INTRODUCTION:

The New Glasgow - Toney River map area lies in central northern mainland Nova Scotia. It includes parts of two basement blocks, the Antigonish and Cobequid Highlands, separated by the Stellarton Gap, which links Cumberland Basin to the north with Minas Basin to the southwest. Other major features include the Cobequid and Hollow Faults, which respectively form the southern boundary of the Cobequid Highlands and the northwestern boundary of the Antigonish Highlands. Stellarton Graben, site of the Pictou Coalfield, is bounded by the subparallel, overlapping ends of these faults. Rocks in the area range in age from middle(?) Proterozoic to late Carboniferous.

This area was first mapped on a regional scale by Logan and others (1902) and Fletcher (1902). Subsequently parts of it have been remapped by various workers (Poole, 1904; Bell, 1940; Haites, 1956; Maehl, 1961; Gillis, 1964; Donohoe and Wallace, 1982; Giles, 1982; Murphy, 1986). This map is a compilation of previous mapping with additional observations. All of the area is till-covered. The best exposures are found along streams, shorelines, and roads.

ANTIGONISH HIGHLANDS:

The oldest rocks in the Antigonish Highlands are assigned to the Georgeville Group, a late Proterozoic assemblage of mafic to felsic volcanics, wackes, and mudstones. In the northwestern Antigonish Highlands, greenish grey, turbiditic, feldspathic wackes and slates of the James River Formation predominate (Murphy, 1986). East of the map area these overlie volcanics. In the northern Antigonish Highlands the Georgeville Group is overlain by Cambro-Ordovician strata. An appinite pluton intruding the lower Georgeville Group has yielded a K-Ar hornblende age of 591 +/- 33 Ma (Wanless et al, 1967, corrected to 1976 IUGS standard).

The upper Ordovician to lower Devonian Arisaig Group (Boucot et al, 1974; Maehl, 1961; Murphy, 1986) unconformably overlies the Georgeville Group. The basal unit is the Bears Brook Formation: predominantly subaerial, green, mafic flows, reddish, felsic volcaniclastics, and arkose. A whole rock Rb/Sr isochron of 430 +/- 12 Ma has been obtained from Bears Brook rhyolites (Cormier and Murphy, personal communication, 1985, In: Chandler et al, 1987). The Beechhill Cove Formation, comprising reddish arkose and greenish, fossiliferous shale and sandstone, overlies the Bears Brook volcanics disconformably, and is overlain conformably by dark grey to black fossiliferous shales and siltstones of the Ross Brook Formation. These shallow marine strata were deposited during Llandoverian time. Greenish grey and dark grey, micaceous, shallow marine siltstone and sandstone of the lower Ludlovian McAdam Formation overlie the Ross Brook Formation disconformably. Wenlockian strata are missing from the western Antigonish Highlands. Greenish, shallow marine sandstones and siltstones, interbedded red and green siltstones and fluviatile, red, calcareous siltstone and marl of the Ludlovian Moydart Formation, are overlain conformably by blue-grey to green-grey, micaceous, cross-laminated, shallow marine siltstone and massive sandstone of the Pridolian-Gedinnian Stonehouse Formation and overlie McAdam and Ross Brook strata.

The Arisaig Group is conformably overlain by red, fluviatile siltstones, sandstones, and minor conglomerate of the Gedinnian to lower Siegenian Knoydart Formation. The Knoydart may be correlated with the Old Red Sandstone of western Europe (Boucot et al, 1974).

Green, subaerial basalts, reddish felsic tuffs, and oligomictic, alluvial fan conglomerates of the Devono-Carboniferous McAras Brook Formation (Fralick and Schenk, 1981; Dostal et al, 1983) overlie pre-Devonian strata in the McGregor Mountain - McLellan Brook area. These rocks are correlative with the Fountain Lake Group in the Cobequid Highlands. Red Knoydart clasts predominate in the conglomerates.

