CLASTIC DIKES WITHIN THE SWAN CREEK SANDSTONE, SOUTHWEST MISSOURI

Joshua D. Elson[1], Mark O. Larson, Joseph M. Talarico, and Brandon T. Ives
Geography, Geology, and Planning, Missouri State University, [1]jde419@live.missouristate.edu

Abstract

The Swan Creek sandstone is an informal member of the Early Ordovician Cotter Dolomite in southwest Missouri. The Cotter generally is a peritidal carbonate, but laminae and interbeds of quartz grains become more prevalent near the top. The Swan Creek is the thickest of these sandstones and is present locally within the top ~20 m of the Cotter. The Swan Creek is a quartz arenite which displays herringbone and low-angle cross bedding (Image 1), indicating a high-energy, near-shore depositional environment.

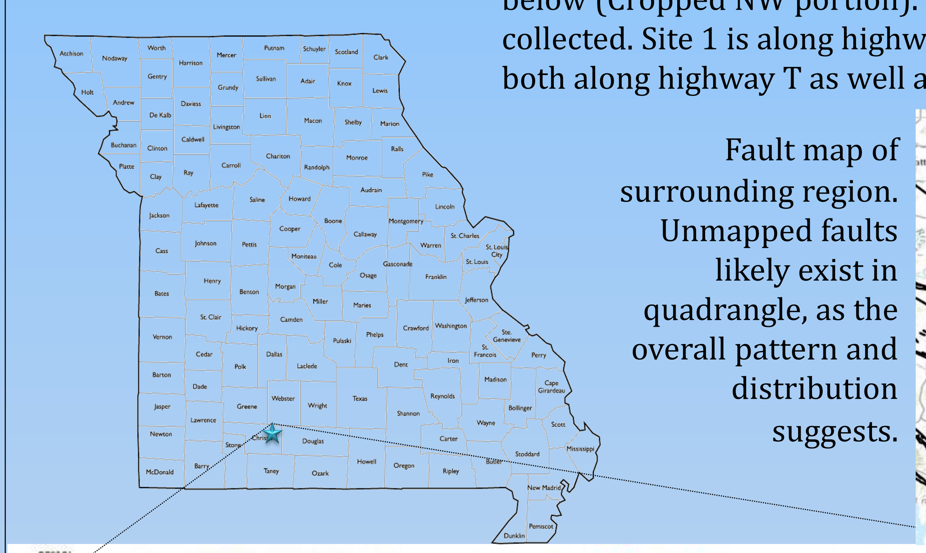
Clastic dikes emanating from the Swan Creek intrude the Cotter's carbonate beds at various locations in southwest Missouri, but are ubiquitous in the type area near Sparta, MO. Here dikes of various thickness cut across cross bedding within the main sandstone body and with their own sets of laminae subparallel to the dike walls. In plan view the thinner dikes form an anastomosing network resembling both shrinkage cracks and boxwork weathering, but vertically they span >2m, and the material within the dikes is heavily cemented quartz arenite that clearly originated within the Swan Creek.

The age of the dikes is poorly constrained. They formed sometime during or after the Early Ordovician and before complete cementation of the main sandstone body. The larger dikes reach 15 cm in width and have a preferred northwest – southeast orientation, the same approximate orientation as the major faults in southwest Missouri. Thus, these dikes may be related to both local and regional tectonic events.

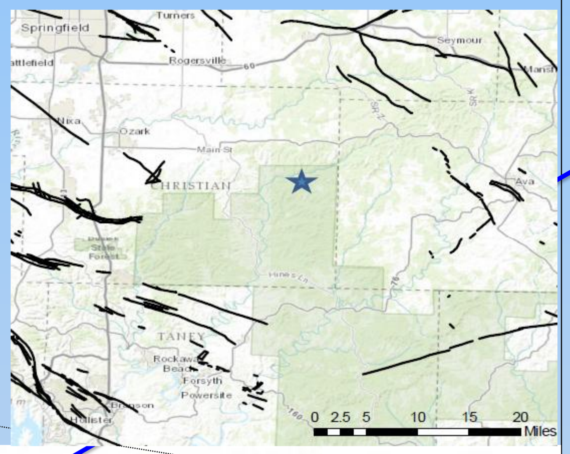
Image 1: Herringbone cross bedding is exhibited in the Swan Creek member. Indicate a tidal environment.

