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Magdalen Islands

Introduction

The Magdalen Islands are a north easterly trending chain of low islands in the Gulf of St. Lawrence, lying between 47 degrees 13 minutes and 47 degrees 50 minutes north latitude, and 61 degrees 8 minutes and 62 degrees 13 minutes west longitude. Of about 15 islands comprising the group, Amherst, Entry, Grindstone, Alright, Wolf, Grosse, East, Coffin and Bryon are the most important. Of these all except Entry near the southeast end of the chain, and Bryon near the northeast end, are more or less united by sand bars. Southwest Cape on Amherst Island is 54 miles from the east end of Prince Edward Island, 130 miles from Gaspe coast, and 95 miles from the Nova Scotian mainland. East Point on East Island is 60 miles from North Cape of Cape Breton Island and 96 miles from Cape Ray, Newfoundland.

The three largest islands - Grindstone, Amherst and Alright - have roads suitable for car or truck travel. Grindstone and Alright are connected by a bridge, but motor travel between Grindstone and Amherst, although possible over a sand bar during favourable conditions of wind and tide, is generally impracticable. A through road, connecting Amherst with most of the islands in the group is now in process of construction. Water transportation by mail-carrying motor boats is available, and once or twice a week Amherst, Entry and Coffin Islands are served by coastal steamer. Airway transportation has been established between Grindstone and Prince Edward Island.

Topographically the islands display three major land forms, viz: (a) sandbars and dunes; (b) a low-lying plain developed on rock at elevations generally less than 100 feet; and (c) on islands of the southwestern half of the group, nearly east-west trending belts of rolling hilly country with elevations up to 580 feet. Many of the hills in (c) vary from small rounded knolls to larger, rounded, more or less symmetrical cones to which J.M. Clarke gave the name "demoiselles", from Demoiselle Hill on Amherst Island.

Stratigraphy

The bedrocks of the Magdalenes all belong, in the writer's opinion, to the Mississippian system, with the generalized sequence in descending order as follows:

	Thickness Feet
Canso group	
Alright formation	
Red and grey sandstones	1250+
----------disconformity ----------	
Windsor Group (Upper)	
Coffin Island beds	
Limestone, calcareous shale, red and grey siltstone and mudstone	1000±
Windsor Group (Lower)	
Adele beds	
Volcanic brecciated basic lavas, fragmentals and tuffaceous volcanic rocks, interbedded with gypsum, limestone, calcareous shale, red and grey siltstone and mudstone	2500±

Adele beds. The Adele beds are dominantly dark basic lava flows, light coloured, finely fragmental pyroclastic rocks and tuffs, interbedded with gypsum, limestone, calcareous shale and brick to brownish red and some green siltstones and mudstones. The lava flows are much brecciated, and have in many places been incorporated as isolated blocks and fragments of varying size within the gypsum and mudstone members. These inclusions are angular (see also Clarke, J.M. 1911, Plate 7; Alcock F.J., 1941, p. 628, fig. 11), and none were noted having the character of volcanic bombs. In a few instances they were seen to be rudely arranged in zones parallel to banding of the gypsum, as if representing fragments of formerly continuous, interbedded, thin lava flows. Many of the volcanic flows are amydaloidal or visicular, although a few are dense and moderately to finely grained. The fragments in the pyroclastic rocks rarely exceed a centimetre in diameter, and are generally much smaller, grading into tuffs. The tuffs and other pyroclastics are commonly light greenish grey to whitish grey.

Outcrops of volcanic rocks are confined to Amherst, Entry, Grindstone and Alright islands, where they form the hilly topography already noted. They occur in the axial regions of two major anticlinal structures. The southernmost of these, which may be called the Demoiselle anticline, runs from midway between West Point and Southwest Cape on Amherst Island in a direction about north 85 degrees to Demoiselle Hill and apparently to Entry Island. The areas of sandstone transversely interrupting the continuity of the outcrops of the Adele beds on this anticline are believed to be due to transverse faults,

lthough they may in part be due to secondary folding. The second main anticlinal structure, which may be designated the Cape Adele anticline, runs from a mile west of Point Herisse on Grindstone Island in a direction about north 80 degrees east to Cape Adele on Alright Island.

