Outcrop behind Walmart, Highland Shopping Centre, Stellarton NS

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The new outcrop behind Walmart at the Highland Mall in Stellarton displays folded clastic sedimentary rocks of the Stellarton Formation. This unit fills the Late Carboniferous (or Pennsylvanian) Stellarton Basin, a subsiding area that developed as a result of movements along a major strike-slip fault system that was probably a transform fault, separating two tectonic plates. The Stellarton basin was small (about 20 km long from east to west, about 8 km wide, from north to south), but subsided rapidly, producing a lake in which was deposited a thick succession of muds, sands, and peats; these are now preserved as shale, sandstone, and coal.

The outcrop behind Walmart lies close to the north edge of the Stellarton basin. The rocks exposed are probably part of the Coal Brook Member of the Stellarton Formation, deposited in the Westphalian 'C' stage of the late Carboniferous Period. A short distance to the south, the rocks are cut by the Bridge Fault which runs through the exit 23 intersection. About a kilometre to the north, an extension of the Cobequid Fault zone, also known as the New Glasgow Fault, marks the northern boundary of the basin.

Like most of the rocks near the north edge of the basin, those exposed in the excavation created for the Walmart store are folded and faulted. Folds are particularly spectacularly displayed and may be seen in both the east and west faces of the excavation. However, the most complete cross-sections of folds are seen in the east face. Overall, the folds are upright to steeply inclined (meaning the axial planes - imaginary planes that roughly bisect the folds - are steep.) Their hinges are subhorizontal to gently inclined.

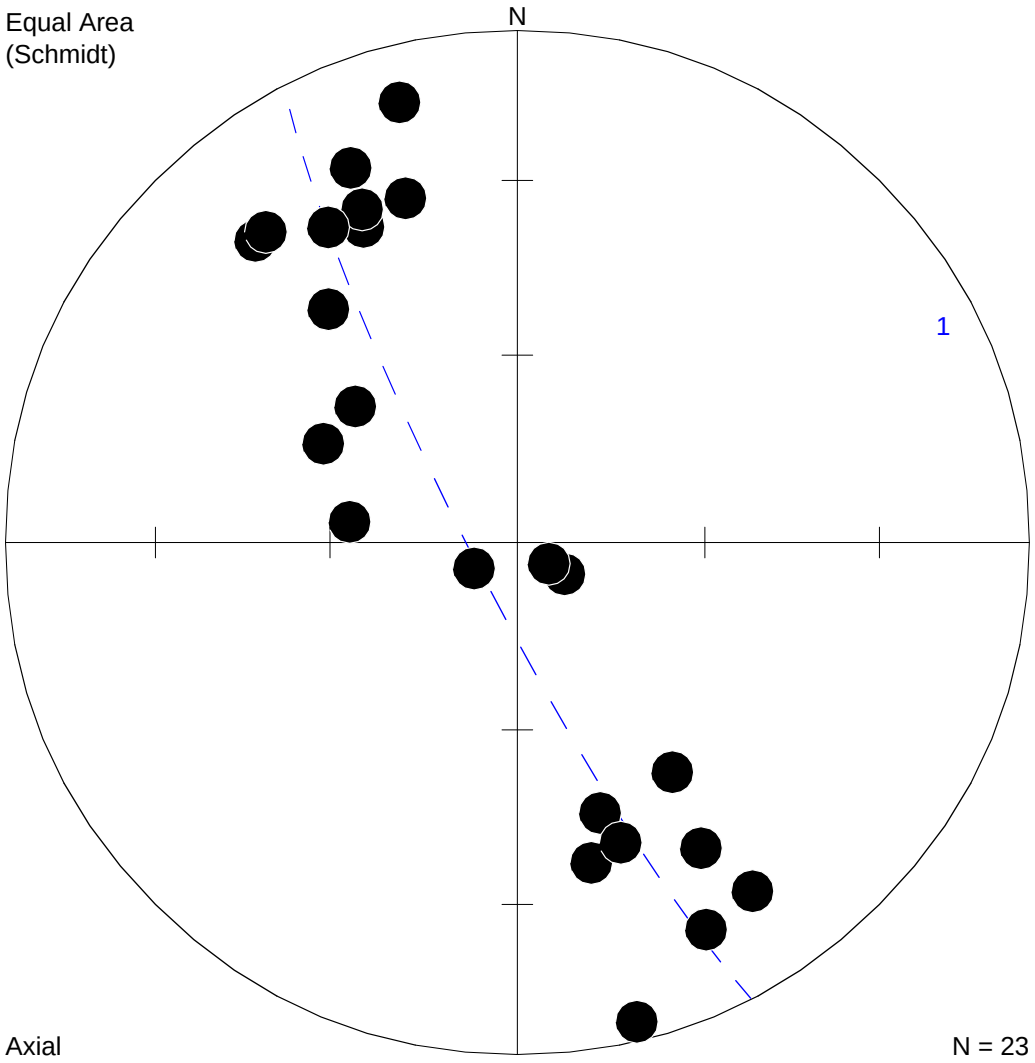
At the south edge of the outcrop is an antiform (an upward closing fold, shaped like an upside-down V) affects a conspicuous unit of dark shale with thin paler siltstone beds. Sedimentary structures show that the rocks in the centre of the fold are the oldest, and therefore the fold can also be characterized as an anticline. The rocks in the centre of the fold are also cut by small faults which offset beds a few centimetres. Most are reverse faults (i.e. the block above the fault plane has moved up and over the block beneath, resulting in a shortening of the beds). Locally there are striations (slickenlines) on bedding surfaces, that probably resulted from flexural slip as the fold tightened.

