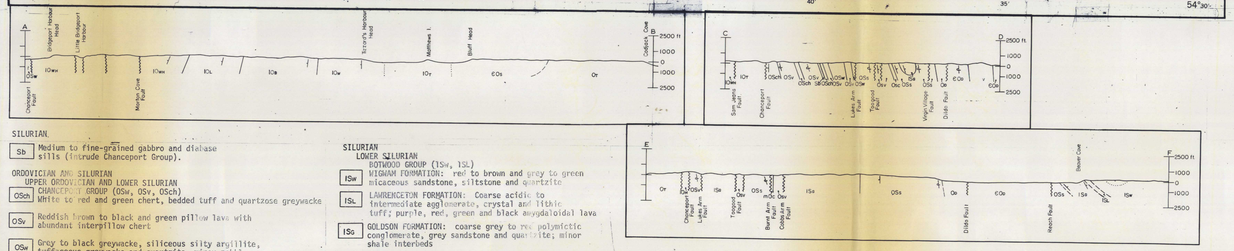
GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES

SHEET 2 E/10



Geological boundary (defined, approximate and assumed)

Bedding, tops known (horizontal, inclined, vertical, overturned)

Bedding, tops unknown (inclined, vertical)

Dyke trend (inclined, vertical)

Schistosity, gneissosity, cleavage, foliation (horizontal, inclined, vertical)

Fault (defined, approximate, assumed)

Anticline (upright, overturned)

Syncline (upright, overturned)

Fossil locality

Mineral occurrence

Mineral prospect, test pit or trench

Shaft or quarry (exploration, abandoned production, producing)

Adit or tunnel

Mineral Occurrences, Prospects and Mines

1. Sleepy Cove. Massive and disseminated pyrite and chalcopyrite in chloritic flattened pillow lavas of the Sleepy Cove formation.
2. Long Point. Chalcopyrite and pyrite filling fractures, vesicles and pillow interstices. Same setting as 1.
3. Wild Cove. Sphalerite, pyrite and chalcopyrite in elm zone in sheared pyritized pillow lavas with felsic dykes.
4. Robins Cove. Pyrite with malachite staining in sheared basalt.
5. Rodney Cove. Pyrite in sheared basalt.
6. Bluff Head. Pyrite in sheared basalt.
7. Trump Island North. Disseminated chalcopyrite and pyrite in quartz veins cutting felsite dykes which cut metamorphosed pillow lava.
8. Trump Island East. Pyrite in a 30 to 45 m. gossan zone developed on amphibolitized pillow lavas.
9. Bridgeport Harbour. Veinlets and disseminated chalcopyrite and pyrite in quartz veins in amphibolite of the Trump Island Formation.
10. Moretons Harbour Head. Veinlets and stringers of pyrite, chalcopyrite and stibnite in pyritized pillow breccia and pillow lavas intruded by felsic dykes.
11. Taylors Room. Veinlets and stringers of chalcopyrite, arsenopyrite, pyrite, sphalerite and gold in pyritized agglomerate and tuff of the Little Harbour Formation.
12. Stewarts Mine. Veins and stringers of arsenopyrite, pyrite, chalcopyrite, gold and stibnite in agglomerate and tuff.
13. Little Harbour. Arsenopyrite veinlets. Same setting as 12.
14. Frost Cove Mine. Veins and veinlets of stibnite, arsenopyrite and pyrite in agglomerate and tuff intruded by felsic dyke.
15. Moretons Harbour. Stibnite veinlets in [illegible] agglomerate.
16. Western Head. Disseminated chalcopyrite, pyrite and arsenopyrite in quartz veinlets on joint and fracture surfaces [illegible] agglomerate.
17. Cobbs Arm Pyrite. Pyrite in bands up to 3 m. thick in volcanics of the Summerford Group.
18. Cobbs Arm Limestone Quarries. Crystalline limestone unit 30 to 40 m. thick.
19. Tinker Island. Ferruginous chert bed in pillow lavas of the Chanceport Group.

SILURIAN

Sb — Medium to fine-grained gabbro and diabase sills (intrude Chanceport Group).