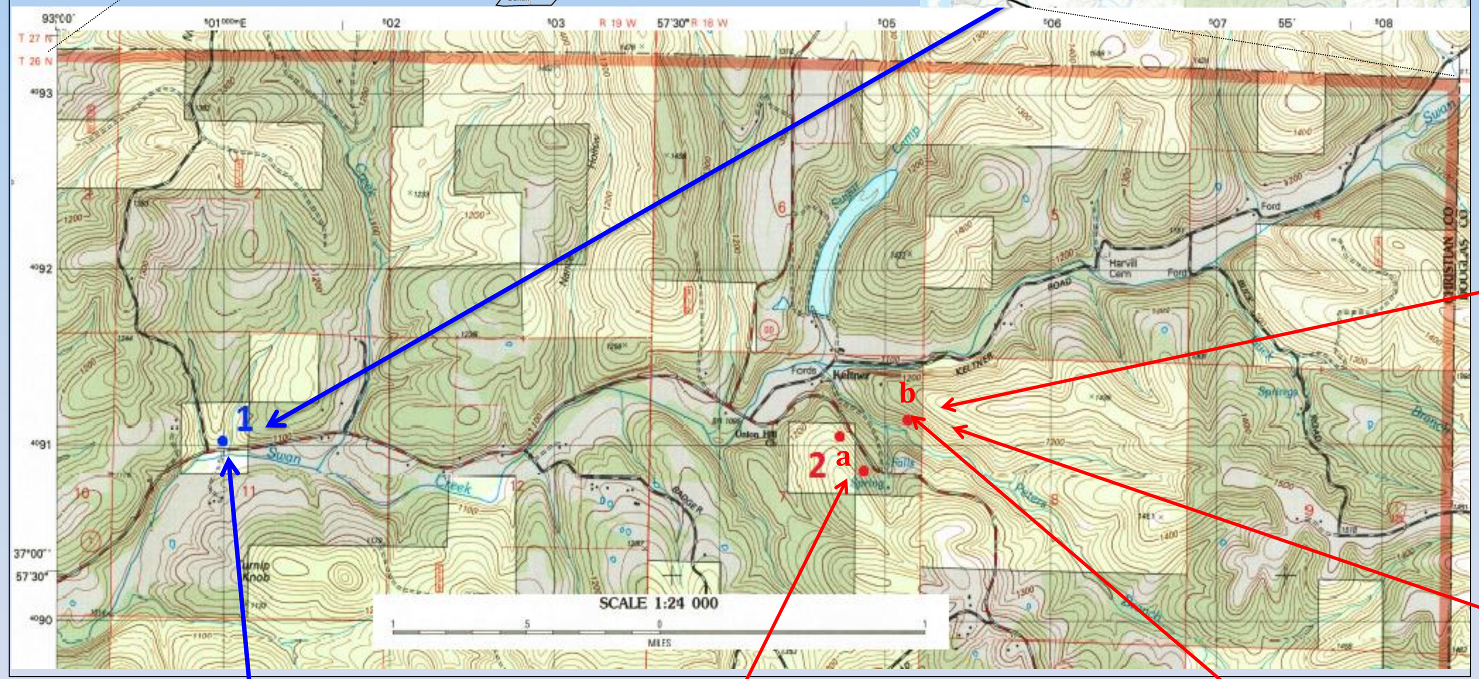
Study Area

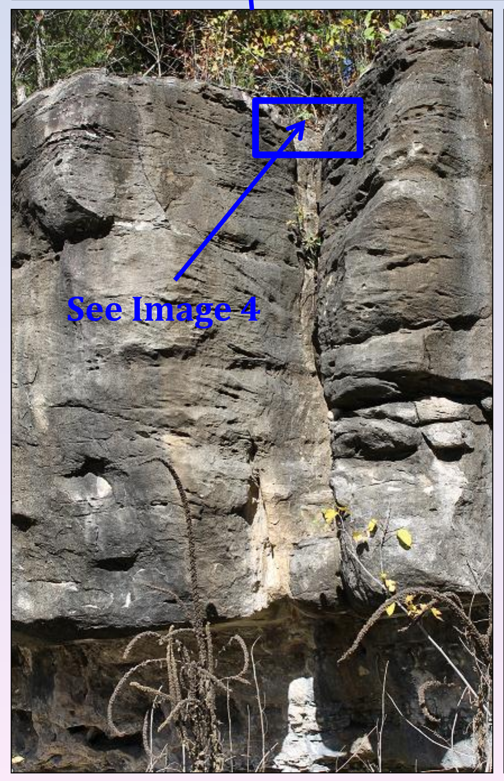
Figure 1. County Map of Missouri to left. Keltner quadrangle map below (Cropped NW portion). Circles indicate where samples were collected. Site 1 is along highway T. Site 2's samples were collected both along highway T as well as across Peter's Branch valley.

