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NORTH SHORE OF THE SAINT-LAWRENCE, AGUANISH TO WASHICOUTAI BAY

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NORTH SHORE OF THE SAINT-LAWRENCE

AGUANISH TO WASHICOUTAI BAY

by Jacques Claveau.

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INTRODUCTION

The geology of the coast between Aguanish and Washicoutai bay, along the north shore of the gulf of St-Lawrence, was mapped by the writer during the summer of 1944. The straight-line distance in an east-west direction between these two places is about fifty-five miles, but the distance covered in following around the many points and bays is considerably greater. The principal village, with a population of approximately 400, is Natashquan, twelve miles east of Aguanish and 530 miles below Quebec city. It is served regularly during the summer months by boats of the Clarke Steamship Company, sailing from Montreal and Quebec. Other settlements and their population include Aguanish (250), Ile à Michon (100), Kegashka (50), and Musquarro (one family). Natashquan, however, is the only village where large amounts of varied supplies can be obtained.

TOPOGRAPHY

The shoreline, except for the regular, monotonous sand beaches between Natashquan and a point three miles west of Kegashka river, is intricately dissected and generally fringed with innumerable rocky islands and reefs. The relief

is low from Aguanish to Kegashka river, the highest points not exceeding fifty feet above sea level, with the average elevation in the neighbourhood of five to fifteen feet. East of Kegashka river, the relief increases appreciably and the shore is frequently a low, sheer wall almost devoid of landing places. At several places east of Curlew point, the elevation exceeds 100 feet.

GENERAL GEOLOGY

The consolidated rocks along this section of the coast are all of Precambrian age. Between the villages of Aguanish and Natashquan they are for the most part granites, granitic gneisses, and pegmatites, but included within these are several bands, up to a mile and a half wide, of highly metamorphosed sedimentary rocks, predominantly quartzitic. Then follows the low, exposureless beach already referred to, extending eastward to a point three miles west of Kegashka harbour. Beyond this, to Washicoutai bay, the coastal rocks are again granite with included belts of granitic gneiss.

Numerous concordant dykes of a black rock which, in some places at least, is distinctly a gabbro or a diabase, cut both the igneous and sedimentary rocks.

Precambrian

Sedimentary Rocks

The bands of sedimentary rock included within the granite and gneiss in the ten-mile stretch of shore between Ile à Michon and Natashquan have a northeasterly trend. The rocks are predominantly quartz-rich, but in general

metamorphism has been so extreme as to leave in doubt their original composition. That they are of sedimentary origin, however, is clearly shown by the presence, in places, of typical impure quartzites, well-banded quartz-biotite schists, and, more rarely, of beds of coarsely crystalline limestone. All these bodies of sedimentary rock have suffered pronounced and repeated granitic injections which have created a great deal of complexity in their mineral composition. The most useful field criteria for their identification as sedimentary rocks are their bedded character and tendency to be rich in quartz or biotite, or in both of these minerals.

Banded Granitic Gneiss

Under this term are included highly metamorphosed rocks of granitic composition with alternating, massive bands of light and dark minerals. Typically, the banding is very sharply defined, but in some occurrences it is indistinct or almost absent. However, it is always noticeable when the outcrops are viewed from a distance.-

The light bands consist of quartz, feldspar, and, generally, small amounts of dark minerals. On the basis of their composition and texture, they may be classed as granitic, pegmatitic, or aplitic. The typical dark bands are composed of closely packed flakes of biotite, more rarely of hornblende or chlorite, in a subordinate quartz-feldspar matrix.

Individual bands range in width from a small fraction of an inch to over two feet. They may persist with a fairly uniform width for several hundred feet, but some are of relatively short length, pinching out completely or fraying

into a number of thinner filaments.

Typical banded gneiss appears spasmodically as concordant bands within the intrusive gneissic granite that borders the coast between Kegashka and Washicoutai bay, and it also forms an appreciable portion of the rock complex exposed along the coast between Aguanish and Natashquan.

The origin of the banded gneiss is doubtful. In part at least it is believed to have resulted from lit-par-lit injection of sedimentary rock by granitic magma.

