Controls on structural architecture and strain partitioning within the Northern Appalachian fold-thrust belt in the Rosendale natural cement region

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Abstract: Deformation in the Hudson Valley foreland-fold thrust belt of southeastern New York State involves a mechanically rigid strut of Late Silurian through Middle Devonian clastic and carbonate sedimentary strata. This rigid strut is sandwiched between thick, relatively ductile units of Ordovician shale (below) and Middle Devonian shale (above). Near Rosendale, units within the Siluro-Devonian rigid strut begin thinning northwards. Here, the most mechanically significant unit within the rigid strut, the Shawangunk Conglomerate, thins from > 100 m thick to 0 m thick in an along strike distance of less than 5 km. The results of recent geologic mapping and cross section construction suggest this stratigraphic change gives rise to significant, along-strike transitions in fold-thrust belt architecture. Northward thinning of the Siluro-Devonian strut corresponds with a decrease in the wavelength and amplitude of megascopic folds, a decrease in the spacing of thrust faults, the occurrence of lateral ramps, and the dying-out of faults into fault-related folds. In addition to controlling the architecture of folds and faults, the rigid strut also appears to have influenced penetrative strain accumulation within the belt. The results of Fry strain analysis of the Binnewater Formation indicate that, although folded and incorporated in thrust sheets, the unit accumulated only very low strains (generally < 3% shortening; max. 8%). Furthermore, the long axes trends of bedding-parallel Fry strain ellipses do not consistently parallel the regional structural grain defined by the trends of fold axes and cleavage in the belt. This scatter suggests that tectonic strain has not completely overprinted primary fabrics, and these ellipses measure composites of depositional/compactional and tectonic fabrics. In contrast, analysis of the anisotropy of magnetic susceptibility (AMS) performed on the same unit yield fabrics that closely parallel the regional structural grain of the fold-thrust belt. These AMS fabrics reflect the preferred orientation of matrix grains in the sandstone samples, which may provide a more sensitive passive strain marker than the distribution of detrital grains. The results of these fabric analyses suggest that the rigid strut transmitted penetrative strain further into foreland and/or directly into brittle, macroscopic mechanisms.

Biography: Dr. Kurtis Burmeister is an Assistant Professor in the Department of Geosciences at the University of the Pacific in Stockton, California. Kurtis obtained his BA degree in Biological Sciences from the University of California at Santa Barbara in 1996 intending to pursue a career in medicine. However, a general education course in geology during his senior year changed those plans. Kurtis obtained a MA degree in Geology and Vertebrate Paleontology at the University of California at Santa Barbara under André Wyss in 2000, and a PhD in Structural Geology under Stephen Marshak at the University of Illinois in 2005. While questions regarding lithospheric deformation form the core of Kurt's experience and interests, his interdisciplinary research approach draws heavily on aspects of geophysics, stratigraphy, petrology, and even paleontology. Kurt's current research projects integrate field-based structural analyses and geologic mapping with lab-based analysis of strain and magnetic fabric analyses to examine the controls on strain partitioning and deformation styles. In addition ongoing research into the controls on the structural architecture of the northern Appalachian foreland fold-thrust belt, Kurt is actively involved in collaborative research projects examining: (1) the structural evolution of the Nankai & Boso accretionary prism complexes of eastern Japan, and (2) the use of magnetic fabrics as a proxy for tectonic fabrics in the Colorado Plateau and the Alisitos arc of Baja California, Mexico.