COBEQUID HIGHLANDS:

The oldest rocks in the Cobequid Highlands are 934 +/- 82 Ma (whole rock Rb/Sr) granitic orthogneisses of the Mt. Thom Complex (Donohoe, 1976; Wallace and Donohoe, 1977; Gaudette et al, 1984). Relationships between the Mt. Thom Complex and younger rocks are obscured by several generations of felsic plutons described below.

Rhyolites, dacites, and minor andesites, intruded by late Paleozoic plutons, are believed to pass westward into shallow marine strata of the Llandoverian-Pridolian Earltown Formation (Wallace and Donohoe, 1977), and are thus correlative with the Arisaig Group. Recent investigations, however, suggest that these volcanics are Precambrian (B. Murphy, personal communication, 1987).

Felsic and mafic terrestrial volcanics, and polymictic orthoconglomerates, wackes, and siltstones of the Diamond Brook Formation, the upper part of the Fountain Lake Group, rest unconformably on Earltown strata west of the map area. The conglomerates may be distinguished from the overlying Falls and Millsville conglomerates by the scarcity of igneous clasts (Fralick, 1980). Spore assemblages (Donohoe and Wallace, 1982), and a Rb/Sr whole rock isochron of 387 +/- 2 Ma from volcanics lower in the Fountain Lake Group (Cormier, 1982), indicate deposition in Emsian-Tournaisian time.

The late Devonian(?) to early Carboniferous Falls Formation, a thick wedge of polymictic orthoconglomerate with minor sandstone and paraconglomerate, overlies the Fountain Lake Group with angular unconformity (Wallace and Donohoe, 1977). The Falls Formation is probably correlative with generally fine-grained fluvial deposits of the Tournaisian Nuttby Formation. Both formations can be assigned to the Horton Group.

A plutonic complex forms the core of the eastern Cobequid Highlands. The largest intrusion is the Salmon River biotite-hornblende granite. A Visean age is probable since it is nonconformably overlain by Riversdale strata and in intrusive contact with the Diamond Brook and Nuttby Formations as well as other plutons. Age relationships of the latter, which include the Glen Road granite, the Eight Mile Brook syenite, and the Brookland and Mount Thom diorites, are uncertain.

STELLARTON GAP:

The Windsor Group is exposed at the eastern end of the Antigonish Highlands, where it lies unconformably on older strata (Giles, 1982), and in fault blocks along the eastern part of the Cobequid Fault system (Bell, 1940; Giles, 1979). Gypsum, anhydrite, and carbonates of the early middle Visean Bridgeville Formation are unconformably overlain by sandstones, siltstones, evaporites and local conglomerates of the Forbes Lake Formation, and sandstone, siltstone, and carbonates of the mid-Visean to earliest Namurian Churchville Formation. Volcanic clasts predominate in the Forbes Lake conglomerate.

Lower Carboniferous strata are overlain by four diachronous cycles of middle to late Carboniferous alluvial fan and fluvial sediments: the Canso, Riversdale, Cumberland, and Pictou Groups.

The late Visean to early Namurian Canso Group rests conformably on the upper Windsor Group in the southern part of the map area. It comprises red and grey fluvial sandstones and siltstones and grey lacustrine strata. In the southwestern part of the map-area, and along fault zones, Canso mudstones are phyllitic. The Canso Group also includes sandstones of the Lismore Formation and polymictic orthoconglomerates of the Hollow Formation deposited north of the Hollow Fault (Fralick and Schenk, 1981). Hollow and McAras Brook conglomerates can be distinguished by the abundance of greenish quartzite clasts in the former (Fralick and Schenk, 1981). Late Visean foraminifera from a limestone bed in the Lismore Formation (Mamet, 1970) suggest a transitional relationship between the Windsor and Canso Groups (Fralick and Schenk, 1981).

The early middle Carboniferous Riversdale Group is in fault contact with or unconformably overlies older strata at the eastern end of the Cobequid Highlands. A lower unit, the Millsville Conglomerate, contains predominantly reddish-brown, polymictic orthoconglomerate with minor sandstone and siltstone. The presence of white quartzite and felsic plutonic clasts distinguish it from the underlying Falls Formation (Fralick, 1980). This unit is transitional to the overlying Boss Point Formation, a sequence of grey and reddish-brown lithic sandstone and conglomerate with minor mudstone and coal (Gillis, 1964). Spore assemblages indicate a Namurian C to Westphalian A age for the Boss Point Formation in the eastern Cobequids (Wallace and Donohoe, 1982). The Riversdale Group was shed easterly into Stellarton Gap from the Cobequid Highlands.