Augen Gneiss

A strongly gneissic rock of granitic composition and with an augen structure forms extensive outcrops on the east bank of Aguanus river, at its mouth. This augen gneiss grades westward into a granite gneiss whose intrusive nature is unmistakable. Half a mile eastward from the mouth of the river, it disappears beneath a heavy blanket of sand, and the next exposures, about a mile farther eastward, are of a coarse granite somewhat similar to the augen gneiss but with the augen structure much less pronounced or absent, and much poorer in ferromagnesian minerals. This granite may be a transition facies between the augen gneiss at the mouth of the river and the granite-gneiss to which it passes farther east. The typical augen gneiss is coarse grained with large 'eyes' and elongated lenticular streaks of light-coloured minerals in a groundmass of feldspar, biotite, and chlorite, minor magnetite, and occasional hornblende. The 'eyes' and 'lenses', which may be as much as several inches in size, consist of crystals of feldspar (chiefly) and quartz, or of aggregates of small crystals of both. Evidence of intense crushing is seen in the

fact that these small crystals are in many cases fragments of originally larger ones.

Although extensive exposures of the augen gneiss were seen only in the vicinity of Aguanish river, the granite at various points along the coast locally displays this structure. It appears to be a step further in the metamorphism than the development of a strong gneissic banding, since it was observed that, before passing to an augen facies, the granite first becomes gradually more and more strongly gneissic.

Granite-Gneiss and Granite.

Granite is by far the most abundant rock exposed along this section of the coast and, except locally and in occasional dykes, the rock is in some degree gneissic. The granite is not all of one age, but, if it is at all possible to establish the relative ages of the several intrusions, very detailed work would be required.

Granite-gneiss extends eastward from the village of Ile à Michon to the first band of sedimentary rocks east of that place, a distance of about two miles. As already noted, it and the augen gneiss at the mouth of Aguanish river are probably facies of a continuous granitic mass. The granite-gneiss is a medium-grained, pink or grey rock. It is devoid of augen structure, but is characterized by the presence of ribbons of pegmatite injected parallel to the strike and dip of the gneissic banding. The ribbons are slightly irregular in width and length, swelling and pinching gently, ending abruptly, or, less commonly, branching off as stringers across the general trend. In places, such ribbons make up the bulk of the rock; in others, they are widely spaced or may

be lacking over a considerable width of the exposed rock. A characteristic feature is the presence, in addition, of 'ptygmatic' folds, that is, of intricately folded or closely crumpled ribbons of injected pegmatite. The peculiarity of these convoluted ribbons is that they have not been folded with the gneiss; the gneissic banding does not parallel these intricately curved veinlets of pegmatite, whereas the straight ribbons, as noted above, are conformable with the gneissic banding in both strike and dip.

Apart from the bands of sedimentary rock already referred to, and shown on the accompanying map, the remainder of the shore between Ile à Michon and Natashquan is composed of a coarse, strongly gneissic, pink to red, biotite granite.

The granite alternating with the banded gneiss along the coast between the eastern limit of the Natashquan sands and Washicoutai bay is in part a similar coarse grained, strongly gneissic, biotite variety. For the most part, however, it is fine-grained, poorer in biotite, and less strongly gneissic. From the presence of inclusions of one granite in another, and differences in composition, it is evident that the large bodies of granite of this easterly half of the map-area do not all belong to one and the same mass or, at least, that they are not all strictly of the same age.

Basic Rocks

A concordant dyke, half a mile wide, of gabbro occurs in granitic gneiss on the east side of the mouth of Musquarro river. Adjacent to the margins of the dyke, the rock is fine grained; otherwise, it is medium grained or, locally, coarse. It is massive and fresh in

some exposures, gneissic and highly altered in others.

A black, highly altered, strongly gneissic rock forms a subordinate but persistent member of the rock complex along other parts of the section of the coast covered during this investigation. It occurs as concordant dykes or bands and as small irregular masses, many of which are rudely lenticular. Some of these bodies are a few hundred feet in width, but, as a rule, they range from a fraction of a foot to about ten feet wide and are too small and too abundant to be shown on the accompanying map. They invariably show chilling effects at their margins, where the grain is much finer than farther in the mass. Hence they are obviously intrusive into the adjacent rocks. They consist now of highly metamorphosed rock and are of four principal types: amphibolite, chlorite schist, hornblende-biotite schist, and biotite schist, the last two often containing various amounts of feldspar. It is believed that all of them were originally gabbro. In some rare cases, the dykes are fine-grained throughout and a diabasic texture is still well preserved in them, in spite of the alteration.