ORDOVICIAN AND SILURIAN
UPPER ORDOVICIAN AND LOWER SILURIAN

OSch — CHANCEPORT GROUP (OSw, OSv, OSch): White to red and green chert, bedded tuff and quartzose greywacke

OSv — Reddish brown to black and green pillow lava with abundant interpillow chert

OSw — Grey to black greywacke, siliceous silty argillite, tuffaceous greywacke and quartzite, minor pebbly conglomerate and chert

LOWER ORDOVICIAN AND(?) MIDDLE ORDOVICIAN

Ob — Medium-grained gabbro plugs and sills (intrude Moretons Harbour Group)

Ot — TWILLINGATE GRANODIORITE: pink to grey, medium- to coarse-grained, massive to strongly foliated tronDjemitic granodiorite (intrude Sleepy Cove and Trump Island formations)

MORETONS HARBOUR GROUP (COs to IOwh)

IOwh — WESTERN HEAD FORMATION: pale green to dark green pillow lava with minor layers of pillow breccia, acidic tuff and chert.

IOL — LITTLE HARBOUR FORMATION: coarse aquagene tuff, pillow breccia and pillow lava; minor finer grained tuff and thinly laminated siliceous tuff

IOch / IOch — BEACHY COVE AND HERRING NECK TERRANE: Coarse- to fine-grained diabase dykes with minor screens of pillow lava and plagioclase-clinopyroxene porphyritic lava

IOW — WEBBER BIGHT FORMATION: dark green to black, plagioclase-clinopyroxene porphyritic, highly amygdular pillow lavas with thin interbeds of cherty argillite; cut by abundant diabase dykes

IOT — TRUMP ISLAND FORMATION: dark green to black pillow lava, pillow breccia and tuff; variably metamorphosed from greenschist to amphibolite and variably deformed to strongly flattened schists and strongly lineated relict pillow lavas

CAMBRIAN AND/OR LOWER ORDOVICIAN

COs — SLEEPY COVE FORMATION: pale to dark green closely packed pillow lava and diabase dykes; minor green to pink agglomerate and tuff

SILURIAN
LOWER SILURIAN

ISw — BOTWOOD GROUP (ISw, ISL)
WIGWAM FORMATION: red to brown and grey to green micaceous sandstone, siltstone and quartzite

ISL — LAWRENCETON FORMATION: Coarse acidic to intermediate agglomerate, crystal and lithic tuff; purple, red, green and black amygdaloidal lava

ISg — GOLDSON FORMATION: coarse grey to red polymictic conglomerate, grey sandstone and quartzite; minor shale interbeds

ORDOVICIAN AND SILURIAN
UPPER ORDOVICIAN AND LOWER SILURIAN

OSg — SANSOM FORMATION: Medium grey, graded greywacke and siltstone, commonly chaotically slumped, grades upwards into well bedded quartzose greywacke and pebbly conglomerate

LOWER TO UPPER ORDOVICIAN
SUMMERFORD GROUP (Osv, mOs, Osc)
Same as Dark Hole Formation (OD)

Osc — Limy tuff and shale, feldspathic greywacke, tuffaceous siltstone and argillite.

mOg — Dark green to pale green pillow lava, massive basalt, plagioclase porphyritic lava, pillow breccia and agglomerate, minor interstitial limestone pods and tuffaceous siltstone

Osv — Dark green to pale green pillow lava, massive basalt, plagioclase porphyritic lava, pillow breccia and agglomerate, minor interstitial limestone pods and tuffaceous siltstone

MIDDLE AND UPPER ORDOVICIAN
HILLGRADE GROUP (mOC, OR)

Or — Rodgers Cove Shale, same as Dark Hole Formation (OD)

mOc — Cobbs Arm Limestone. White crystalline limestone, dark grey silty limestone, limy tuff and shale.

