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PRELIMINARY REPORT, GEOLOGY OF THE SAINT-AUGUSTIN AREA, DUPLESSIS COUNTY

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DEPARTMENT OF NATURAL RESOURCES

RENÉ LÉVESQUE, MINISTER

P.-E. AUGER, DEPUTY MINISTER

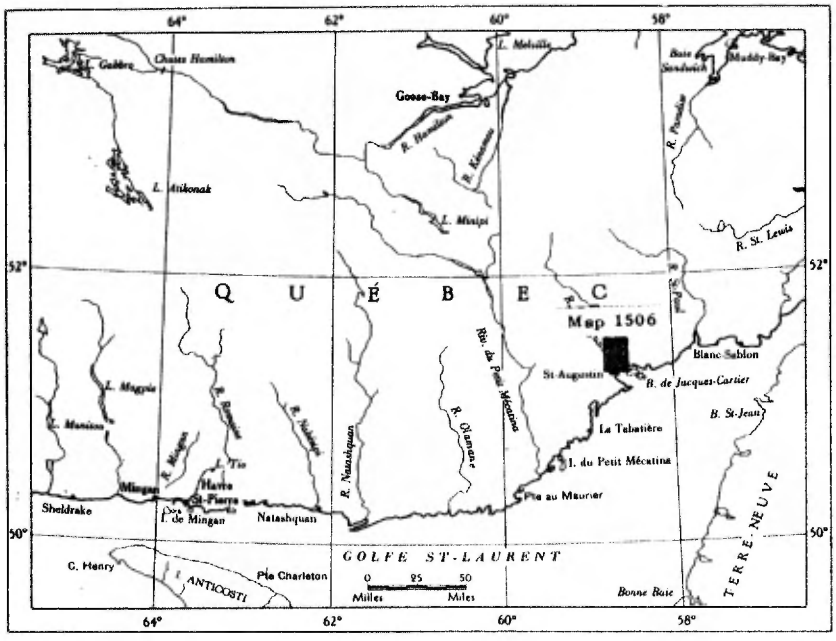
Geology of the ST. AUGUSTIN AREA

DUPLESSIS COUNTY

PRELIMINARY REPORT

by

R. Davies



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QUEBEC DEPARTMENT OF NATURAL RESOURCES

RENÉ LÉVESQUE, MINISTER P.-E. AUGER, DEPUTY MINISTER

GEOLOGICAL SURVEYS BRANCH

H. W. McGERRIGLE, CHIEF

GEOLOGY

OF

ST-AUGUSTIN AREA

DUPLESSIS COUNTY

PRELIMINARY REPORT

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INTRODUCTION

The St-Augustin area, mapped by the author during the summer of 1962, borders on the north shore of the Gulf of St. Lawrence, about 350 miles east of Sept-Iles. It is bounded by longitudes 58°30' and 58°45' and latitudes 51°09' and 51°27', and covers about 220 square miles. It includes parts of Cook and Bougainville townships, and the village of St-Augustin, at the mouth of the St-Augustin river, is near the centre of the area.

Very little information is available on the geology of this part of the province. De Puyjalon (1899) reported on the minerals of the North Shore, and Longley (1944) described the area between Aguanish and Lobster Bay. Hale (1962) did a reconnaissance survey of an area covering 7,000 square miles which includes the area mapped by the writer.

The area may be reached either by ship (Clarke Steamship Co. Ltd.) leaving Quebec fortnightly, and taking about five days to reach St-Augustin, or by plane (Northern Wings Ltd.) from Havre-St-Pierre or Sept-Iles on a biweekly service.

The main rivers, St-Augustin and Coxipi, flow southward and provide the easiest means of access, respectively, to the western and eastern halves of the area. Numerous islands and long runs of fairly sheltered water mark the coastal part of the area.