The anticlinal distribution of the Adele beds on Amherst Island was previously noted by J. richardson (1881, p. 59). Alcock, however, believed that the volcanics on Grindstone Island were folded in a syncline (Alcock 1941, p. 638). That the major structure here is anticlinal is attested by the dips of the younger red and grey sandstone of the Alright formation that adjoin the Adele beds on both Grindstone and Alright Islands. These sandstones overlie the Adele beds accordantly wherever their contacts with Adele beds are not faults, and they form the limbs of the major anticlinal folds.

The Windsor strata that form a part of the Adele beds are to some extent intricately mixed by flowage with the volcanic beds, and the detailed sequence is not decipherable. Gypsum occurs in one or two thick members in addition to minor zones, and as a result of its flowage the volcanics and harder sediments have been brecciated. Fortunately fossiliferous calcareous beds are present in the Adele complex and were noted at the following localities:-

(1) 6500 feet south of Cap le Trou. A very fossiliferous, brown-weathering calcareous siltstone furnished the following:

Batostomella exilis (Dawson)
Productus (Linoproductus) lyelli Verneuil
Productus prouti Beede
Diaphragmus tenuicostiformis (Beede)
Fugnax magdalena Beede
Dielasma davidsoni (Hall & Clarke)
Romingerina anna (Hartt)
Leptodesma dawsoni (Beede) Leptodesma borealis (Beede)
Pseudamusium simplex (Dawson)
Aviculopecten lyelli Dawson
Naticopsis howi Dawson
Stroboceras hartti Dawson
Diodoceras avonensis (Dawson)

This fauna indicates a correlation with Subzone B of the Windsor group of Nova Scotia and is considered to belong to an upper part of that division. The fossiliferous beds are at present exposed only as rubble, and their relation to adjoining gypsum is not known. About 1,000 feet east of them gypsum is seen to underlie extrusive trap. If this latter gypsum belongs to the same member as that which adjoins the calcareous shale, as seems probable, the fossiliferous beds probably underlie this gypsum member.

(2) Shore of Green Cape Bay at a small headland, about 2,200 feet of

the southeast corner of the bay. Gypsum here, dipping about 52 degrees north 23 degrees west, is overlain by about 3 feet of calcareous grey siltstone, including a thin bed of dark mudstone with broken small shells. The only fossils gathered were Pseudamusium debertianum (Dawson), ostracoda, and rare Nodosinella priscilla (Dawson). The last mentioned species apparently suggests a correlation with some part of subzone C of the Windsor group. Seemingly the fossiliferous bed and the underlying gypsum lie interbedded with volcanic rocks, but it is possible that the supposedly younger volcanic rocks which are separated from the fossiliferous bed by a concealed interval, have been upfaulted and are actually older than the fossiliferous bed.

(3) About 4300 feet northeast of wharf at Grindstone Island. Buff grey calcareous shale occurs here and is overlain and underlain by red mudstone with which is associated some brecciated trap. The faunule collected here includes:

Worm trails
Productus (Linoproductus) lyelli Verneuil
Edmondia rudis McCoy
Leptodesma borealis (Beede)
Leptodesma dawsoni (Beede)
Aviculopecten lyelli Dawson
Pseudamusium debertianum (Dawson
Murchisonia gypsea Dawson
Anthrapalaemon sp.
Paraparchites gibbus Bell

The age indicated is some part of subzone B of the Windsor group.

(4) On Alright Island about 4300 feet southeast of R.C. church at House Harbour. An outcrop of red limestone, about 8 feet thick, partly brecciated occurs on the shore about 700 feet northwest of a disconformable contact of the Adele beds with grey sandstone belonging to the Alright formation. The limestone is sparingly fossiliferous and only worm trails, Dielasma davidsoni, Pseudamusium debertianum and Lithophagus pooli were noted. These fossils may be found elsewhere in both subzones B and C of the Windsor. The limestone is overlain by red mudstone and siltstone in which is included a five foot bed of gypsum. The mudstone has a few thin greenish grey interbeds, some of which carry pseudomorphs of large salt hoppers.

(5) On shore, 1,700 feet southwest of Cape Adele, Alright Island. The descending sequence of Adele beds including the fossiliferous beds is as follows:

(d) Light grey tuff
(c) Limestone, blackish grey, vesicular, very fossiliferous — 60± feet
(b) Gypsum, grey, banded, — 25± "
(a) Light grey tuff, similar to (d)

The fossils gathered from beds (c) include:

Batostomella exilis (Dawson
Productus (Linoproductus) lyelli Verneuil
Diaphragmus tenuicostiformis (Beede)
Pugnax magdalena Beede
Romingerina anna (Hartt)
Aviculopecten lyelli Dawson
Pseudamusium simplex (Dawson)
Naticopsis howi Dawson

This is a typical assemblage of the lower part of the subzone B of the Windsor group.