To the north of the fold, the strata are almost vertical, and young to the north. Two pale units of sandstone show 'coarsening upward' profiles suggested that they represent small deltas or shoreline deposits that built into the lake. Farther north, a younger unit of darker shales and siltstones is folded in another fold, a broader synform (a U-shaped or V-shaped fold) which is also a syncline because the youngest rocks (the paler siltstones exposed at the top of the face) are in the middle. Continuing north, the upper pale sandstone unit seen on the south limb of the syncline reappears, younging to the south this time. Another two folds affect this unit - an anticline and a syncline. These two folds are generally smaller and closer together than those that lie to the south, and they are probably 'parasitic' folds, formed on the limb of a larger structure. A conspicuous fault cuts the sandstone beds in the vertical north limb of the parasitic syncline. This fault offsets bedding in a 'normal' sense (the hangingwall, the block above the fault plane, is offset downward.) However, the fault also has the effect of shortening bedding, making it a contractional fault. A reasonable explanation for this geometry is that the fault formed before folding, as shortening of the rocks started, and that it was later rotated into its present orientation as the beds were folded. Although it is inaccessibly high in the cliff, the fault trace does appear to be curved, and does not cut the south limb of the syncline, consistent with the hypothesis that it formed before folding.

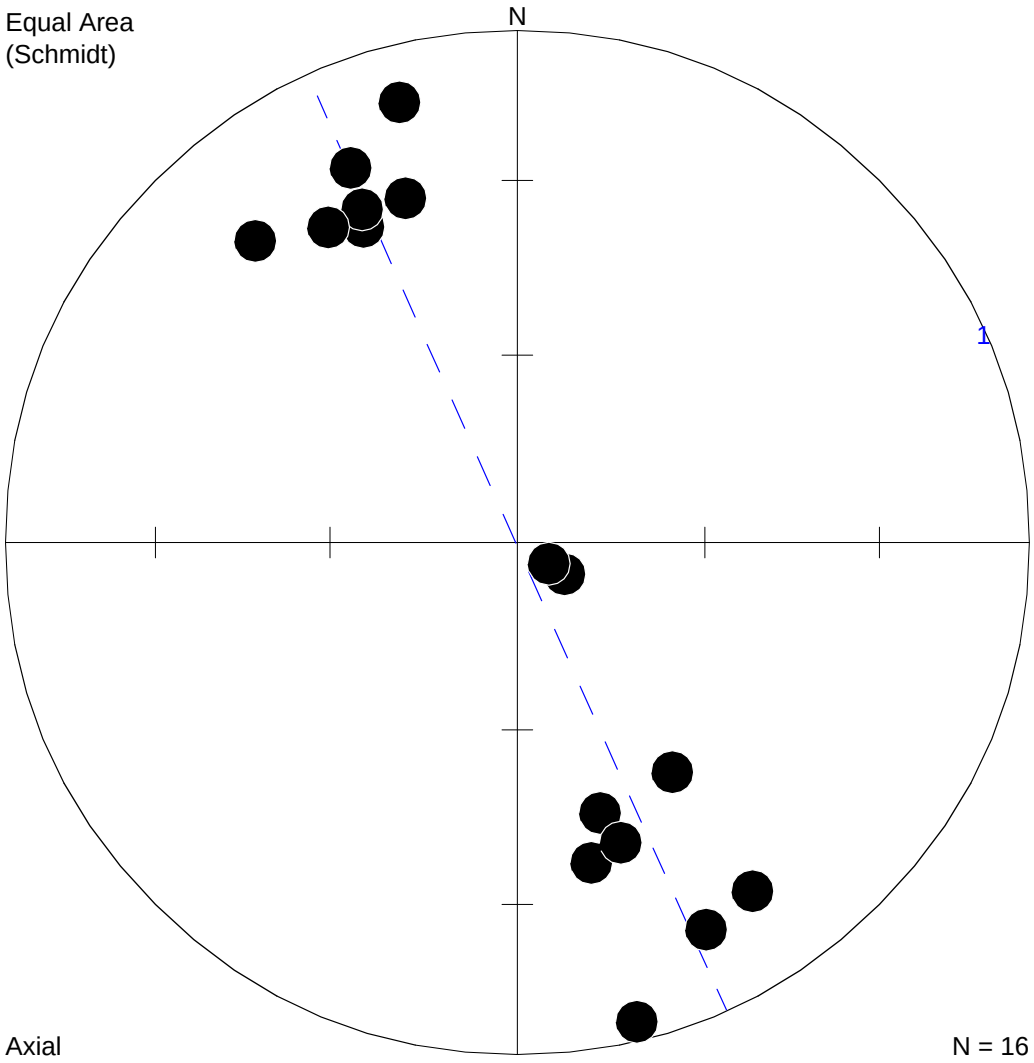
Beyond the folds, the beds are near-vertical, younging to the south. The lower sandstone unit reappears, and below it a thick succession of darker shales and siltstones, the same beds that were exposed in the core of the first anticline.