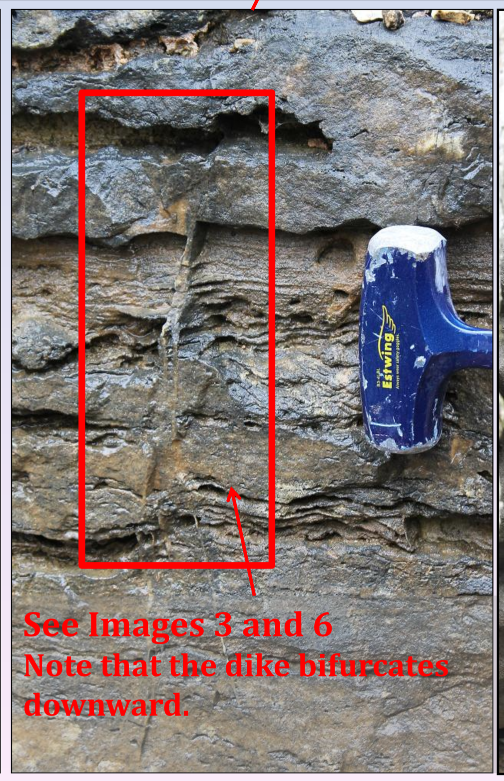


Fault map of surrounding region. Unmapped faults likely exist in quadrangle, as the overall pattern and distribution suggests.









Data:

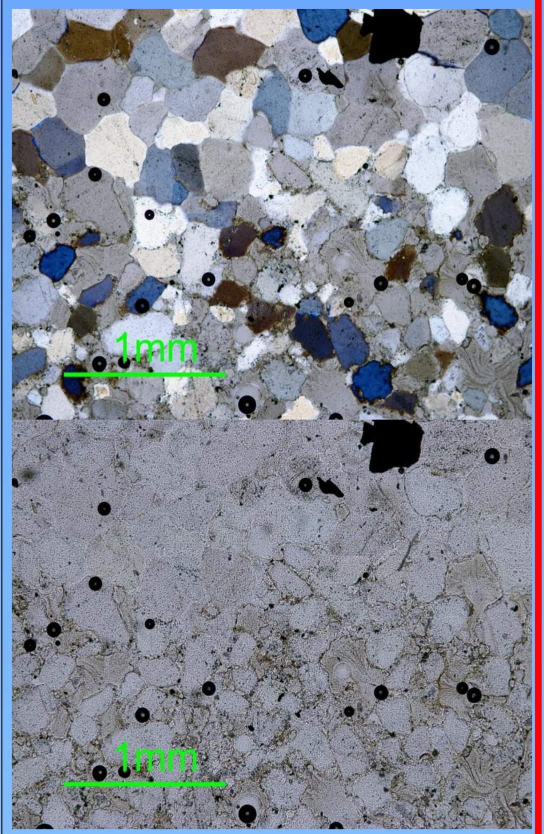
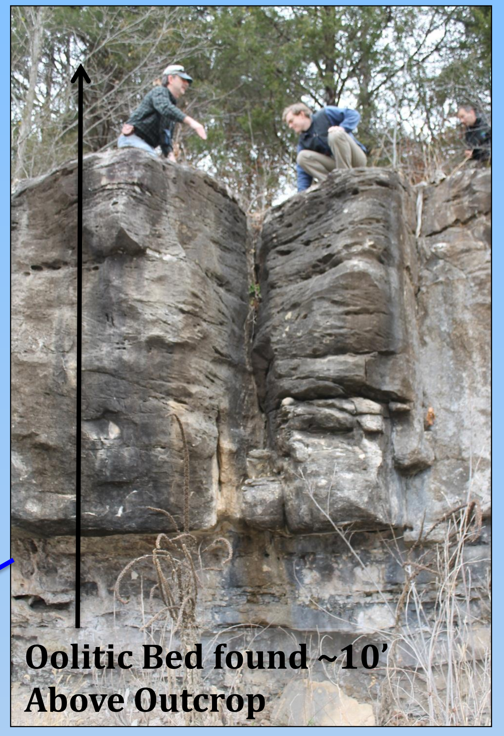
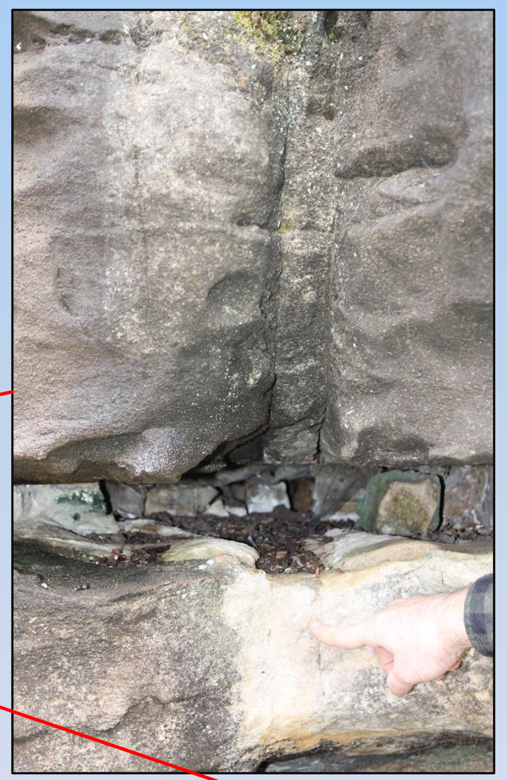
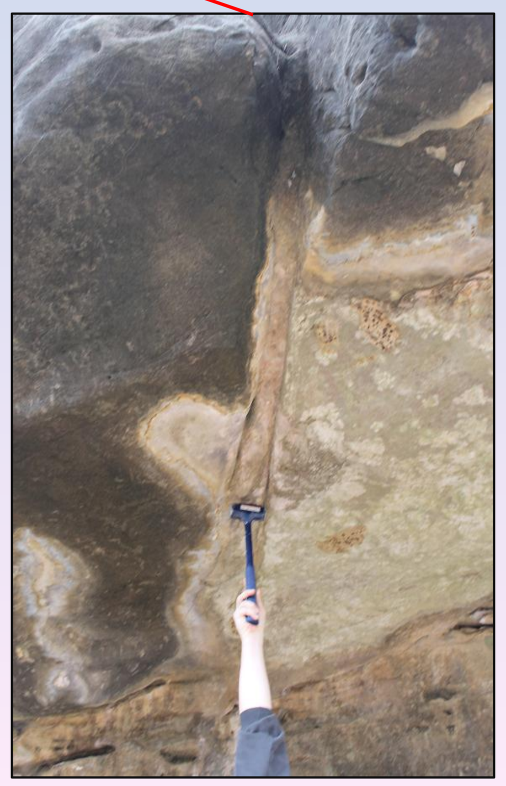


Image 2: Thin section from Stop 2b. This is the pure Swan Creek member, note the diversity.