From the foregoing observations it is concluded that the volcanic rocks are clearly interbedded with Windsor strata belonging to subzone B. There is some doubt, however, whether any of the volcanics are as young as subzone C.

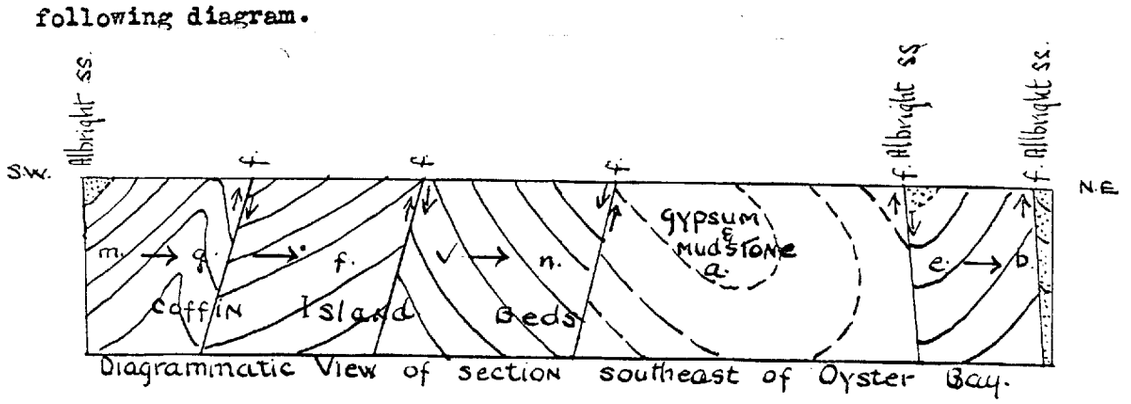
The thick zones of gypsum and mudstone have intricately penetrated the volcanic rocks as a result of folding and rock flowage, and the extreme brecciation of the volcanics is ascribed to this cause. Some of the coarse breccias have been considered by other observers to be original volcanic agglomerates (Clark 1911, p. 148; Alcock 1941, pp. 639, 643). The writer, however, failed to see any evidence of volcanic bombs. The only volcanic bed which at all resembled bomb formation was a trap flow, about 80 feet thick that was less brecciated than most. This bed outcrops about 425 feet north of the contact of the Adele beds with grey sandstone of the Canso group north of Grindstone Island wharf. Unbrecciated blocks remaining in this trap are of sufficinet size to permit spheroidal weathering which gives to many of them a pseudo-bomb appearance. The same bed apparently is present on the shore of Alright Island about 2,500 feet southeast of the R.C. church at House Harbour, which would give a strike of about north 73 degrees east.

The term "terre grasse" has been used locally for red or grey mudstone of the Windsor group, and Alcock (1941, p. 638) considered it to be an alternation product of gypsum. In the writer's opinion this mudstone is a normal, unaltered constituent of the Windsor sequence, for it corresponds to many Windsor mudstones associated with gypsum in Nova Scotia and Newfoundland. At the property of the Quebec Manganese Mines Ltd. on Grindstone Island the terre grasse is a red clay forming part of a fault gouge in which Windsor red mudstone and trap breccia of the Adele beds and red sandstone of the

Canso group are all included. It is probable, however, that other deposits that have been termed terre grasse are altered tuffs (Alcock 1941, p. 640).

No reliable estimate of the thickness of the Adele beds can be given. Richardson (1881, p.5) considered them to be at least 2,000 feet thick on Amherst Island. In the Cape Adele anticline the fossiliferous limestones south of Cape Adele on account of their flat dip and age correlation are inferred to lie in the axis of the anticlinal structure. The Adele beds in the southern limb of the anticline are faulted against red sandstones of the Alright formation, while those of the northern limb disconformably underlie basal Alright beds. The Adele beds in this northern limb outcrop for a distance of about 3,500 feet across the strike. No reliable mean dip could be inferred from observations of the Adele beds, although the beds immediately below the contact with Alright sandstone dip about 70 degrees north. At an assumed mean dip of 65 degrees the maximum thickness of Adele beds could be as high as 3,175 feet providing there has been no duplication of beds by secondary folding or faulting. However such duplication is probable, for some beds in this section were observed to dip to the southwest and these may have been overturned. Allowing for sufficient duplication to give a mean dip of 45 degrees the maximum thickness would be 2500 feet, which is probably more nearly correct.