MIDDLE AND UPPER ORDOVICIAN (Caradocian)

OD — DARK HOLE FORMATION: black carbonaceous, siliceous argillite and argillaceous siltstone; locally chert and tuff at base

CAMBRIAN AND/OR LOWER ORDOVICIAN

EOc — CONCER DACITE PORPHYRY: Dacite, granodiorite and other stocks (intrude Dunnage Melange)

EOd — DUNNAGE MELANGE: Black to green and black chaotic argillite and pebbly to cobbly mudstone with exotic blocks and boulders of pillow lava, greywacke, bedded clastic rocks, agglomerate, gabbro, limestone and granite; v. large volcanic masses in shaly melange

TWILLINGATE

NEWFOUNDLAND

Scale: One Inch to One Mile = 1/63,360

1/2 MILE 0 1 2 3 MILES

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EXPLANATORY NOTES - Twillingate Map-Area

The oldest known rocks in the map-area are within the Dunnage Mélange (EOD). Kay and Eldridge (1968) collected the Mid-Cambrian trilobite Kootenia from a limestone lens within the mélange on Dunnage Island. This indicates only that some of the material within the mélange is as old as Mid-Cambrian but it does not give the time of formation of the mélange. Horne (1969) interpreted the Dunnage Mélange to be overlain conformably by the Caradocian Dark Hole Formation (OD) but this contact has since been interpreted as a strike-slip fault on the north side of Dildo Run (the Dildo Fault of Bergström et al., 1974). This fault may not be a significant feature and from relationships on Farmers Island to the south (2E/7) it appears that Horne's (1968) interpretation is correct and that the Dunnage Mélange is dominantly a mid-Ordovician feature.

Perhaps the oldest sequence of rocks in the map-area is the Moretons Harbour Group (redefined after Strong and Payne, 1973) which occurs north of the Chanceport Fault. This sequence is composed almost entirely of volcanic rocks and is at least 9 km thick. The top of the sequence is not exposed. The lowermost unit, the Sleepy Cove Formation (EOg), is composed dominantly of pillow lavas and is correlated with the Lushs Bight Group pillow lavas of western Notre Dame Bay (2E/12, 12 H/9) on lithologic and chemical similarities. The chemistry of these rocks indicates that they are oceanic tholeiites.

The Sleepy Cove Formation and the Lushs Bight Group are considered to be dominantly Cambrian in age since the Brighton Gabbro Complex, which intrudes the Lushs Bight Group in the Pilleys Island Area (2E/12) gives an $^{40}Ar/^{39}Ar$ age of 495±5 m.y. Stukas and Reynolds (1974).

The remaining formations of the Moretons Harbour Group are believed to represent an island arc assemblage overlying the ancient oceanic crust. The great abundance of dykes in the Webber Bight Formation and the Beachy Cove and Herring Neck Terranes indicate proximity to a volcanic centre. These formations are believed to be dominantly Lower Ordovician since they correlate with the fossiliferous Western Arm and Snooks Arm Groups (2E/12).

The lower formations of the Moretons Harbour Group are intruded by the Twillingate Granodiorite and are considerably metamorphosed, especially along the southern contact of the intrusion where the granodiorite itself is also considerably metamorphosed. The age of the Twillingate granodiorite is unknown but it is certainly pre-Acadian and is probably as old as Early Ordovician.

Volcanic rocks south of the Chanceport and Lukes Arm Faults which are probable time-equivalents of the Moretons Harbour Group, are represented by the volcanic rocks of the Summerford Group (Osv). These rocks are similar lithologically to the Moretons Harbour Group but units are considerably thinner and the whole volcanic sequence is approximately 1 km thick although a definite base to the succession has not been established. Fossils ranging in age from Tremadocian to Llandeilian have been collected from these volcanic rocks (Horne, 1970; Bergström et al., 1974). These volcanic rocks are conformably overlain by the Llandeilian Cobbs Arm Limestone (m0c) and by a limy tuff-shale unit (m0a).

Cessation of Lower to Middle Ordovician volcanism and mélange development is marked by an extensive Caradocian black shale (Osc, OR, OD) which is equally extensive throughout the central volcanic belt of Newfoundland. This shale unit, although very persistent laterally, is a very condensed sequence and may contain graptolites representative of three complete zones in less than 30 m of sediment.