The early Upper Carboniferous Cumberland Group includes two formations in Stellarton Gap. Predominantly red, fluvial sandstone, mudstone, and minor conglomerate of the middle Westphalian B Middle River Formation rests disconformably on Canso strata south of the Cobequid Fault (Bell, 1940) and lie conformably or disconformably on Boss Point strata to the north. The Westphalian B to early Westphalian C New Glasgow Conglomerate, a thick sequence of reddish-brown, polymictic conglomerate with minor sandstone and siltstone, interfingers downwards with the Middle River Formation. Contacts with older strata (e.g.: south of Fraser's Mountain) are not exposed. The New Glasgow Conglomerate can be distinguished from older conglomerates by the presence of Canso and Windsor clasts, especially carbonates.

The upper Carboniferous Pictou Group overlies the New Glasgow Conglomerate disconformably or conformably. Fluviatile redbeds are typical of the Pictou Group throughout the Maritimes, but in Stellarton Gap greybeds predominate. These strata, informally named the Merigomish Formation, comprise thick sets of nested channel sandstone beds alternating with thick grey or red mudstones, and minor thin coals and oil shales. A thin stromatolitic limestone lies at the base of the formation. To the west, the Merigomish Formation is overlain by predominantly red Pictou strata. Spore assemblages indicate that the Merigomish Formation was deposited in late Westphalian C to Westphalian D time.

Partly coeval with the Merigomish Formation, but separated from it by an easterly-trending ridge of Cumberland and Canso Group rocks, is the Stellarton Formation. This comprises oil shale- and coal-bearing, grey and red, lacustrine, and alluvial shales, sandstones, and minor conglomerates. Spore assemblages indicate an early Westphalian C to early Westphalian D age. The Stellarton Formation is entirely restricted to the Stellarton Graben.

SURFICIAL GEOLOGY

Till blankets most of the map area. Till thickness is variable, up to 25 m or more locally. Three tills have been recognized: a red clay till derived from the north, a hybrid till produced by reworking and mixing of the lower till with material from the south, and a local stoney till produced by limited ice advance from the Antigonish Highlands during the final phase of glaciation (R. Stea, personal communication, 1987). Most of the ice contact features such as kames and eskers are restricted to the Cobequid and Antigonish Highlands.

STRUCTURAL GEOLOGY

The Mt. Thom Complex has undergone at least three major deformations, thought to be early Hadrynian or older (Donohoe and Wallace, 1985). Early isoclinal folds with axial plane foliation are refolded by open, upright folds. Locally these display incipient, axial planar, crenulation cleavage.

Georgeville Group strata in the western Cobequid Highlands have undergone folding about variable axes. Steep dips are due to tilting of fault blocks. Folding predates cleavage development (Murphy, 1986).

Major regional deformation took place during the middle Devonian. Arisaig Group and Earltown Formation strata show gentle open folding about variable axes (Wallace and Donohoe, 1977; Murphy, 1986). A regional cleavage, best developed in fine-grained strata, was imposed on early Devonian and older rocks at this time. In the Cobequid Highlands slatey cleavage is only developed locally. In the western Antigonish Highlands cleavage is subhorizontal in Georgeville strata east of the Coromonie Fault, but dips westerly, to the west of it (Murphy, 1986). Reverse movement on the Hollow Fault (Boucot et al, 1974), and transcurrent, followed by thrust faulting in the western Antigonish Highlands (Murphy, 1986), indicate regional SE-NW compression. The end of this deformation event was marked by normal movement on the Hollow Fault (Boucot et al, 1974).

