Minor folds and their relationship to regional fold evolution, central Meguma Terrane, Nova Scotia

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The highly anisotropic turbidite sequences of the Meguma Group are folded into upright, noncylindrical, northeast-southwest trending box and chevron folds. Minor folds are well developed in coticule layers in the Beaverbank member, the basal unit of the Halifax Formation in central Nova Scotia. Classical interpretations for the development of minor folds involve layer-parallel shortening predating regional fold development, with minor folds becoming asymmetric as regional folds develop. This interpretation has been used for the origin of buckled bedding-parallel veins in the Meguma Group.

Minor folds in coticule layers display ptygmatic, sinusoidal, box, and chevron fold geometries, and all folds are moderately noncylindrical. Fold geometry is mainly ptygmatic in regional fold hinges whereas minor folds are more open and commonly display a box fold geometry on regional fold limbs. Some minor folds on regional fold limbs are asymmetric, consistent with flexural flow folding, whereas others are symmetric with axial planes and cleavage at high angles to bedding. Folding of coticule layers record significantly more

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shortening in regional fold hinges than on regional fold limbs. Coticule layers are always folded in regional fold hinges, however, coticule layers are locally non-folded on regional fold limbs. In thin section, outer arc extension is common in folded coticule layers, recording tangential longitudinal strain. Cleavage exhibits a divergent fan pattern around the outer arc reflecting inverse tangential longitudinal strain. Extensional fractures occur along garnet grain boundaries indicating that fold initiation postdates garnet formation. Coticule layers display boudinage parallel to regional cleavage which records significant vertical and hinge-parallel extension.

The observed minor fold geometries, in particular box folds, support development during layer-parallel shortening. However, the lack of minor folds in coticule layers on some regional fold limbs, the contrast in the degree of shortening recorded by minor folds in regional fold hinges compared with limbs, and the variation in symmetry of minor folds and associated cleavage on fold limbs suggest minor folds record additional strain during progressive development regional folds. We suggest the observed features of minor folds can be explained by layer-parallel shortening in the flat segments of early formed regional box folds followed by hinge migration, resulting in redistribution of minor folds, and continued shortening in fold hinges during progressive fold development. This interpretation is consistent with the box and chevron fold character of regional folds; such folds typically initiate with little layer-parallel shortening and involve considerable hinge migration during development.