The Caradocian black shale units (Osc, OR, OD) are everywhere overlain conformably by the upper Ordovician to Silurian Sansom Greywacke (OSs). The thickness of this formation varies from 115 m to 1500 m. Sedimentary structures within the formation suggests that these sedimentary deposits may be classified as proximal turbidites with a source-area to the northwest (Horne, 1970). Rock fragments within the coarser beds are composed dominantly of volcanic rocks and cherts, and fresh plagioclase crystal fragments are common. The obvious source-area for the Sansom greywackes is the thick Lower to Middle Ordovician island arc volcanic sequences (Moretons Harbour Group) and associated intrusions (Twillingate Granodiorite) which were probably farther northwest prior to movement along the Chanceport Fault.

The Sansom Formation contains lentils of coarse polymictic conglomerate throughout and eventually grades upwards into similar coarse conglomerates of the Goldson Formation (ISG). Subordinate amounts of greywacke and quartzite locally also comprise part of the Goldson Formation. The formation has a maximum thickness of at least 1500 m and a definite top is exposed only on the Port Albert Peninsula east of the Reach Fault. Sedimentary structures suggest a fluxoturbidite origin for the Goldson Formation (Horne 1970). Grey fossiliferous argillite and silty conglomerate at Pikes Arm and Tooggood Arm (Williams 1963) are included in the Goldson Formation on this map. Williams (1963) included the Goldson Formation in the Botwood Group but it is here removed from the Botwood Group because of its intertonguing and gradational contact with the Sansom Formation and similar turbidity origin and because other formations of the Botwood Group occur only east of the Reach Fault, a major tectonic feature in central Newfoundland.

Rocks which are definitely younger than the Goldson Formation occur only east of the Reach Fault and are included in the Botwood Group. The lowest formation of the Botwood Group is a subaerial volcanic unit known as the Lawrenceton Formation (Williams 1972). It has a maximum thickness of 200 m in the map-area but is as thick as 1500 m in the type-area to the south. It conformably overlies the Goldson Formation at Port Albert (McCann, 1973) and is conformably overlain by micaceous sandstones of the Wigwam Formation (ISW) (Williams, 1972). The top of the Wigwam Formation is unknown; however, volcanic members are known to occur higher in the stratigraphy of the formation in the Fogo Map-area (2E/9) to the east (Eastler, 1969). Fossils from the Wigwam Formation are dominantly Lower to Middle Silurian although Early Ludlowian graptolites have been reported by Berry and Boucot (1970) from south of the map-area. Between the Lukes Arm and Chanceport Faults lies a north-facing, steeply dipping sequence of rocks of questionable age which are included in the Chanceport Group (OSw, OSv, OSh). These rocks are correlated with the Cottrells Cove and Roberts Arm Groups to the west (2E/11, EE/16, 2E/12, 2E/5). These correlatives are definitely younger than correlatives of the Sansom Formation but relationships with the Goldson Formation are not established, although a Silurian age for the Chanceport Group is most probable. Possibly, Chanceport volcanism is contemporaneous with Lawrenceton volcanism in more submarine conditions. The chemistry of the Chanceport volcanics shows a definite calc-alkaline trend with slight alkaline tendencies.

Thin gabbroic sills (Sb) intrude the Chanceport Group. Pre-tectonic and post-tectonic diabase and rhyolite dykes cut most units in the map-area. The youngest rocks are Jurassic lamprophyre dykes which transect even the major faults.

The structural geology of the area is dominated by northeast-trending, steeply dipping faults. These faults are remarkably continuous and are generally parallel to the stratigraphy. Some, such as the Cobbs Arm Fault, repeat the stratigraphy and are best interpreted as early thrust faults which were later steepened with the bedding during Acadian deformation. The other faults such as the Lukes Arm, Dildo, Tooggood and Chanceport Faults are possibly also thrust faults. Other more northerly trending faults such as the Virgin Village, Burnt Arm and the Reach are clearly post-Acadian features.

Acadian fold trends on New World Island are parallel to the faults and were perhaps influenced by the early presence of these faults. East of the Reach Fault, Acadian trends are more typically north-northeast.

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