The shale layers show slightly different geometry from the sandstone layers, a common phenomenon in folded clastic successions. The sandstone layers show nearly 'parallel' folds, in which the thickness of a layer (measured perpendicular to bedding surfaces) does not change as it is traced around the fold hinge. This indicates that they were relatively compentent (stiff) during folding. In contrast, the shale layers are thickened at the fold hinges, indicating that the fine-grained rocks were more able to flow during deformation.

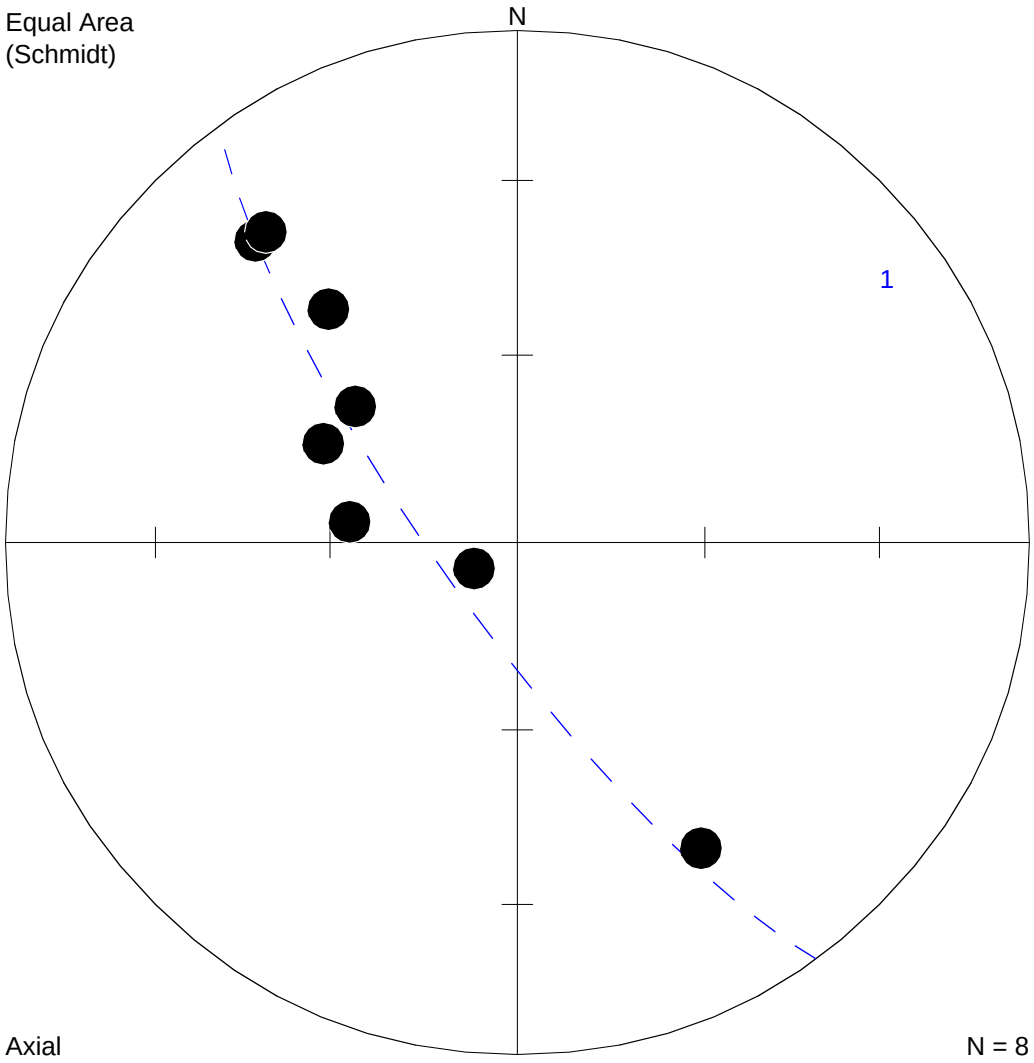
The long, roughly east-west wall of the excavation is nearly parallel to the axes of the folds, with the result that it does not show spectacular cross-sections of the folded strata. However, towards the west end of the outcrop, folds can again be seen in cross-section, though the profiles are slightly different from those at the east end. This is probably because the hinges of the folds have slightly variable plunges, as can be demonstrated by plotting the orientations of bedding on sterographic projections (below). The two parasitic folds plunge slightly more steeply, and slightly counterclockwise of the main folds. This suggests that they may have originated slightly later than the main folds during dextral strike-slip deformation of the basin.



Poles to bedding (east face, all measurements). '1' marks orientation of best-fit fold axis.



Poles to bedding (large folds only). '1' marks orientation of best-fit fold axis.



Poles to bedding (parasitic folds only). '1' marks orientation of best-fit fold axis.