Coffin Island beds. These beds are well exposed in the seacliffs south of Oyster Pond on Coffin Island. At the time the writer examined this section parts of it were inaccessible from the beach on account of tidal conditions. Moreover, the section is cut by faults, and is further complicated by the presence of a thick zone of gypsum and mudstone. For these reasons the section as given below must be considered as a very rough approximation to the true one. The writer's interpretation of the structure is indicated in the following diagram.



Diagrammatic View of section southeast of Oyster Bay.

In the detailed section that follows the beds are in the order met with as one proceeds from the southwest to the northeast. On the other hand the letters assigned to the beds express the writer's opinion of the sequence of deposition of strata from the oldest (a) to the youngest (v)

Alright formation	Thickness Feet
Red sandstone, dipping 23 degrees N. 8 W.	
----------disconformity ----------	
(m) Limestone, grey, with a few thin interbeds of argillaceous shale, dipping like beds above	17.5
(l) Breccia, intraformational, calcareous, reddish grey, the fragments being red shale	1.2
(k) Shale, calcareous, grey, with argillaceous bands	4
(j) Shale, grey and reddish, argillaceous, interbedded with calcareous shale and thin limestone	5.5
(i) Shale, argillaceous, grey with brick red laminae, and thin calcareous bands	27.
(h) Sandstone, red, thinly bedded with calcareous concretionary pellets (dip 44 degrees N 48 W)	5.
(g) Shale, grey, argillaceous, interbedded with red calcareous siltstone carrying ball-like concretionary; lies in an anticlinal drag fold	28+
---------- fault ? ----------	
(f) Mudstone and siltstone, red with green bands, and cut by gypsum veinlets	130 ?
--------- fault ---------	
(The following beds from (q) to (a) are considered to be overturned)	
(v) Shales and marls, grey with red bands; some grey beds have pseudomorphs of small salt hoppers (dip 54 degrees N 100 E.)	200 ?
(u) Limestone, dark grey, thinly bedded	15±
(t) Limestone, thinly bedded and light grey calcareous shale	75±
(s) Limestone, thinly bedded, dark grey (dips 60 degrees N 100 E)	3
(r) Shale, calcareous, light grey	125±
(q) Limestone, thinly bedded, dark grey	25±
(p) Shale, calcareous, grey (dips 45 degrees N 87 E)	25±
(o) Mudstone and siltstone red and grey	15+
---------- - fault ----------	
(p) Shale, calcareous, light grey	25±
(o) Mudstone and siltstone, red and grey, with gypsum veinlets	130±
(n) Shale, calcareous, light and dark grey	35±
----------fault ----------	
(Mudstone and siltstone, red and grey, mashed with many	
(gypsum veinlets	
(a)(Gypsum	
(Mudstone and siltstone, red and grey	
---------- fault - -------	
(Synclinal drag fold, with basal calcareous sandstone of the Alright formation).	
(e) Shale, calcareous, purplish grey (dip 40 degrees N 155 E)	20±
(d) Limestone, nodular, purplish grey (dips 28 degrees S 15 W)	7
(c) Limestone, thinly bedded, dark grey with purplish and mottled calcareous shale, including a 4-foot bed with columnar structure (algal ?), which Alcock (1941, p. 638) mistook for a lava flow.	9
(b) Mudstone and siltstone, red (top dips 60 degrees N 27 W)	30+
Total	950+
------- ----- fault ----------	
Alright formation	
Red sandstone with one or more beds intraformational limestone conglomerate	

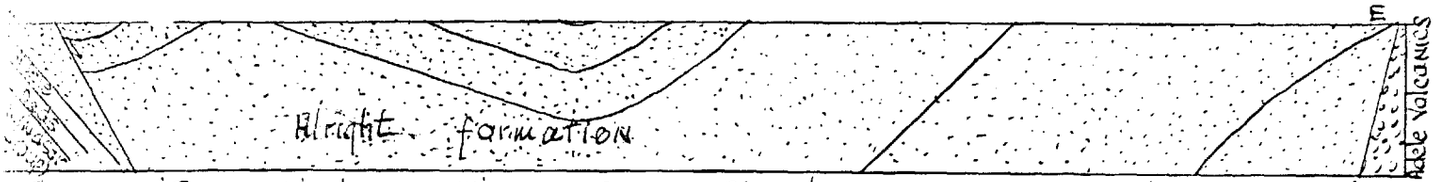
Many of the limestone and calcareous shales of the above section are fossiliferous. The faunules gathered by the writer are listed below together with their correlations.

