Geometric Variability and Spatial Extent of an Acadian Dome and Basin Fold Interference Pattern in NW Vermont

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Two east-dipping thrust faults that formed during the Ordovician Taconian Orogeny divide the bedrock geology of Vermont's Champlain Valley into lithotectonic slices. On the west, the Champlain thrust (CT) placed M. Cambrian – M. Ordovician sedimentary rocks over L. Cambrian – M. Ordovician sedimentary rocks. Farther east, the Hinesburg Thrust (HT) placed L. Proterozoic – E. Cambrian chlorite-sericite grade metamorphic rocks over rocks above the CT. Subsequent deformation during the Devonian Acadian Orogeny resulted in the folding of both faults and other Taconian structures. Previous work recognized two sets of open, upright folds— a N-S-trending, asymmetric, open-tight fold set (F_3) and an E-W-trending, open fold set (F_4)— that create a dome and basin fold interference pattern. We report on the spatial extent and variable geometry of this pattern between the towns of Colchester and Mechanicsville with the goal of understanding how it formed and its significance.

The dome and basin pattern is best developed in chloritic schists in the upper plate of the HT. This trend may reflect the presence of mica-rich lithologies, which are relatively weak and easily deformed. Between Mechanicsville and southern Williston, F_3 and F_4 are equally developed and display wavelengths ranging from a few meters to 1-6 km. The folds trend N-S and E-W, respectively, and are associated with two steeply dipping, orthogonal crenulation cleavages (S_3 and S_4) and related crenulation lineations (L_3, L_4). However, farther north, toward the leading edge of the HT, the two folds sets are not orthogonal and are unequally developed. At Oak Knoll, F_3 is dominant whereas F4 is younger and represented by broad arches. Orientations also are different: S_4 is weak and strikes WNW whereas S_3 is penetrative and strikes to the south. The L_3 and L_4 lineations also form an oblique angle, suggesting they were rotated as F_3 folds formed. These observations suggest that the two folds sets formed approximately at the same time. Geometric changes toward the leading edge of the HT also raise the possibility that the pattern formed by an Acadian reactivation of the HT.

Ongoing analysis seeks to further resolve the relative ages and three dimensional geometry of the fold sets along strike of the thrust belt and resolve whether they reflect an Acadian reactivation of the HT.