Application of Structural-Metamorphic Patterns and Absolute Time Constraints to Tectonics in Southwest Newfoundland

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Southwest Newfoundland is a complex polyphase deformed and metamorphosed terrane which is partitioned into terranes (C, I, and II) along the major Carboniferous Long Range and Devono-Carboniferous Cape Ray faults. Individual terranes are characterized internally by rational structural-metamorphic patterns and by coherent rock assemblages, which may suggest but not prove several general tectonic scenarios for each terrane. Further detailed structural and metamorphic (P-T-path) studies, and bio/geochronological data in individual terranes and parts of terranes will test, modify, and reformulate these geological models. The general framework of spatial, geometric and metamorphic patterns will, however, continue to be of value in choosing critical areas and problems, in deciphering such details as overprinting information (may be important in kinematic studies), and in providing regional context and alternative hypotheses compatible with the current data array for the region. Some of the important elements of the framework of southwest Newfoundland will be summarized below.

Terrane C, the fossil-bearing Carboniferous sedimentary terrane northwest of the Long Range Fault, characterized by open, upright enechelon folds, steep faults and minor thrusts related to a dextral (oblique-slip) wrench system (Knight 1983); it is a terrane of low metamorphic rank against which the pre-Carboniferous, ophiolite-based Terrane I of up to granulite grade has been uplifted along the Long Range Fault with a strong, high-angle-reverse component associated with a horst. The Carboniferous rocks give a Visean (Early Carboniferous) age to this late fault movement, perhaps only the final stage of a longer-lived fault.

Terrane I, between the Long Range and Cape Ray faults, exposes extensive ophiolite, and metasedimentary-metavolcanic cover either related to the ophiolite or Grenvillian in age, intruded by tonalite and later gabbroic to granitic plutons. A steep fault/shear zone internally juxtaposes two different ophiolite and cover packages, forming a domain (=subterrane) boundary. The terrane, as well as both domains, show extreme variations in strain intensity and metamorphic grade. Shallowly dipping and plunging structures are preserved in the cover rocks, which commonly record the highest strain and metamorphic grade; these are overprinted by retrogressive, steeply dipping foliations,

shear zones and faults related to movements on the major terrane and subdomain boundary faults. The structural geometry and metamorphic pattern outlined so far suggests high temperature thrust zones focussed in the ophiolitic (and/or Grenvillian) cover rocks, overprinted by the steep fabrics associated with horsting and oblique-slip displacement along the terrane/domain boundary faults. Terrane I is overlain directly and unconformably along the southeast bounding Cape Ray Fault, by the Early-Middle Devonian Windsor Point Group, itself further deformed on the Cape Ray Fault, giving and Early? to Late Devonian age to the major movements of the Cape Ray Fault.

Terrane II, between the Cape Ray and Grand Bruit faults, contains metavolcanic, metasedimentary and meta-igneous rocks, all imprinted with intense, northeasterly to easterly striking, steep foliations and shear zones, and gently northeasterly plunging lineations. These predominant structures are syn-metamorphic and generally the second regional fabric recorded, post-dating pre-metamorphic recumbent isoclines. The major Cape Ray Fault, along which the fossiliferous Windsor Point Group was deposited and deformed, evolved from this deformation stage; this and other geochronological data suggest it overlapped the Early to Middle Devonian. The effects of this major deformation were in turn affected by a later event, consisting essentially of differential bulging, juxtaposing rocks of different metamorphic history along steep, dextral oblique-slip and high-angle-reverse faults which form the internal domain or subterrane boundaries. The uplifts of one such domain is well calibrated by Late Devonian to Early Carboniferous Ar/Ar cooling ages and the reverse fault impingement of mid- to upper-amphibolite-facies rocks against the greenschist-facies Windsor Point Group along the southwest segment of the Cape Ray Fault. This is in contrast to the dextral oblique-slip deformation of the group along the northeast segment of the fault, where it lies unconformable on another Terrane II domain with early Devonian Ar-Ar cooling ages. The pattern as a whole suggests early recumbent folds and/or nappes followed by a major period of transpression, the latter beginning with sinistral? oblique-slip shear evolving into faulting and ending with differential bulging and dextral oblique-slip as the system "locked."