	Faunules	Correlation
Beds (e)	Productus subfasciculatus Bell Composita windsorensis Bell Spirifer adonis Bell Martinea sp. Dibunophyllum sp. Pugnoides sp Phillipsia sp	Windsor group, Subzone C (lower part)
Beds (m)	Nodosinella sp. Productus (Linoproductus) sp. Productus avonensis Bell Leptodesma acadica (Beede) Small gastropods Small crinoid stems	Windsor group Subzone C (lupper part)
Beds (n)	Productus (Linoproductus lyelli Verneuil Leptodesma borealis (Beede) Modiola hartti Bell	Windsor group Subzone D
Beds (r to t)	Productus avonensis Bell Martinia galataea Bell Schizodus sp. Lithophagus poolii (Dawson) Bucanopsis sp	Subzone E

It will be noted in above correlation that beds (r to t), although apparently dipping below beds (n) in the section, actually are younger, which is the basis for considering the beds in this part of the section to be overturned (see diagram). This is in agreement with their position with reference to the fault that separates them from beds (m), which is inferred to be an underthrust to the northwest.

The complete absence of any volcanic beds in this section is significant in view of the fact that the strata are all of Upper Windsor age. The fossiliferous calcareous beds associated with the volcanics on Grindstone, Alright and other islands in the southwestern part of the Magdalens were all correlated with the Lower Windsor, with the possible exception of a Nodosinella-containing bed at Green Cape Bay. It is concluded, therefore that volcanic activity in these Islands was mainly, if not wholly, confined to Lower Windsor time.

Alright formation This formation may most readily be studied in the seacliff section on Alright Island west and east of Basse Point.



Composite vertical section of Basse Pt. shore. scale 500ft = 1 IN.

The formation consists of grey and red sandstones which in this section have a computed thickness of at least 1250 feet. The total thickness must be greater than this, for there has been an unknown loss of strata at the surface due to downfaulting at both ends of the section, and at Basse Point the highest strata in the section dip under the sea.

The contact with Adele beds at the western end of the section is well exposed, and is a disconformity, the beds of both series dipping 42 degrees in a direction north 162 degrees east. The top bed of the Adele series is a green grey siltstone of the Windsor group. The basal Alright bed is a dark brownish ferruginous sandstone which is overlain by more compact grey sandstone carrying weathered nodules of pyrite. Two hundred feet southeast of the contact the Alright grey sandstone flattens to the apparent axis of a syncline. However there must be a fault here and not a synclinal axis between the southerly and northerly dipping strata, for the southerly dipping beds to the contact are computed to be only 110 feet thick, whereas the beds dip northerly for 850 feet along the shore and are computed to be 210 feet thick. Thereafter the beds fold over into an anticline, and the dips in the remaining part of the section change from south 20 degrees east to south 28 degrees west. This change, which takes place about 1,000 feet northwest of Basse Point is due to an open synclinal fold. Much of the section at Basse Point and eastward around Cape Alright is inaccessible along the shore, but the strike of the beds remains fairly constant up to the eastern contact with Adele beds, which is a fault. It is this eastern limb of the Basse Point syncline that provides the computed thickness of 1250 feet for the Alright formation. The exposed thickness of strata in the western limb was estimated to be about 570 feet, so that the loss of strata at the surface by faulting in this limb must be at least 700 feet. Much, if not all, of this loss is ascribed to the fault that occurs as noted above 200 feet south of the disconformable contact with the Adele. The Alright-Adele contact north of Cape Alright at the eastern end of the section is a fault, whereby Alright beds have been brought down against trap breccia. This fault trends apparently about north 95 degrees

east and pitches 73 degrees south; the actual vertical displacement may not be great.