These basic dykes have, in many instances, suffered drastic deformation in addition to severe alteration by hydrothermal solutions. They exhibit local segmentation and squeezing into lenses, indicating that the region has been subjected to renewed disturbances subsequent to those that caused the structures (such as banding of the granite gneiss) along which the basic bodies were intruded.

Granite Dykes and Pegmatite.

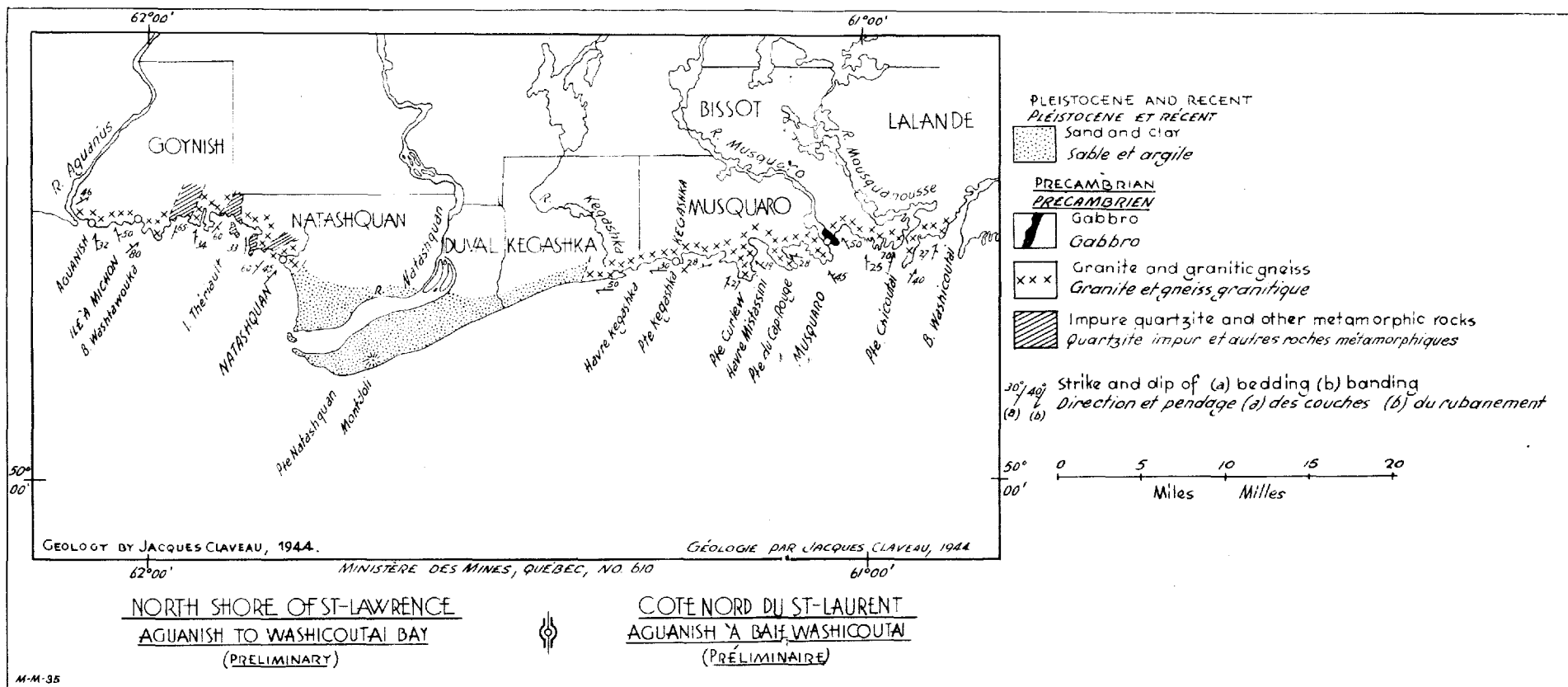
A few dykes of fine-grained, pink,

biotite-rich granite cut some of the large masses of granite and the gneisses of the area. A pegmatitic granite which locally grades into true pegmatite outcrops in small masses in the four-mile stretch of shore between Aguanish and the first band of sedimentary rocks east of that village.