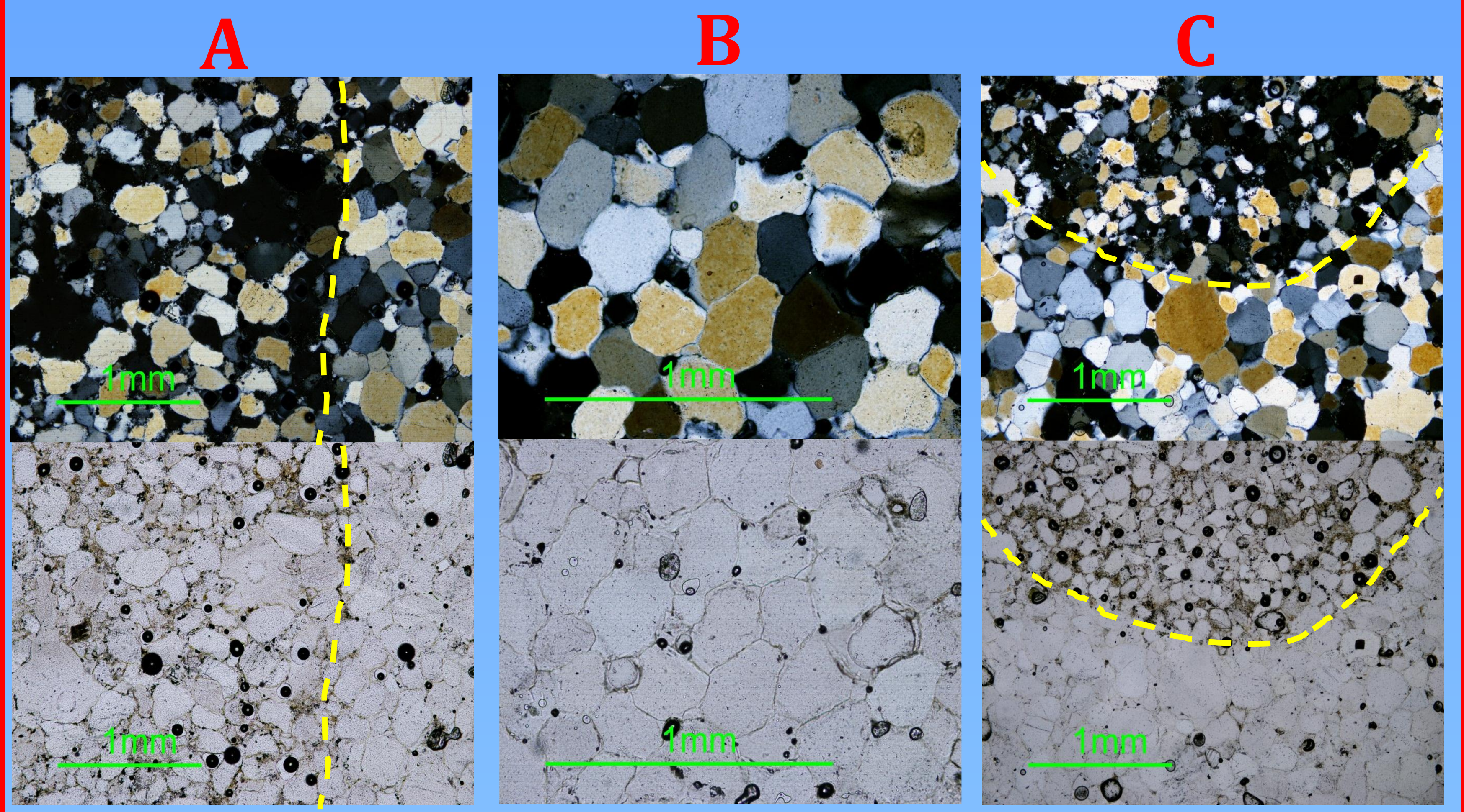


Image 3: Thin sections from Stop 2A. These show the thin dikes that stand in relief against the rest of the Swan Creek member. The dike is obviously better sorted and has a higher rounding coefficient than the surrounding rock. A and C are excellent examples of the dike boundary. B is zoomed in to show multiple quartz overgrowth stages.

