Integration of Structural Analysis, an EMI Survey, and Hydrogeology in the Plainfield Quadrangle, Central Vermont II

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The Plainfield 7.5' Quadrangle lies on the western side of the Connecticut Valley Trough (CVT)- a post-Taconian (Ordovician) extensional basin that was filled in with Silurian-Devonian sedimentary and volcanic rocks. The basin was deformed and metamorphosed during the Devonian Acadian Orogeny, and later intruded by post-orogenic granitoids of the New Hampshire Plutonic Series (NHPS). From oldest to youngest, the rocks in the field area consist of interlayered gray phyllites and impure marbles (Waits River Fm, DSwt and DSwl1), interstratified gray phyllites and phyllitic quartzites (Gile Mt. Fm), and biotite granites (NHPS). The degree of metamorphism ranges from biotite- staurolite grade.

We observed three distinct sets of topographic lineaments: the first set follows the dominant bedding-parallel cleavage (S1) that is pervasive in all metasedimentary lithologies. The second set follows the less prominent NW/SE trending fracture set. The third set follows E-W fractures that are orthogonal to the dominant foliation (S1). Whereas all three lineament sets are clearly expressed in the Waits River Fm, lineaments in the Gile Mt. Fm are dominantly E-W.

We conducted detailed (1:4000) EMI in specific areas of the Waits River Fm that demonstrated a direct correlation between linear zones of high conductivity and ~E-W fracture sets measured at outcrops, suggesting the fractures may be groundwater pathways. Both M-folds and Z-folds were identified in the EMI plots and correlated to locations on the cross section of the area, further evidencing the asymmetric east verging F2 fold geometry. It was hypothesized that the folds are most distinguishable in the surveys taken when the ground was not saturated.

In a summary 3D conceptual model, three scenarios of maximum bedrock well yield were identified: 1) down plunge of an F2 fold, 2) into a fractured marble member, or 3) into any thick marble unit with high porosity.