Renewed SE-NW compression in the late Carboniferous resulted in gentle to open folding of older Carboniferous strata about NE axes, and dextral movement on the Hollow and Cobequid Faults, which led to formation of the Stellarton Graben (Yeo and Gao, 1986; Gao, 1987). The length of the graben suggests that late Westphalian dextral displacement was about 10 km. Within the graben, minor open folding about NE axes and second-order faulting developed. Near the major faults penetrative fabrics are developed in middle Carboniferous strata.

Northerly-trending Mesozoic normal faults cross-cut all earlier structures.

GEOLOGICAL HISTORY

The Mt. Thom Complex records a middle Proterozoic intrusive event, as well as the Grenville Orogeny, during which the rocks were metamorphosed to upper greenschist or almandine amphibolite grade. Late Proterozoic, cratonic rifting is recorded by the volcanics and marine sediments of the Georgeville Group (Murphy, 1985).

The absence of lower Paleozoic strata in the map area suggests that this was an area of emergence at that time. Middle Paleozoic strata of the Arisaig Group lap onto the Antigonish Highlands. Volcanics and redbeds at the base of the Arisaig Group were deposited under terrestrial conditions. Volcanism was followed by lower Llandoverian marine transgression (Boucot et al, 1974). Lower and middle Arisaig shallow marine clastics were derived from a source that lay to the northeast. The absence of Wenlockian strata within the map area, in spite of its presence just to the east, suggests local uplift. Shallow marine conditions returned again until late Ludlovian time, when fluvial redbeds were deposited. A third transgression took place in the Pridolian. Deposition of shallow marine clastics in the Gedinnian, derived from a new source to the southeast, possibly the Meguma Terrane, was followed by regression and deposition of coastal floodplain redbeds in the Siegennian (Boucot et al, 1974). The stratigraphic hiatus which followed probably records the collision of the Meguma Terrane with eastern North America and the final closure of the Iapetus Ocean.

Major regional deformation took place in the middle Devonian, as noted above. Terrestrial volcanism, accompanied by shedding of coarse-grained molasse from the Cobequid and Antigonish Highlands is recorded in the Fountain Lake Group and McAras Brook Formation. This began by the middle Devonian and continued intermittently at least into the late Devonian. The Cobequid and Hollow Faults were active by this time. Alluvial fan sedimentation persisted into the early Carboniferous.

A series of extensive, marine transgression-regression cycles are recorded by deposition of carbonates, evaporites, and clastics of the Windsor Group in Visean to early Namurian time. The final regression is represented by fine-grained terrestrial clastics of the Canso Group. Renewed uplift of the Cobequid Highlands is signalled by development of alluvial fans and fluvial plains of the Riversdale Group, shed eastward into Stellarton Gap during late Namurian - early Westphalian time.

Renewed activity on the Cobequid-Hollow Fault system in the middle Westphalian is indicated by alluvial fan deposits of the Cumberland Group, which prograded northerly into Stellarton Gap over fine-grained fluvial deposits shed from the highlands. Dextral movement on the faults in late Westphalian time led to formation of the Stellarton Graben, in which lacustrine and fluvio-deltaic deposits of the Stellarton Formation, including coals and oil shales, accumulated. Deposition of the Pictou Group began at about the same time from northerly flowing anastomosing rivers, interspersed with small lakes. Pictou sedimentation persisted regionally until the Permian, long after subsidence and deposition within Stellarton Graben had ceased.

At least four phases of Wisconsinan glaciation may be recognized from glacial striae in the map area (Stea, 1984; Stea and Finck, 1984; Myers and Stea, 1986). About 38,000 years ago (Grant, 1977), following the Sangamonian interglacial stage, a major ice lobe spread over the area, moving towards the east and southeast. Following a period of retreat, the ice advanced again, this time moving toward the south and southeast. After another interstadial period, ice again spread into the area, but this time from the south. In the final phase, ice flowed southwesterly away from a local centre in the Antigonish Highlands, accross Stellarton Gap and around the Cobequid Highlands. Glaciation ended about 14,000 years ago (Grant, 1977).