The area is rugged, and has the features of an ancient peneplain cut by deep pre-glacial valleys now occupied by lakes and streams. St-Augustin and St-Augustin-Nord-Ouest rivers flow along fairly wide alluvium-filled valleys. Trends of the valleys and ridges are determined mainly by zones of fracture, which are most noticeable along the coast, and to a lesser degree by more easily weathered zones in the gneisses. Local relief of the islands is 200 feet, and that on the mainland, 500 feet.

Drainage of the area is south by way of St-Augustin and Coxipi river, and southeast by way of St-Augustin-Nord-Ouest river, into the Gulf of St. Lawrence. The smaller streams and lakes follow the local structural trends before entering the larger rivers.

Forested areas are confined to river valleys and sheltered slopes; the tops of hills and most of the coastal islands have only a thin moss cover over bedrock.

GENERAL GEOLOGY

All the consolidated rocks are Precambrian in age. Gneisses underlie almost the entire area and vary in composition from pink orthoclase-biotite gneiss to grey and greenish grey plagioclase-biotite gneiss. Garnetiferous varieties are common in certain horizons; sillimanite varieties are more local. Amphibolites, though seldom of any great thickness, are both interlayered with, and intrusive into, the gneisses. Narrow bands of quartzite and calc-silicate rocks are abundant in the south. A large gabbroic dyke strikes a little east of north and crosses at least two-thirds of the area. The youngest intrusive rocks are diabase dykes generally no more than a few feet wide.

Unconsolidated gravels, sand, silt, and clay of Pleistocene and Recent age occur in the valleys, in depressions, and on the sides of hills.

Gneisses

The gneisses vary in colour, texture, and composition, but for general mapping purposes they were divided into three main groups: 1) pink, 2) grey or greenish grey, 3) mixed or undifferentiated. Weathering causes much confusion in making these separations. However, the grey gneisses generally weather more easily than the pink and become a friable dirty brown aggregate. The pink gneisses generally maintain their pinkish colour.

West of St-Augustin river the banding of the two types is so closely spaced, often in the order of inches or fractions of an inch, and gradations between the two are so common, that it was not always possible to map them separately. In addition to the classification based on colour, the mineralogical composition, including the proportions of quartz and mafic minerals and some characteristic accessory minerals, was useful in the identifications.

The gneisses are cut by pegmatite, aplite, and quartz veins. Many aplites are difficult to distinguish from fine-grained, conformable, pink gneisses low in mafic minerals. Near St-Augustin village, pink granites intrude the grey gneisses. The mode of occurrence of these granites and the nebulous aspect of the feldspars and quartz in some stringers and in the host rock suggest that they may have been partly emplaced by melting.

Pink potash feldspar gneisses: These rocks are generally medium grained and lower in mafics than the grey gneisses. Coarse-grained varieties are common in the south. Mafics make up to 1-10% of the rocks and consist mainly of biotite and magnetite; locally there is a little hornblende or rare, small disseminated

garnets. The garnetiferous variety occurs west of St-Augustin river and in a zone passing through La Sarre lake. The quartz content is generally in the order of 20-30%, but may be as high as 40%. Those rocks, low in mafics, have a poorly defined foliation.

Grey plagioclase gneisses: These are medium-grained, though some coarse-grained varieties are found. The mafic constituents, biotite, magnetite, hornblende, and pyroxene, make up 3-25% of the rock, but average 5-15%. The quartz content is generally in the order of 10-20%. Feldspars are white, grey or greenish and are well twinned. The rock has a good foliation owing to the abundance of oriented mafic constituents.

Grey garnetiferous gneisses: Garnetiferous gneisses occur abundantly in the well-defined zones of grey gneiss in the northeast, as well as in the less well-defined garnetiferous zone passing through La Sarre lake. They also crop out sporadically in other zones of grey gneisses. Red porphyroblasts of garnet up to an inch across are distributed both in the gneiss and in the associated interlayered quartz-feldspar bands or veins. Generally the garnets constitute only a few per cent of the minerals but locally amount to as much as 20%.