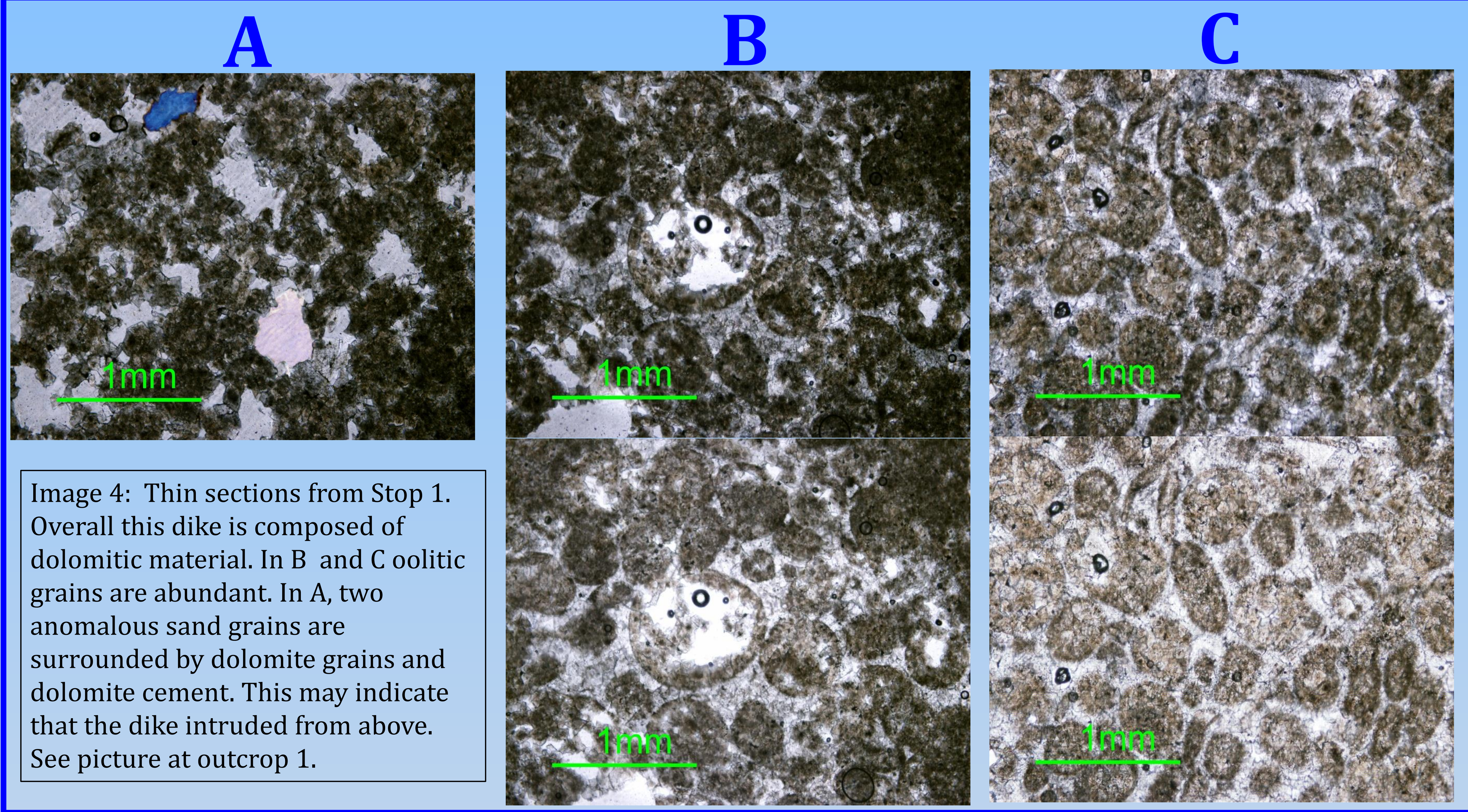


Image 4: Thin sections from Stop 1. Overall this dike is composed of dolomitic material. In B and C oolitic grains are abundant. In A, two anomalous sand grains are surrounded by dolomite grains and dolomite cement. This may indicate that the dike intruded from above. See picture at outcrop 1.