ECONOMIC GEOLOGY

The Pictou Coalfield in Stellarton Graben is one of the major coalfields of eastern Canada (Bell, 1940; Hacquebard and Donaldson, 1969). Production from 1818 to 1984 was 60.7 million tonnes. Small-scale production still continues near Westville. Estimates of reserves remaining in the Stellarton Formation range from 64 (Chesal, 1982) to 69 million tonnes (Hacquebard, 1979) of high volatile A bituminous and medium volatile bituminous coal. Preliminary mining feasibility studies by Suncor Inc. indicate that about 22 million tonnes could be recovered from the Foord seam east of the old workings, with further potential. Ash content is relatively high, but sulphur is low, making these coals attractive for thermoelectric generating purposes. Extensive oil shales are also found in the Stellarton Formation (Macauley and Ball, 1984; Naylor and Smith, 1986; Kalkreuth and Macauley, in press). Hydrocarbon yields are generally too low for them to be of economic interest, however (Naylor and Smith, 1986).

A number of small copper occurences and one zinc showing are found in the Merigomish Formation. Chalcocite and malachite are locally associated with coaly lenses, presumably redox traps (Dunsmore, 1977), possibly localized above faults, while sphalerite is found in a small pyritic coal seam on the Toney River. Galena is found locally on fracture surfaces in the Stellarton Formation. None of the occurrences have known economic potential.

The Windsor Group appears to have the most potential of Carboniferous strata to host massive sulphides (Kirkham, 1985). Disseminated chalcopyrite is found in Windsor Group limestone near Limerock (Giles, 1979; Kirkham, 1985). Chalcopyrite and sphalerite also occur in Windsor limestone near Churchville (Kirkham, 1985).

Several small iron deposits are found in the northwestern Cobequid Highlands. The only one of note within the map area is an oolitic hematite bed in Beechhill Cove sandstones near Falls Brook (Wright, 1975).

Willemite and native silver are found in calcite veins in Georgeville Group metasediments near Kirkmount. These veins are thought to be related to faults (Sangster, 1986).

Crushed and dimension stone has been taken from several quarries in the Merigomish and Boss Point formations and from pre-Carboniferous strata. Quarries at Hardwood Hill and McLellans Mountain are currently operating. Attractive building stone can be found at Eight Mile Brook and at Sawmill Brook (Dickie, 1986; in preparation). Occurrences of fine-grained Windsor Group limestone, potentially suitable for quarrying, have been described by Murray (1975) near Churchville, McLellans Brook, and Limerock. Shale from the Stellarton Formation is quarried south of New Glasgow for tile and brick-making.

Gravel for road construction is extracted from several deposits in the western Cobequid Highlands (Fowler and Dickie, 1977).

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Nova Scotia Department of Mines and Energy

Energy, Mines and Resources Canada / Énergie, Mines et Ressources Canada

Canada

NEW GLASGOW - TONEY RIVER

Scale 1:50 000 - Échelle 1/50 000

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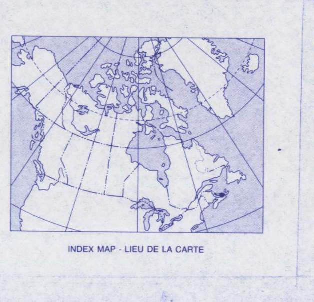

INDEX MAP - LIEU DE LA CARTE

Geology compiled by G.M. Yeo from mapping by: J.W. Gillis (1958, 1959, 1960, 1962), P. Giles (1982), G.M. Yeo (1985, 1986), and J.B. Murphy (1986).

Citation: Yeo, G.M., 1987. Geological map of the New Glasgow-Toney River area (NTS 11E/10 and 11E/15s), 1:50,000 scale, Geological Survey of Canada Open File Map No. 1656.

11E/14	11E/15 O.F. 1656	11E/16
11E/11	11E/10	11E/9
11E/6	11E/7	11E/8

NATIONAL TOPOGRAPHIC SYSTEM REFERENCE
SYSTÈME NATIONAL DE RÉFÉRENCE CARTOGRAPHIQUE

LEGEND

STRATIFIED ROCKS

CARBONIFEROUS

PICTOU GROUP
- Cp — Undivided PICTOU GROUP: mudstone and sandstone.
- CM — MERIGOMISH FORMATION: mudstone, sandstone, conglomerate, minor limestone, coal, and oil shale.
- Cs — STELLARTON FORMATION: shale, sandstone, coal, and oil shale.