Sillimanite-garnet gneiss: Associated locally with the garnetiferous grey gneisses in the neighbourhood of Thunay River ponds and south of St-Augustin bay, are zones a few feet to a few tens of feet wide of sillimanite-bearing rocks. The sillimanite is associated with biotite and garnet in distinct layers a fraction to a few inches wide, separated from each other by bands of garnetiferous quartz-feldspar material. The sillimanite is in prisms up to 1 inch long and 1/8 inch wide, as for example on Grosse-Isle island in the southwest corner.

Quartzites

Quartzites occur east of Thunay River pond and west of St-Augustin bay. At the first locality two bands were mapped, the more continuous eastern one forming a prominent cliff face about 2 miles long that can be easily traced on the aerial photographs. At the second locality, several bands are exposed along the bank of Pagachou brook as well as inland on either side of the river. One of these bands, near Oies bay, is about 60 feet wide. Other bands farther east are 3 to 4 feet wide.

The quartzites consist mainly of quartz with, in places, variable amounts of pink feldspar either disseminated through the rock or concentrated in narrow irregular bands from a fraction of an inch up to 2 inches thick. The quartzite is glassy white to grey, but much of the weathered surface is stained by iron oxides. Thin layers of muscovite occur along foliation planes. The rock is well jointed and breaks into conspicuous angular blocks.

TABLE OF FORMATIONS

Pleistocene and Recent	Sand, silt, gravel, clays, peat
Unconformity	
	Diabase dykes
	Intrusive contact
?	Gabbro dykes
Intrusive Contact	
	Pegmatite and aplite Diorite - Monzonite dykes White syenite
	Intrusive Contact
	Amphibolites Pink granites
	Intrusive Contact
Precambrian	Amphibolites (interlayered)? Calc-silicate rocks Quartzite Sillimanite garnet gneiss Grey garnetiferous gneisses Grey plagioclase gneisses Pink, potash feldspar gneisses

Foliation is brought out by the feldspathic bands and by the iron stains on the weathered surface. The quartzites have fairly well-defined contacts with, and are conformable to the foliation of, the associated gneisses.

Carbonate and Calc-silicate Rocks

Like the quartzites, the carbonate and calc-silicate rocks are rare. They occur in bands generally less than 20 feet thick that are interlayered with the gneisses on the shore of Oies bay, where the best exposures are found, and in the immediate surroundings. As a rule these rocks weather more easily than the adjacent gneisses or quartzites and this may be a reason for their sparse exposure. Inclusions of the calc-silicate varieties were seen in three monzonite dykes.

These rocks are well banded, and may be highly contorted as shown by relics of disrupted layers now completely surrounded by calcite. The layers are from a fraction of an inch to several feet thick and consist of variable proportions of carbonate, pyroxene, scapolite, phlogopite and quartz. Calcite is particularly abundant in the exposures on the shore of Oies bay. Pyrite, fluorite, apatite, chalcopyrite, and molybdenite were identified in some specimens.

Amphibolites

Amphibolites are relatively abundant as conformable layers in the gneisses or as dykes transgressing the foliation. They are all essentially amphibole-plagioclase rocks with biotite mainly in the thinner layers. The layers and the dykes are of diverse thicknesses and range from inclusion-like lenses a few feet long to large bodies hundreds of feet across.

Foliation is generally well developed in the amphibolites but is most apparent in the biotite-rich layers. The rock is dark greenish black, and medium grained. It consists essentially of greenish black to black hornblende and grey-white to grey or slightly greenish grey feldspar. The mafic constituents generally compose 40-50% of the rock. Biotite-rich zones also occur within the large masses, and appear to be due to shearing or minor faulting.

The weathered surface is mottled black and dirty white, the actual shade depending on the proportion of dark to light minerals present; the biotitic varieties are generally darker. Some outcrops weather dirty greenish black or dark greenish brown to rusty brown. The surface is generally rough especially in the coarse-grained varieties. The more schistose varieties are more broken and easily weathered.

The amphibolites that appear to be interlayered usually have fairly regular contacts, whereas many of the dyke-like bodies are very irregular and appear to have followed joint planes that lack definite trends.

