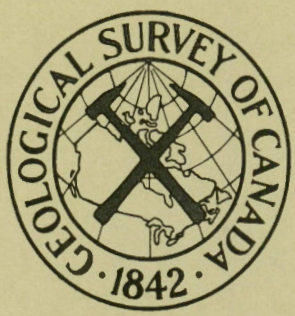

GEOLOGICAL
SURVEY
OF
CANADA

DEPARTMENT OF ENERGY,
MINES AND RESOURCES

PAPER 70-9

NOTES TO ACCOMPANY MAPS OF THE GEOLOGY OF MERIGOMISH AND MALIGNANT COVE MAP-AREAS, NOVA SCOTIA

(Report and Maps 4-1970 and 5-1970)

D. G. Benson

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(11E/16 E1/2, 11E/9)

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NOTES TO ACCOMPANY MAPS OF THE GEOLOGY OF MERIGOMISH AND MALIGNANT COVE MAP-AREAS, NOVA SCOTIA

The northeast-trending Antigonish Highlands, which have a maximum elevation of 1,000 feet, are the main topographic feature. A low rolling plain to the northwest, the Antigonish lowland to the east, and the Cape George lowland north of it are underlain by relatively undisturbed Carboniferous rocks. There are a few good outcrop sections along the coast, but inland exposures are discontinuous and found mainly in stream valleys.

Hugh Fletcher (1887) studied these areas as part of a series of 1 inch to 1 mile maps of northern Nova Scotia. The Arisaig region was investigated by M. Y. Williams (1914) and paleontology of the Silurian rocks examined by F. H. McLearn (1924). The detailed stratigraphy, paleontology and structure of the Arisaig area were examined and reported on by W. S. McKerrow, A. J. Boucot, W. K. Fyson and others (Boucot et al., 1965). The aeromagnetic map (Geol. Surv. Can. Map 1775G) at a scale of 1 inch to 1 mile does not cover the southwestern corner of the area.

The Browns Mountain Group (1-4), an unfossiliferous eugeosynclinal assemblage overlain by sediments, is probably of early Cambrian to late Ordovician age. The three rocks divisions are interbedded and minor amounts of each volcanic type appear in the other divisions. The rhyolitic division (1) may be the oldest, but no age relationships are indicated between the andesitic and laminated siltstone divisions. The rhyolitic volcanics (1) probably issued from vents in the Keppoch Brook area whereas the andesitic volcanics (3) issued from several vents, now the site of gabbro and diorite (6) plugs. Further study of the undivided Browns Mountain rocks (4), which belong mainly to the laminated siltstone division, should result in their subdivision. Poor outcrop distribution in the central part of the map-areas prevents a more detailed subdivision.

Ordovician siltstone and quartzite (5) which conformably overlie laminated siltstone (2) on Iron Brook, contain crinoid fragments but these are of no value in establishing the age of the strata.

Diorite and gabbro (6) plugs and stocks have intruded parts of the Browns Mountain Group (1-4) and are thought to be the same age as the andesitic volcanics (3), but in a few places the volcanics appear to overlie the gabbro. A minimum age of 411 $\pm$ 20 m.y. can be inferred from a K-Ar date obtained from the analysis of hornblende from a diorite dyke cut by an aplite dyke of possible Devonian age.

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The conglomerate of the Malignant Cove Formation (7) is composed almost entirely of clasts of Browns Mountain Group rocks and is slightly more indurated than similar Horton conglomerate (19b). It is intruded by diabase dykes (18) not found in the Horton Group.

Granite (8) on Beaver River is regarded as Ordovician; this is based on field relationships, cataclastic texture and one radiometric potassium-argon date on biotite of 432 $\pm$ 18 m.y.

The Dunn Point volcanics (9) have been dated as 430 $\pm$ 15 m.y. by whole rock rubidium-strontium analysis (Fullager and Bottino, 1968), a date generally accepted as the Ordovician-Silurian boundary. These volcanics are locally interbedded with the basal beds of the Beechhill Cove Formation (10) and tuff laminae are found in the lower beds of the Ross Brook (11), indicating that the volcanics are in part Silurian.

The type section of most of the Arisaig Group (10-15) is along the shore near Arisaig. The strata also represent a North American reference section of Silurian and Lower Devonian fauna of European aspect. The Beechhill Cove Formation (10) lies unconformably upon the Browns Mountain Group (1-4) and some of the Dunn Point volcanics (9), but south of Hollow Fault it probably conformably overlies siltstone and quartzite (5). On detailed examination, the Ross Brook Formation (11) can be subdivided into upper and lower units based on the relative amount of wacke and pelitic sediments. There are several tuff laminae in the lower part of the formation and about 15 feet of basal black shale are exposed east of Arisaig. The type section of the French River Formation (12) is a plunging syncline exposed on French River 1/2 mile south of Highway 4. As the upper contact was not observed a minimum thickness of about 160 feet is based on three main exposures of about 40 feet each. The McAdam Formation (13) outcrops along the shore in a series of fault slices that give an apparent thickness much greater than the approximately 600-foot true thickness. The Moydart Formation (14) is easily recognized along the shore by the greenish weathered surface but this colour is not so apparent at other exposures. The Stonehouse Formation (15) along the shore is entirely Silurian but inland Lower Devonian fauna are found.