Large and small dykes of salmon-pink and red pegmatite are fairly abundant between Aguanish and Natashquan, but farther east they are not plentiful. They usually contain subordinate amounts of biotite and greyish plagioclase in addition to the large percentage of pink orthoclase and milky quartz. The pegmatite is the youngest rock of the Precambrian complex of the region. It cuts all the rocks previously described, including the basic dykes and those of fine-grained pink granite. Where it cuts these dykes, it is frequently seen to have been injected in a curious 'flamboyant' pattern, that is, in small, flame-like splashes. This peculiar pattern of injection results from the filling by pegmatite of gash features in these basic and granite dykes.

STRUCTURE

Remarkable parallelism exists in the trends of the various structural features of the area. Notable agreement in the strike and dip is found between the bedding of the sedimentary rocks and the gneissic banding of the granitic rocks that enclose them. Between Kegashka river and Washicoutai bay, granite which has been intruded as sheets between narrow belts of banded gneiss has, itself, a more or less marked banding parallel to that of the gneiss. The basic dykes or lenses have the same trend and attitude as the rocks into which they are intruded. Most of them



also display a strong schistosity concordant with the banding of the surrounding granitic gneiss.

The strike of the bedding and banding oscillates between northwest and northeast, except in the area between the eastern border of the Natashquan sands and Red Cliff point (pointe du Cap Rouge), where it tends, as a rule, to be east-west with a shallow northerly dip. The trend of the bays and points generally provides a faithful guide to the trend of the rock formations. Between Aguanish and Natashquan, the strike varies between north-northwest and northeast and a moderate east dip prevails. Slightly east of Red Cliff point, the formations strike northwest, with an intermediate easterly dip. Going eastward from here, there is a gradual change in the strike to north-south, and, finally, about halfway between Musquarro and Musquanousse river, to northeast, and here the dip changes abruptly from east to west. Near Washicoutai bay, the dip again reverses to east and the strike becomes very erratic in places.

A salient structural feature in the area is the presence of prominent fractures transverse to the trend of the banding. These fractures have an approximate east-west orientation. Some of them show a slight displacement along their strike and should be termed faults.

ECONOMIC GEOLOGY

Graphite

Occasional flakes of graphite were observed in a lens of coarsely crystalline limestone included in crumpled quartzites along the eastern border of the most westerly band of sedimentary rocks, about three miles east of the

village of Ile à Michon. The limestone lens and a few other similar ones are segments, displaced and squeezed, of thin limestone layers that originally were interbedded with the quartzitic sedimentary rocks. The possibility of finding commercial deposits of graphite is very small, as the graphite is restricted to the limestone which, in turn, is very rare along the stretch of coast examined.

Iron Sands

Large deposits of iron sands lie near the mouth of Natashquan river. They extend along the six-mile stretch of shore between the mouth of the river and Mont-Joli, a small hill two and a quarter miles east of the lighthouse at Natashquan point. The black iron sand occurs as flat, elongated lenticular patches in a buff-coloured sand and is best seen on the beach or along a low nearby beach escarpment cut by the surf. The lenses extend for several hundred feet inland under a cover of grassy dunes in the western part of the deposits and of heavily wooded peaty topsoil in the eastern part.

The Natashquan iron sands have been known since the early days of mining in Canada, but it was not until 1911 that serious attention was focused on them and a thorough study, which lasted for three consecutive years, was undertaken by the Mines Branch of the Federal Department of Mines.

In 1911, MacKenzie (1) investigated, by means of bore-holes and using a seven-inch

(1) MacKenzie, Geo.C., The Magnetic Iron Sands of Natashquan; Mines Branch, Department of Mines, Ottawa, Pub. No. 145, 1912.

sand auger, a narrow east-west area of 169 acres extending from the mouth of the river to Natashquan point, an approximate distance of four and a half miles, and extending about 500 feet inland. As a result of this work he estimated that, within this area, to an average depth of 16 feet, there were available 5,800,000 tons of crude sand which would yield 500,000 tons of magnetic concentrates containing 67 per cent iron.