The only rocks that clearly intrude the amphibolites are pegmatite, granite, and aplite dykes. Inclusions of the amphibolite occur in syenitic dykes.

Diorite - Monzonite

Dykes of monzonitic to dioritic composition are abundant and well exposed along the coast and shores of the islands surrounding St-Augustin bay. They vary in width from a few feet to a few tens of feet. Although the contacts with the country rock are sharp, they are very irregular and no definite trend could be determined. These dykes, being well-jointed, are more easily weathered than the country rock. Joints are closely spaced and on weathering the rock breaks into angular blocks.

Although there are several different varieties of dyke rocks all are closely similar mineralogically. They are characterized by the presence of biotite as the major mafic constituent, with commonly some hornblende and magnetite, and a deficiency of quartz. Total content of mafic minerals ranges between 10% and 20%. In general, the feldspar is pinkish but in some varieties it is grey. Disseminated grains of pyrite are common. The rocks are ordinarily medium dark, the shades depending on the colour of the feldspars.

Some dykes appear massive in the field, but most have a faint and many a very good foliation. The foliation is parallel to all observed contacts. The rocks are generally medium to fine grained with some varieties containing phenocrysts of feldspar and large flakes of biotite. The weathered surface is smooth in the fine-grained varieties but rough in the coarse-grained, and, where rich in biotite, the surface is pitted owing to the removal of the biotite.

Inclusions of the amphibolite and calc-silicate rock were seen in several of these dykes. The only younger rocks that cut the dykes are pegmatite and aplite veins.

Gabbro

Several outcrops of coarse-grained gabbro lie along a prominent lineament across the area in a direction a little east of north. These exposures, which may belong to one dyke, are clearly visible on aerial photographs of the area north of Belon pond. Here the width appears to be about 1/8 mile. The eastern contact with the gneisses on St-Augustin river just above the confluence with St-Augustin-Nord-Ouest river is sharp and nearly vertical.

The composition of the dyke is extremely variable from place to place. On St-Augustin river the typical rock is essentially dark greenish grey and consists of grey well-twinned plagioclase, biotite, pyroxene, chlorite and magnetite. The mafic constituents amount to about 20% of the rock. Exposures to the north, however, are typically brick-red "syenitic-looking" rocks, consisting of pink feldspar with a few laths of grey feldspar. Mafic constituents are essentially chlorite, mica, and hornblende, and in a typical specimen amount to about 10% of the rock. Varieties of both types are very much richer in mafics. A little pyrite was seen in a number of specimens.

Although the rocks to the north are typically red and those to the south, grey, both were seen together in the same outcrop on St-Augustin river, the red variety occurring as irregular veins, patches and zones in the grey. In places the pink feldspar is scattered throughout the rock.

At and near the contacts with the country rock, the dyke becomes medium grained. In the contact zone, both the gabbro and the country rocks are cut by narrow, fine-grained, diabase dykes.

A few outcrops of a second dyke of similar composition 125 feet wide and $\frac{1}{4}$ to $\frac{1}{2}$ mile long were observed to the west of St-Augustin river just above St-Augustin-Nord-Ouest river.

Diabase

Diabase dykes are closely associated with the gabbro dyke at several places along the coast. All are fine grained and contain small phenocrysts of feldspar in many places. The weathered surface varies in colour from light grey to dark greenish black or black, being dirty or rusty brown in places, and much of it is finely pitted.

The dykes vary in width from 6 inches to 15 feet. They are emplaced in joint planes which, along the coast, strike N.47°-65°E. and dip 75° NW. Dykes associated with the gabbro parallel the dip and the strike of the latter.

White Quartz Syenite

White quartz syenite, which may be related to the monzonites, was found only on Galibois island just west of Riquet Portage. A more typical exposure lies just outside the area on Paul Nadeau island.

The rock is massive, medium to somewhat coarse grained, and light greyish white or, locally, slightly pinkish. The weathered surface is a dirty white and fairly rough owing to removal of mafic constituents. It consists essentially of greyish white, in places slightly pinkish, feldspar. Mafic constituents, mainly silvery green chlorite, make up 3-5%. Quartz is rare. Disseminated grains of pyrite are common.

