Kinematic analysis of Late Paleozoic deformation in the western Cumberland Basin

B.C. Reed
Department of Geological Sciences, Ohio University, Athens, Ohio 45701, U.S.A.
J.H. Calder
Nova Scotia Department of Natural Resources, P.O. Box 1087, Halifax, Nova Scotia B3J 2X1, Canada
J.B. Murphy
Department of Geology, St. Francis Xavier University, Antigonish, Nova Scotia B2G 1C0, Canada
and
R.D. Nance
Department of Geological Sciences, Ohio University, Athens, Ohio 45701, U.S.A.

The Cumberland Basin is a large (3600 km^2) east-west-trending synclinorium located in northwestern Nova Scotia. Sediments at the centre of the basin are at least 7 km thick, suggesting anomalously rapid deposition in comparison with other Devono-Carboniferous basins in the Canadian Appalachians. The basin is bounded to the south by the

Copyright © 2015 Atlantic Geology

Cobequid Highlands, to the northwest by the Caledonian Highlands of southern New Brunswick, and to the east by the Scotsburn Anticline.

Upper Devonian to Lower Permian sedimentary rocks of mostly continental origin fill the basin and consist of conglomerates, sandstones, shales, and local but important deposits of coal and evaporites. These sedimentary rocks were deformed by faults and folds prior to the deposition of the Late Westphalian to Stephanian Pictou Group that unconformably overlies the Late Carboniferous Cumberland, Mabou, and Windsor groups in the northern Cumberland Basin.

Major east-west-trending faults including the subparallel Athol, Sand Cove, and Sand River faults that can be traced across the Cumberland Basin from Springhill to Chignecto Bay. To the east, the faults become splayed and join smaller north-south faults or die out near Springfield. The westward trace of these fault zones beyond the shoreline of Chignecto Bay is uncertain. Northwest-trending fault splays are exposed along the shore, but these either die out or are truncated by the sinistral northeast-trending Harvey-Hopewell Fault in the Caledonian Highlands. Inland exposure of these faults is poor, but analysis of structures elsewhere within the basin, such as those displayed by the Springhill coal seams, can be used to provide a kinematic synthesis of the evolution of the Cumberland Basin.

The Athol, Sand Cove, and Sand River fault zones outcrop along a 5 km section of the coast of Chignecto Bay from Sand River to Clam Cove. These faults deform the Late Carboniferous Ragged Reef Formation of the Cumberland Group which comprises massive, coarse conglomerates interbedded with finer-grained lithic arenites and thin beds of siltstone and shale that locally contain coalified fossil tree remains. Overall displacement across the fault zone is uncertain. Offset along individual normal and reverse faults is usually a matter of only a few metres, although the combined offset across the fault zone may be substantial.