The Knoydart Formation (16) contains ostracoderm and placoderm fish fossils. It is conformable with the underlying Stonehouse Formation (15) and is unconformably overlain by Carboniferous sediments.

The James River granite body (17) has an age of 370 m.y. based on rubidium-strontium analysis of feldspar (Fairbairn et al., 1960). Boulders of this granite are common in the Horton conglomerate (19b) to the east and south.

There may be more than one age of diabase dykes (18) but cross-cutting relationships were observed only on the coast where they cut Devonian granite (17) and older rocks. Dykes of similar lithology but of different age cut Carboniferous rocks in the Hopewell map-area (Benson, 1968).

The Horton Group (19) unconformably overlies the Devonian Knoydart on McArras Brook. No fossils or spores were obtained from these poorly sorted sediments and volcanics, but they are probably entirely lower Horton. The Horton rocks of the Antigonish and Cape George lowlands are predominately conglomerate and coarse-grained wacke. Spore analyses of samples from Rights River indicate the presence of upper Devonian pebble-conglomerate in association with minor argillaceous limestone, and of upper Lower Carboniferous (Viséan) medium-grained wacke. Thus, a more complete Horton section is present in these lowlands.

The transgressive marine Windsor Group (20) unconformably overlies most older rocks. Near McArras Brook, the lowest recognizable bed which is the "B" subzone is about 150 feet above theunconformable contact with the Horton Group (19). Windsor beds appear to directly overlie the Knoydart Formation (16) on Baillie Brook. Subzone "A" beds conformably overlie coaly Horton (19) beds near Big Marsh. The Windsor rocks of the Antigonish Basin, which unconformably overlie rocks of the Horton and Browns Mountain groups, contain evaporite sections.

The Canso Group (21) includes those rocks formerly mapped as Lismore Formation by Bell (1944). Belt (1965) who has suggested revision of the Upper Carboniferous of the Maritimes, has discarded the term Canso Group in favour of Mabou Group. This revision is based mainly on spore analysis. The Windsor-Canso contact is gradational and the contact is arbitrarily placed at the base of the first grey wacke bed above the limestone. The lowest spore samples above this contact correspond to microspore zone B of the Canso-Riversdale.

The New Glasgow Conglomerate (22) is an extension of thick deposits to the west in the New Glasgow map-area. It unconformably overlies the Canso Group (21) and has a thickness of about 400 feet. Spore samples from Sutherlands River, to the west of the map-area suggest that part of the formation may be correlated with microspore zone D of the Canso-Riversdale. At the mouth of French River and north of Egerton, single outcrops of probable New Glasgow Conglomerate unconformably overlie the Canso (21) rocks.

The Pictou Group (23) is a coarse fluvial facies that overlies the finer grained Canso Group (21) with apparent unconformity. It contains a 3-foot thick coal seam at Coal Point on Merigomish Island, and abundant plant fossils at Kings Head.

Recent sedimentation continues to fill in Merigomish Harbour and its present configuration differs greatly from that shown on old maps and hydrographic charts. Although the present coastline is submerging, there are several terraces near Lismore that are above the present sea level and valley floors. Most of the lowland area is covered by glacial deposits and the valleys in the Antigonish Highlands have been modified by glaciers. Kame terraces are common, and several good examples can be seen along Barneys River. Glacial gravels north of the Highlands contain mainly Browns Mountain Group boulders and cobbles, but a gravel deposit near Arisaig comprises about 60 per cent Carboniferous, 40 per cent Browns Mountain, and no Silurian clasts. Gravels in the Antigonish Lowland contain about the same ratio of clastic material.

The Antigonish Highlands have undergone at least three periods of deformation, two of which affected the Silurian rocks. The Taconic (Ordovician) and Acadian (Devonian) orogenies were accompanied by granitic intrusions whereas only minor folding and faulting occurred in the Carboniferous. The present topography is due mainly to horst and half-graben structures which developed from late Devonian to Lower Carboniferous. Periodic readjustment of the Browns Mountain horst during the Carboniferous contributed material to the sedimentary basins. The Browns Mountain and Hollow Faults are both unconformably overlain by middle Lower Carboniferous (Horton) to Upper Carboniferous sediments. A small slice of Windsor caught in the Hollow Fault, suggests intermittent local movement along the fault.

Early attempts were made to mine barite, chalcopyrite and bornite in Windsor (20) limestone near the contact on Brierly Brook, hematitic sandstone in the McAdam Formation (13) on Arisaig Brook, copper sulphides in felsite breccia near Pinkietown, and barite in limestone conglomerate near Big Marsh. Recent exploration work has been undertaken on base metal geochemical anomalies near Upper Barneys River and on pegmatite dykes that contain traces of uranium minerals and copper sulphides near Georgeville. Galena, sphalerite and minor chalcopyrite are found in carbonaceous remains in the Canso Group (21A) on Sutherlands Brook. Minor amounts of malachite are found in the Windsor Group (20) on the coast near Knoydart Brook. Traces of base metal minerals (chalcopyrite, galena) occur in many of the dioritic intrusives and adjacent volcanic and tuffaceous rocks. There are good gypsum exposures near St. Joseph and Brierly Brook. Phosphatic nodules and fossils are found in the middle and upper parts of the Arisaig Group. A rock quarry on the coast near Georgeville supplied crushed rock about ten years ago. Numerous gravel deposits are found throughout the area.

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