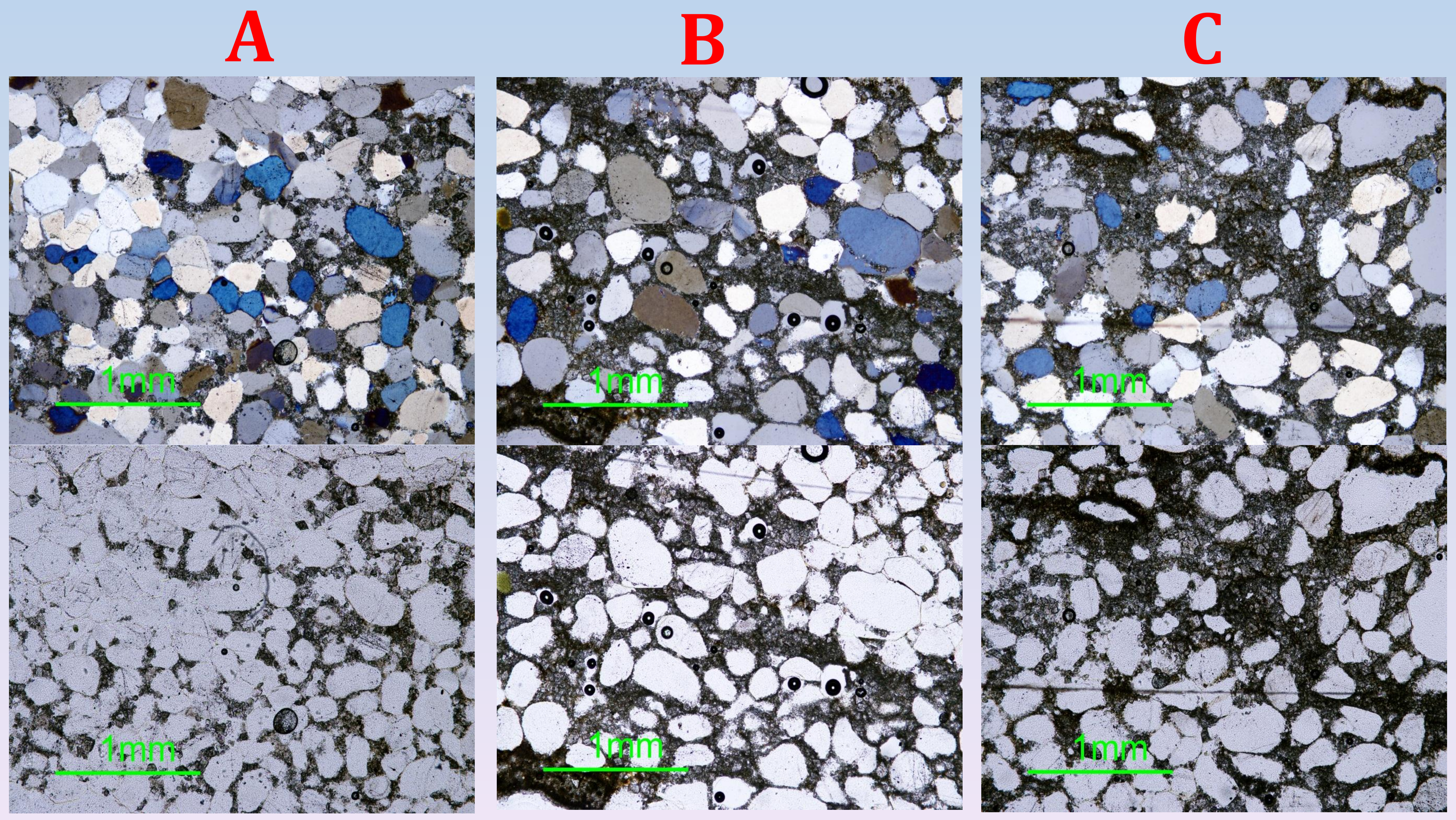


Image 5: Thin section images from dike fill at Stop 2B1. Dike fill has varying round and sorting coefficients. Variation ranges from full grain support to full matrix support with dolomite and even silica cement.