The beds in the western limb of the Basse Point syncline are dominantly grey sandstone whereas those in the eastern limb are dominantly red. Yet grey beds of the western limb apparently lie at the same stratigraphic horizons as red beds in the eastern limb. That such a lateral change of colour is probable is exemplified by grey beds in the eastern limb itself, which, in the seacliffs may be seen to grade laterally along the strike into red sandstone and vice versa. Similar lateral gradation of grey to red was noted elsewhere on both Alright and Grindstone Islands and forced the conclusion that the grey sandstones are only a local facies of the red.

Because the grey sandstone has been considered by some observers to be older than the red and to be separated by an unconformity (Alcock 1941, p. 642) the evidence for considering grey and red sandstones as facies of one formation is presented below.

(1) Later changes from grey to red and vice versa actually seen in cliff sections, as noted above.

(2) Mount Mounette, Alright Island, north of House Harbour is a hill or knoll consisting of grey sandstone striking about North 83 degrees east and dipping 24 degrees North. Following this strike to the shore there are continuous exposures of similar striking and dipping beds, but all are red sandstones. The grey sandstone of Mount Mounette is fine-grained, and consists of angular quartz grains similar to those in the red rocks lying in the same zone on the shore.

(3) Cap de Meules, Grindstone Island, is underlain by grey sandstone. The sandstone is decidedly crossbedded, but near the wharf the true strike is about north 106 degrees east and the dip 25 degrees south. At Leslie Cove south of the cape the grey sandstone is partly unconsolidated, which precludes accurate judgment on the true strike and dip. The dip is flatter, however, and apparently about 15 degrees in approximately the same direction as at the wharf. The writer could find no evidence for any angular unconformity here. The unconsolidated sandstone passes laterally, and in places abruptly, into consolidated beds both to the north and to the south, and in the latter direction there is an abrupt lateral change to typical red sandstone.

(4) A knoll-like hill, similar to that of Mount Mounette, is developed on grey sandstone about 2700 feet east of Pte. Herisee on Grindstone Island. The sandstone is very cross-bedded, but the true strike is inferred to be about north 56 degrees east and dip 22 degrees northwest. This strike extended to the sea cliffs enters a section consisting entirely of red sandstone, which south of Cape Herisee have the similar strike and dip to the grey sandstone of the Knoll.

(5) At some localities grey sandstone was noted to overlie Adele beds disconformably e.g. south of House Harbour on Alright as already noted. At other localities red sandstone has a similar relation. For example north of Cape Adele, Alright Island, red sandstone lies disconformably upon trap breccia. The basal red beds are a sedimentary breccia, 25 feet thick, carrying angular trap pebbles and including near the base a banded limestone, 8 feet thick, which

likewise carries a few trap pebbles. These beds, which dip about 65 degrees north 5 degrees east, are directly overlain by red sandstone. The basal sandstone, moreover, includes a few conglomeratic lenses which carry both angular and rounded trap pebbles.

Red sandstone lies disconformably upon Windsor strata in the seacliffs south of Oyster Bay on Coffin Island. The sandstone as well as the immediately underlying Windsor beds dip about 22 degrees in a direction north 15 degrees west.

(6) The grey and red sandstones are similar in constitution and differ mainly in colour. They are both fine- to medium-grained and consist dominantly of angular quartz. While some of the grey sandstone is known to carry in addition a minor amount of wind-etched rounded quartz grains, particularly where the sand is unconsolidated, it is not improbable that as close an examination of the red sandstone would yield like grains. The grey sandstone is generally calcareous, particularly the harder sandstone making up the knoll-like hills. Some beds carry abundant concretionary spheroids from the size of peas to marbles. A marked calcareous content was at first thought to be a characteristic of the grey sandstone, but acid tests showed the presence of calcareous interbeds in the red sandstone, and red beds carrying calcareous concretions similar to those in the grey were also noticed.

(7) Both the grey and red sandstones are markedly cross-bedded. This cross-bedding is not considered to be aeolian, but is of a kind commonly seen in rapidly deposited strata of flood-plain origin such as those of the Pictou group on Northumberland Strait.

No fossils were seen anywhere in the Alright formation. Its disconformable relation to the Lower rocks of the Adele as well as to Upper Windsor strata on Coffin Island implies an appreciable interval of erosion. The stratigraphic and structural relations to the Windsor are similar to those of the Canso group of Upper Mississippian age in Nova Scotia. A correlation with this group rather than with any younger group is accordingly considered to be the more probable. This is apparently in agreement with Alcock's correlation of the red sandstone with the Bonaventure formation.