In the following year (1), he returned with a 4-inch drill, using a steel pipe casing which permitted of boring below ground-water level, and investigated in detail the sands at the tip of the peninsula. The area covered extended two miles east of the mouth of the river and for about 1,500 feet inland, totalling some 184 acres. In 1913, Parsons (2) examined an area of 340 acres, stretching from Natashquan point to Mont-Joli and extending 2,000 feet inland.

The result of this three-year investigation showed that, between the mouth of the river and Mont-Joli, there was available a total of more than 27,000,000 tons of dry crude sand averaging 6.54 per cent of magnetic concentrates.

Magnetite

Magnetite occurs in pegmatite as nodules not exceeding the size of an egg and, as a rule, much smaller. These occurrences are of mineralogical interest only.

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- (1) MacKenzie, G.C., Summary Report, 1912, Mines Branch, Department of Mines, Ottawa, pp. 69-71.
 - (2) Parsons, C.S., Summary Report, 1913, Mines Branch, Department of Mines, Ottawa, pp. 90-96.

Pyrite

Fine whitish pyrite is disseminated in impure quartzites at a point about two and a quarter miles east of the village of Ile à Michon or close to half a mile east of the western border of the western-most sedimentary band. The shoreline here trends slightly east of north, coinciding closely in orientation with the sedimentary beds, which strike about north-northeast and dip steeply east. The mineralization is distributed in a zone from 10 to 20 feet wide, running parallel to the trend of the quartzite beds and following close to the water line. The rusty-weathered surface of the mineralized zone can be followed for a total distance of 2,200 feet, interrupted here and there by water of overburden. In one place, there are, in addition to the disseminated pyrite, splashes and lenticular veinlets of the mineral up to two feet long and half an inch wide. An assay of a sample carrying the disseminated mineralization gave 0.002 oz. gold and 0.054 oz. silver per ton, and 0.07 per cent copper.

An occurrence of pyrite was also noted in Mistassini harbour, at a point on the shore four and a quarter miles due west of the village of Musquarro. The mineralization is at the contact of granite-gneiss and pink pegmatite, in a vein 20 feet in length and 10 inches in maximum width, trending N.55°W. and dipping 40 degrees to the northeast. The vein has a strong schistosity developed parallel to its strike and consists of pyrite veinlets, half an inch or less in width, in a rust-laden host of mica, quartz, and a soft, greenish mineral, probably serpentine. The pegmatite wall of the vein contains considerable magnetite which persists, although in gradually decreasing amount, to a distance of

6 to 7 feet from the vein. Assay of a sample from the richest portions of the vein gave 0.002 oz. gold and 0.046 oz. silver per ton, 0.12 per cent copper.

CONCLUSIONS

As will be apparent, only very meagre indications of mineralization were observed in the rocks along and adjacent to this section of the coast. From a point three miles west of Kegashka harbour to Washicoutai bay, the rocks exposed are granite and granitic gneisses. and, except at Mistassini harbour, they are devoid of any noteworthy mineralization. West of Natashquan, the presence of fairly wide bands of sedimentary rocks in the granite is more encouraging and, in fact, there is tangible proof in at least one of these bands of the activity of mineralizing solutions.

Despite the scantiness of observed mineralization, it is recommended that prospectors examine the area between Aguanish and Natashquan. The sedimentary bands here are large enough to constitute favourable loci for the deposition of minerals. Observation along the shore provides only a very narrow cross-section; the bands should be followed inland and searched diligently before passing judgment on them. The same holds true for the apparently barren eastern part of the area. The tendency is to condemn areas of old gneisses and granite. It is doubtful whether this practice is fully justifiable. As has been shown in certain districts near Romaine river (1) (2),

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- (1) Longley, W.W., Forget Lake Area; Quebec Dept. of Mines, P.R.175, 1943.
 - (2) Claveau, Jacques, Wakeham Lake Area; Quebec Dept. of Mines, P.R. 181, 1943.

the rocks may change quite abruptly, giving place to structures and assemblages that are favourable for the formation of mineral deposits.

Broad generalizations on vast areas, based on the examination of restricted portions, are not to be commended. If the rocks of a section of the coast are barren, it does not necessarily follow that a similar condition prevails inland.