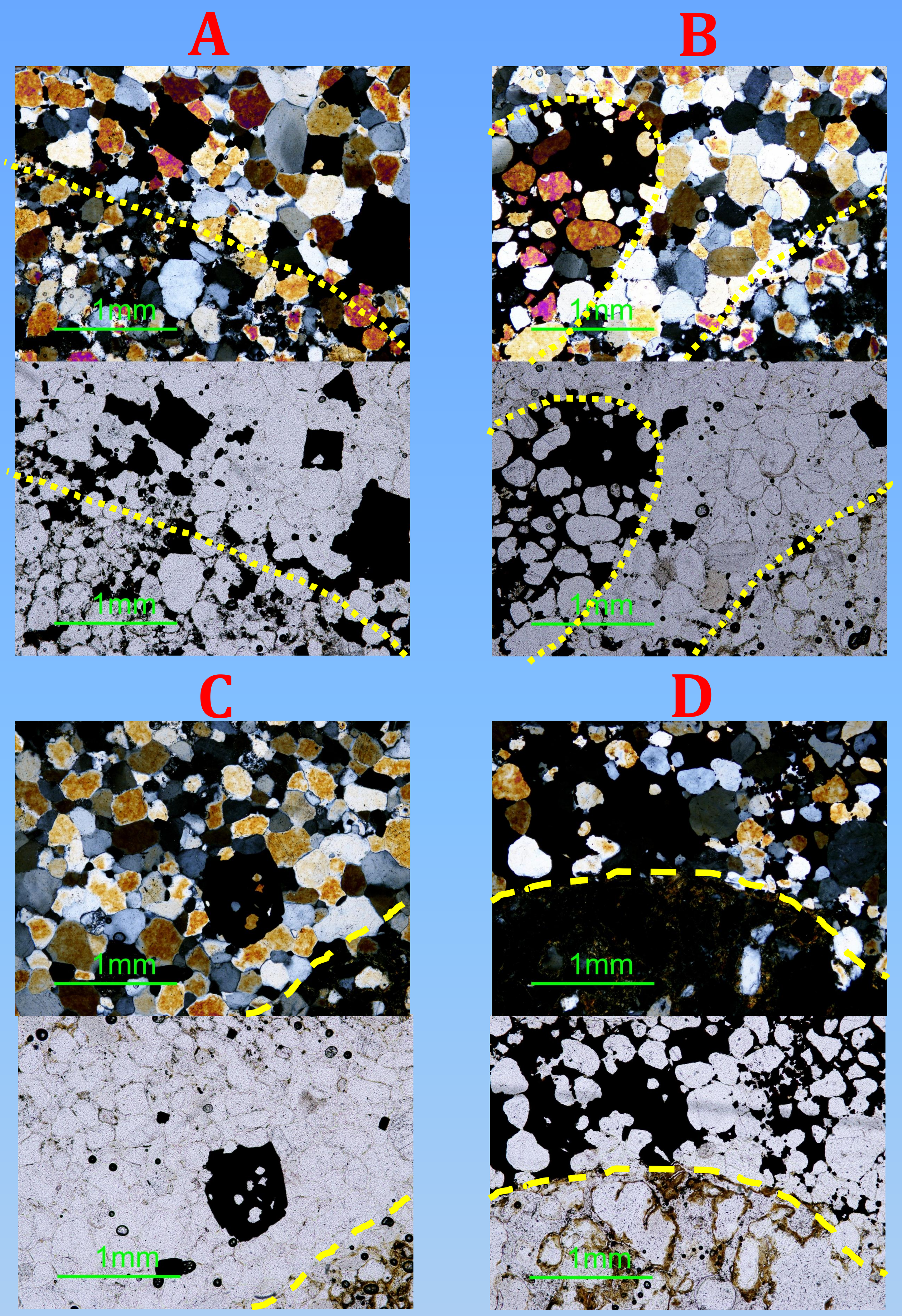


Image 6: Thin sections of a thin bifurcating dike with iron-oxide (goethite, pyrite?) grains and cement. A shows cube shaped crystals/grains of iron oxide cement within the dike (dike wall is apparent). B shows the bifurcation point. Iron-oxide nodule just outside the dike here. C highlights an iron-oxide grain with quartz grains within, implying that the iron-oxide is a detrital grain. D shows well rounded grains within the dike, supported by iron-oxide cement, against a sandstone with clay matrix and iron-oxide cement. This dike highlights the complexity and anomalous nature of the dikes.

Discussion and Conclusions

The thin sections taken of the various dike fills are unexpectedly non-uniform. The thin dikes are mostly composed of more mature sandstone than the Swan Creek Member itself, as well as some iron-oxide material. While the larger dikes are made up of sandstone, dolomite and oolitic dolomite. The thin dikes seem to suggest intraformational transport, and both the thin and the larger dikes suggest intrusion from above (See Fig 1 Stop 2 picture). These events may be linked. There have been tectonic forces in the region post deposition. Fig 1 shows a fault map which highlights the uniform orientation of faults in the region. Unmapped faults may exist in our study area, and would support a tectonic origin for these dikes. We need to attempt to establish a correlation between the dike orientation (NNW trending?) patterns and faults in the region (NW trending). If the dikes concurrently developed we would need to conduct geochemical tests in order to ascertain any age correlation.
The iron-oxide grains either suggest that a fractured sandstone with iron-oxide cement provided some of the grains for that dike, or that iron-oxide percolated into the dike and filled pore space, crystallizing as well. Another option is that the iron-oxides came from the surrounding unit, either in the form of nodules or cement pockets, and the dikes incorporated these features.

Acknowledgments

We would like to thank Dr. Charles Rovey II (Professor of Geology MSU) for his interest and support in starting and continuing the project, as well as his expertise on determining the mineralogy and sedimentology of the rocks. We would also like to thank Stephen Shields (M.S. candidate MSU) for his instruction on making and finishing thin sections as well as his expertise on mineralogy of sedimentary rocks.