Structure

Folds All bedrock strata of the Magdalen Islands are involved in the same major folds. The writer could find no evidence for the view that the red sandstone is an approximately horizontal formation, and that its high dips are all cross-beds. In many places it is true the cross-bedding precludes any reliable determinations of true strikes and dips, particularly where the true dips are less than 15 degrees. This is so at Hospital Cape where the true dip is inferred to be about 10 degrees in a direction north 12 degrees west, and also near Etang du Nord wharf where true dip is about 10 degrees northwest. There is, however, abundant evidence, particularly where the red sandstone is not faulted against the Adele beds, that it, like the grey sandstone, rests disconformably upon the older series, and forms the limbs of the anticlinal folds in which the Adele beds occupy the axial

regions. The attitude of the red as well as of the grey sandstone is the clue to the major folding of the area.

The southern half of the Magdalen Islands group is characterized by the presence of two major anticlinal folds, trending north 75 to 85 degrees east. The southermost of these, the Demoiselle anticline, crosses the southern part of Amherst Island and runs to Entry Island. The second, or Cape Adele anticline, occupies much of the central part of Grindstone and the southern part of Amherst Island. The area between these two anticlines is largely under the sea, but Alright strata on Amherst Island dip mainly northwesterly and on Grindstone and Alright Islands southerly to southwesterly, indicative of a major syncline. North of the Cape Adele anticline beds of the Alright formation form the northern limb of that structure, and the southern limb of an inferred succeeding syncline. This syncline is only inferred, because no observations were made by the writer in areas northeast of Alright Island except on Coffin Island, where Windsor strata younger than those included in the Adele beds are found. These Upper Windsor strata owe their position to a third anticlinal fold; for they are overlain at one point disconformably by northerly dipping Alright red sandstone, and, although they form part of an upfaulted block, the Alright beds lying north of them also dip northerly.

Faults. The whole area of the islands would have to be geologically mapped in detail in order to determine the number and pattern of faults. The writer can only record the result of limited observations on Grindstone, Alright and Coffin islands. Some of the contacts of the Alright formation with Adele beds are faults. For example north of Cape Alright red sandstone of the Alright formation is faulted against Adele brecciated trape. The fault is normal, trending at the shore outcrop about north 95 degrees east, and pitching 70 degrees south; the slickensided surface of the fault indicates movement inclined about 20 degrees to the vertical.

South of House Harbour Alright grey sandstone lies disconformably upon Windsor strata of the Adele series, but only 200 feet southeast of the contact the Alright beds are cut by a fault along the southeastern side of which the Alright beds are downthrown and dip northerly. The structure is apparently a broken syncline. This fault would appear to trend about south 50 degrees west,

and to determine the contact between Alright grey sandstone and Windsor beds of the Adele series on the shore north of Grindstone Island wharf. It is probable also that this fault continues across Grindstone, marking the southern contact of the Adele beds, and passing through Alright strata to a point south of Gull Island, a small islet offshore from Etang du Nord. For Alright sandstone just west of Etang du Nord wharf dips about 10 degrees northwest, whereas the dip on the shore near the southeast end of Etang du Nord lagoon is about 45 degrees in direction about north 70 degrees west. This latter locality lies about east of Gull Island. Gull Island itself was not visited by the writer, but from the Grindstone shore appears to be occupied by Adele volcanics overlain by Alright red sandstone dipping moderately in a northerly direction.

The contact of the Alright formation with Adele beds in the north limb of the Cape Adele anticline is not exposed. The Adele beds of the anticline near the western end of Grindstone do not owe their termination of outcrop to a westerly plunge of the anticline, for Alright strata are continuously exposed in the seacliffs from Etang du Nord to Pte. Herrisee, and, dipping northerly, strike inland directly towards the Adele beds. It appears necessary to postulate a northerly fault running transverse to the anticline to explain the relations here between Alright and Adele rocks.

The faults on the peninsula southeast of Oyster Bay, Coffin Island, have already been noted in discussion of the Coffin Island Upper Windsor beds. Their contact with Alright red sandstone in the eastern part of the peninsula is inferred to be a fault, and probably this is the same fault that may be seen on the shore at the northeastern end of the cliff section, where it forms the contact between red Windsor shales and Alright red sandstone. At the shore the fault is vertical; if it is the same fault as that inferred above to run inland in the eastern part of the peninsula, it must trend about south 75 degrees west. Faults running oblique to this trend cut the Windsor strata, but some at least are probably older, for the most important of them has underthrust late subzones against earlier ones of the Upper Windsor; this fault seems to trend about north 40 degrees east.

