

Deformation gradients along the Champlain thrust

Motivation

The Champlain Thrust Fault is a prominent geologic feature in the Champlain Valley. The fault affords the opportunity to study varying deformation responses in the Iberville shale footwall both immediately adjacent to the fault and at depths of 100 meters or more, as it is exposed in multiple locations across the Champlain Valley.

Problem Statement

By examining the features within the deformed Iberville Shale layers adjacent to the Champlain Thrust Fault I am attempting to categorize, compare, and contrast the deformation response of the rocks both immediately adjacent to and well below the fault. The purpose of this examination is to describe a relative deformation gradient and determine the causes of variations in deformation.

Methods

The majority of the time on this project has been in the field recording the orientations of features within the shales, such as bedding, foliation, veining, cleavage, dolostone inclusions, and faults. The occurrence and orientations of these features were analyzed and compared to those at the other sites. In addition, for each outcrop analyzed, a high-resolution image was taken and the features listed above were highlighted to illustrate their relationships.

Results

The shale layers just below the fault contained compressed bedding layers, an abundance of veins of many orientations, parasitic folds and numerous faults with coinciding shear zones.

The layers at depth are characterized by thicker bedding layers, well-defined folds, dolostone inclusions, several generations of en-echelon veins, and a few prominent faults.

Conclusions

The layers of the Iberville Shale nearest to the Champlain Thrust were stressed at a greater rate from motion along the fault than those at depth. This is the primary cause of the variations in deformation between the sites and by relating deformation responses to depth we can interpolate a relative deformation gradient. Through the application of geologic fieldwork and materials science, this places one of the defining features of our region within a structural context.