CUMBERLAND GROUP
- CNG — NEW GLASGOW CONGLOMERATE
- CMR — MIDDLE RIVER FORMATION: mudstone, sandstone, and minor conglomerate.

RIVERSDALE GROUP
- CBP — BOSS POINT FORMATION: sandstone and conglomerate.
- CMV — MILLSVILLE CONGLOMERATE (may include Falls Formation)

CANSO GROUP
- Cc — Undivided CANSO GROUP: sandstone and mudstone.
- CL — LISMORE FORMATION: sandstone and mudstone.
- CH — HOLLOW CONGLOMERATE

WINDSOR GROUP
- Ccv — CHURCHVILLE FORMATION: sandstone, shale, and limestone.
- CFL — FORBES LAKE FORMATION: shale, conglomerate, and limestone.
- CBV — BRIDGEVILLE FORMATION: gypsum, anhydrite, and carbonates.

CARBONIFEROUS - DEVONIAN

HORTON GROUP
- DCF — FALLS FORMATION: conglomerate, sandstone, and siltstone (may be equivalent to Millsville Conglomerate)
- DCN — NUTTBY FORMATION: siltstone, sandstone, and conglomerate.

DEVONIAN

FOUNTAIN LAKE GROUP
- DCDB — DIAMOND BROOK FORMATION: basalt, siltstone, and wacke.
- DMB — McARAS BROOK FORMATION: conglomerate and volcanics.
- DK — KNOYDART FORMATION: sandstone, mudstone, and limestone.

SILURIAN

- SE — EARLTOWN FORMATION: rhyolite, dacite, and minor clastics.

ARISAIG GROUP
- SA — Undivided ARISAIG GROUP: siltstone.
- Ss — STONEHOUSE FORMATION: mudstone and limestone.
- SM — MOYDART FORMATION: sandstone and mudstone.
- SMcA — McADAM FORMATION: siltstone and sandstone.
- SRB — ROSS BROOK FORMATION: mudstone and sandstone.
- SBC — BEECHHILL COVE FORMATION: sandstone and mudstone.

ORDOVICIAN

- OBB — BEARS BROOK FORMATION: andesite, rhyolite, and volcaniclastics.

PROTEROZOIC

GEORGEVILLE GROUP
- PG — Undifferentiated GEORGEVILLE GROUP: mafic and felsic volcanics, slate, and wacke.
- PJR — JAMES RIVER FORMATION: feldspathic wacke, slate, and minor volcanics.
- PMT — MOUNT THOM COMPLEX: gneiss.

PLUTONIC ROCKS

CARBONIFEROUS
- Cg — SALMON RIVER PLUTON: granite.

DEVONIAN - PROTEROZOIC
- PDd — MOUNT THOM and BROOKLAND PLUTONS: diorite.
- PDg — GLEN ROAD PLUTON: granite.
- PDs — EIGHT MILE BROOK PLUTON: syenite.

SYMBOLS

- Outcrop: undifferentiated, carbonates, volcanics
- Geological boundary: defined, approximate, assumed
- Bedding (tops known): horizontal, inclined, vertical, overturned
- Bedding (tops unknown): inclined, vertical
- Foliation: inclined, vertical, dip unknown
- Fault: defined, approximate, assumed (solid circle on downthrown side; arrows indicate relative movement)
- Fault/shear zone:
- Anticline (plunge indicated):
- Syncline (plunge indicated):
- Trace of coal seam: approximate, assumed
- Fossil locality:
- Spore locality:
- Shaft or pit:
- Slope entrance:
- Quarry:
- Gravel pit:
- Prospect: Cu = copper, Pb = lead, Zn = zinc, Fe = iron, Mn = manganese, Ba = barite
- Diamond drill hole:

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OTTAWA

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