculations of total quartz cement, both inter- and intragranular cement, between the two sandstone suites can provide information on the mass-transfer of silica and its preferential localization, i.e. do comminuted areas within the thrust fault act as silica importers or exporters? More precisely, do the extensively fractures quartz grains act as preferential nucleation sites (import silica) or are they subject to dissolution due to small surface area of broken pieces, thus providing (exporting) silica? Again, cathodoluminescence imaging is a vital technique used to answer this fundamental question. Whole rock elemental analyses to strengthen observational quantitative data would provide additional value to this study. Quantification of elemental components combined with petrographic information provides more robust conclusions in answering mass balance questions.

I propose to do X-Ray Fluorescence (**XRF**) whole rock elemental analysis of 20 samples, 10 deformed and 10 undeformed sandstone samples, for which petrographic data is presently being collected. XRF Spectrometry will provide concentrations of major elements such as SiO_2, $A1_2O3$, CaO, MgO, Na_2O, K_2O, $Fe_2\ O_3$, and MnO. Minor element concentrations include Ba, Nb, Rb, Sr, Y, Zr, and others. With whole rock elemental analyses, one is not limited to silica abundances and their distribution between deformed and undeformed sandstones but also provides information about the distribution of less abundant elements that may or may not show the same distribution as silica, and may behave differently; *i.e.*, immobile.