Slate belt tectonics in the Bickerton Barrens, N.S.: Horizontal extension and simple shear within the Meguma Basin

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Greenschist facies sedimentary rocks underlying the Bickerton Barrens illustrate a long history of inhomogeneous progressive deformation. A discontinuous deformation path gave rise to several phases of deformation, each governed by a particular type of crustal shortening. The earliest event produced a layer-parallel shear of variable intensity throughout a shale-sandstone multilayer exceeding 5 km in thickness. Within the multilayer bedding and stratiform quartz veins acted as both the principal planes of shear and anisotropy. Flattening associated with layer-parallel shear is evidenced by the formation of gently dipping, grain alignment cleavage and the development of gently plunging, step folds. Localities where bedding is down-folded may mark the site of underlying

faults, perhaps themselves rooting in the basement to the multilayer. The Meguma slate belt is held to be thin-skinned.

Layer-parallel shearing was followed by a period of layer-parallel shortening. Where the multilayer remained flat, gently plunging parallel folds were produced by buckling. Depending upon the ratio of competent to incompetent beds the buckle folds developed by either flexural slip folding or neutral surface folding. At an early stage in the buckling of the multilayer pressure solution cleavage began to develop with a characteristic moderate dip. This cleavage together with certain quartz veins and the grain alignment cleavage were passively folded and steepened. In having done so they provide a record of most of the limb rotation during buckling. Newer and successively steeper pressure solution stripes were initiated as the fold limbs continued to rotate and the axial surfaces approached the vertical. Subsequent to most but not all of the buckle folding and late in the episode of layer-parallel shortening the generally upright slaty cleavage was imposed on all earlier folds. Cleavage-related flattening locally produced minor folds, in particular cuspate isoclines of the bedding. Objects in the plane of the steep foliation are typically extended subhorizontally parallel to the regional fold axes. Rotation of obliquely orientated step folds into the regional E-W grain of the slate belt occurred before or during the formation of the slaty cleavage. Regional wrench movements may have been active early during buckling as well as late during the imposition of the upright LS-fabrics.

After the beds acquired slaty cleavage they ceased to behave as a multilayer. Gravitational instability following inhomogeneous layer-parallel shortening probably caused the vertical collapse of the slate belt. An associated flattening produced variably intense but regionally pervasive subrecumbent folds and gently dipping crenulation cleavage. Superimposed coaxially on the major fold structures, they are commonly seen to affect the steep cleavages but rarely to deform the bedding. There does not appear to be any preferred direction of translation during this episode of shortening

The slate belt largely acquired its present configuration in a period of shear folding which most likely succeeded gravitational collapse. At this time the strong, upright foliations were the principal planes of anisotropy and so they became the principal planes of shear. The hinges of the major folds suffered relatively large strains late in the layer-parallel shortening event and, therefore, they were naturally favoured to be the most active sites of shear folding. Reclined crossfolds and crenulations possibly result from shear related compression; their conjugate nature reflecting both dextral and sinistral movements. En echelon boudins extended equally in several directions seem to imply a plane strain and an operative simple shear.