The rock clearly cuts the gneisses of which it contains numerous subangular to rounded inclusions, principally of amphibolite and up to several feet across. Other inclusions in the syenite are calc-silicate rock and biotite amphibolites. The syenite is cut by aplites.

Granite and Pegmatites

No large body of intrusive granite occurs in the area. However, small masses of pink, fairly massive, and coarse-grained granite cut the gneisses, particularly near St-Augustin village.

Pegmatites and aplites are widespread. The pegmatites, in addition to quartz and feldspar, contain biotite, hornblende, some magnetite, and, in a few places, garnet. Quartz veins are abundant west of St-Augustin village.

PLEISTOCENE AND RECENT

Clays, sand and gravel partly fill the major valleys. Good cross-sections are exposed on the banks of the St-Augustin and St-Augustin-Nord-Ouest rivers. In all cases a grey or khaki clay underlies the arenaceous materials and is probably of glacial origin.

In many places, especially in the north, the clay is overlain by water-laid, well-sorted gravel or alternating layers of gravel and sand. Above the gravel are considerable thicknesses of Recent, variously coloured sands, with occasional thin clay, grit, pebble and heavy mineral (mainly magnetite) layers. Organic material occurs here and there and current bedding is common. Marine terraces appear at different levels particularly in the south.

Beautifully striated glacial pavements with friction cracks and grooves are found along the coast where recently exposed. The hills have been smoothed off and rock basins, now occupied by lakes, are common. The direction of ice movement is generally to the southeast.

Much of the coarser unconsolidated material can be matched with local rock types. However, boulders and pebbles of siltstone and fossiliferous limestone, which are quite common, are foreign to the area.

STRUCTURAL GEOLOGY

Schistosity and Foliation: The general strike of the gneisses in the northern half of the area is NNW. and is remarkably consistent. The dips here are to the east throughout, and are generally steep on the west side of St-Augustin river and shallow on the east side. In the northeast corner the foliation swings to strike north.

Immediately south of Tardivet pond the foliation strikes east. South of St-Augustin-Nord-Ouest river and west of St-Augustin village, the strike and dip of the foliation are very irregular. Farther south, the foliation returns to the general NNW. trend and then follows the outline of St-Augustin bay, which is a circular basin.

Lineations west of Dazé brook plunge 20°-40° NW.; along Bougainville passage they plunge 5°-25° SE.; and around St-Augustin bay they plunge in towards the interior of the basin at somewhat steeper angles than the preceding.

Folds: A tight symmetrical fold plunging to the NNW. occurs in the neighbourhood of Thunay River ponds. It is well shown on the aerial photographs and by the attitude of foliation in the rocks.

Faults, Shear zones: A remarkable feature of the area are three sets of linears that probably correspond to traces of faults. The most prominent set strikes parallel to the coast. Evidence for a fault is found in Bougainville passage and Petit-Rigolet strait, where horizons cannot be matched on either side of the channels. The presence of the fault is further indicated by a small fault on the north shore of Bougainville passage and shear zones on Forgeron and Genévriers islands - all being parallel to the passage. The second set of linears is north-south and parallel to the gabbro dyke and the long axis of the Thunay River ponds. The third set has an east-west trend which corresponds to that of shear zones on Genévriers island.

Joints: Joints are well developed in the gneisses throughout the area. Most strike parallel to the prominent linears and generally dip steeply.

ECONOMIC GEOLOGY

Disseminated grains of pyrite were observed in almost all the rock types. Small cubes of pyrite with a little chalcopyrite and occasional flakes of molybdenite were seen in the calc-silicate rocks around Oies bay. The best showing was on a small island of amphibolite. Among the other minerals of economic significance, magnetite is found in sand and in small pegmatite dykes. Minor quantities of apatite and fluorite were identified in the limestone and calc-silicate rocks.

Sand is abundant in the valleys of the major rivers, and gravel, along a series of rapids on St-Augustin river, just north of the area.

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