Oil Possibilities

If oil in economic quantity should ever be found anywhere in the Gulf of St. Lawrence area attention might be directed thereafter to the Magdalen Islands as a possible field for exploration. Not only would the Islands be

portant on account of their geographical position in the Gulf, but because their youngest strata are Mississippian. The structural trends of the folds on the islands are nearly east-west which trends projected westward would lie in the Carboniferous area of New Brunswick, after passing near the northwestern tip of Prince Edward Island. This suggests that the islands probably lie northwest of the main geosyncline in subbasins of which very thick freshwater Pennsylvanian sediments were laid down in Nova Scotia. In New Brunswick it is known that Pennsylvanian deposits north of the Caledonian Mountain belt were laid down only as a relatively thin sheet. It is inferred that similar conditions for their deposition prevailed in the Magdalens during the Pennsylvanian.

The Mississippian rocks in the anticlinal axial regions of the Islands, are highly inclined to vertical, and include interbedded thick lava flows and fine pyroclastics. Conditions are decidedly unfavourable for retention of any petroleum that may have originated in the Windsor rocks. It is inferred, however, that more competent, pre-Windsor rocks may have folded in a much simpler manner than did the overlying incompetent Windsor beds. The extreme brecciation of the volcanics in the folded Mississippian series is inferred to be due to flowage of interbedded gypsum, mudstone, and probable salt zones. One can only guess whether pre-Windsor rocks may be expected to lie beneath. A thick section of freshwater strata of the Lower Mississippian Horton group is known to be present near Cape North at the northern tip of Cape Breton Island, 60 miles southeast of the Magdalens. Where seen by the writer these Horton strata have in a few places petroleum seepages represented by scattered tar-like residues, but no oil-shales were noted similar to those of the Albert formation. It is quite possible that if any Horton rocks are present at all in the Magdalen Islands area they may have a facies more like the Albert. On the other hand it is possible that the area was too far to the northwest to be in the basin of Horton deposition at all, and that the pre-Windsor sequence of the Magdalens may be similar to that of the Bay of Chaleur region, and if so the Windsor rocks would be underlain by Devonian and Silurian marine beds.

The lowest exposed Windsor noted in the Islands belongs to subzone B of the Windsor and outcrops on the shore of Alright Island about 1,600 feet southwest of Cape Adele. This is considered to lie approximately on the axial line of the Cape Adele anticline.

References

Alcock, F.J.

1941. The Magdalen Islands. Can. Instit. Min. Metall. Trans. Vol. XLIV, pp. 623-649 (1941).

Clarke, J.M.

1911. Observations on the Magdalen Islands. New York State Museum, Bull. 149, pp. 134-355.

Richardson, J.

1881. Report on a Geological Exploration of the Magdalen Islands. Geol. Surv. Canada, Rept. Prog. 1879-80, Pt. G, pp. 1-15.

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CANADA

DEPARTMENT
OF
MINES AND RESOURCES
MINES, FORESTS AND SCIENTIFIC SERVICES BRANCH

GEOLOGICAL SURVEY OF CANADA

Ottawa, February 17, 1949.

Memorandum to:

Dr. G. Hanson
Chief Geologist
Geological Survey of Canada

I enclose a copy of report of work I did for the Imperial Oil Company last summer. There are acutally three short reports as follows:

(1) Magdalen Islands
(2) East River of Pictou Unfinished.
(3) Sussex Area, N.B.

Possibly you would like to keep this report in your files for future reference. If not, it may be returned to me.

As my work was of a consultant nature, the report is rather sketchy, particularly of the East River of Pictou area, and not complete accounts of the geology of the various areas. The objective of the work was correlation and determination of the rock structures.

As a result of the work the G.S.C. maps of Sussex and Waterford areas, N.B. (Maps 829A, 845A) seem to require some revision, and it may be as well for this reason to have the report on file. Also the interpretation of the Geology of the Magdalens is much different than that published by Alcock (Can. Inst. Min. Metall. vol. 44, 1941)

Wallace A. Bell

Transferred from Chief Geol file 781

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