Fold mechanisms in the shallow crust: an example from the Siluro-Devonian Arisaig Group, Antigonish Highlands, Nova Scotia

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The Silurian-early Devonian Arisaig Group, consisting mainly of shale and fine-grained sandstone, was deformed in the middle Devonian into regional NE- to NNE-trending folds, an event traditionally attributed to the Acadian orogeny. These strata are unconformably overlain by interbedded basalt and red clastic rocks of the McArras Brook Formation. The Arisaig Group affords a chance to study fold mechanisms in the shallow crust related to the Acadian orogeny. The observed structural features are indicative of classical complementary fold-fault regimes with evidence of coeval compressional and extensional tectonic features. Outcrop-scale fold propagation is associated with ramp-flat thrust fault geometry and local extension is recorded by a set of conjugate normal faults. Many of the outcrop-scale folds have sheared limbs and show evidence of a complex progressive deformation. The rare occurrence of slickensides along bedding planes indicates that flexural slip mechanisms are not dominant.

Although a synoptic plot of structural data suggests a complicated folding pattern, stereoplots of bedding data around individual folds reveal a more simple geometry, one that is dominated by conical folds rather than classically cylindrical folds (i.e., the axis of rotation does not lie in the bedding plane). The axial plane, fold, and conical axes orientations show high variability, further suggesting a complex progressive deformational history. Taken together, the data suggest that outcrop-scale structural features in the Arisaig Group are more complex than regional geometries would indicate. The data indicate that fold mechanisms in the shallow crust during the Acadian orogeny were related to coeval fault movements in underlying strata, yielding geometries possibly imposed by coeval dextral strike slip movement along the Hollow Fault.