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PRELIMINARY REPORT ON THE BOURGET AREA, CHICOUTIMI COUNTY

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PRELIMINARY REPORT

ON

THE BOURGET AREA

CHICOUTIMI COUNTY

BY

R. F. JOOSTE

QUEBEC
1948

P. R. No. 222

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I N T R O D U C T I O N

The Bourget area, examined and mapped by the writer during the summer of 1948, covers about 200 square miles, and is bounded by latitudes 48°30'N. and 48°45'N. and longitudes 71°15'W. and 71°30'W. It is in Chicoutimi county, immediately north of Saguenay river and about twenty miles east of lake St. Jean. It includes most of Bourget and Bégin townships, and portions of Labrecque, Taché, Kénogami, Falardeau, and Simard townships.

Industrial centres such as Chicoutimi, Arvida, Kénogami and Jonquière are only a few miles southeast of the area; St. Joseph d'Alma and Riverbend are about eight miles west of the western boundary. All parts of the map-area can be easily reached by means of gravelled roads which connect with these towns.

The map-area lies within the lake St. John anorthosite mass, one of the largest known

areas of such rock, but only small parts of it have been geologically mapped. The St. Charles titaniferous magnetite deposits are in the southwestern part of the map-area, and it was hoped that similar deposits might occur elsewhere in the anorthosite. Recently, renewed interest has been shown in the apatite-rich portions of the St. Charles deposits, and in titaniferous deposits generally.

The region has been settled for more than 50 years, and the larger part of the arable land has been cleared. Most of the usable timber has been either cut or destroyed by forest fires. There are, however, a few stands of timber left, notably in the northeastern part of Bégin township, along the steep banks of Saguenay river, and on parts of the ridged areas.

Hydro-electric power is available from large developments on Saguenay river, such as Shipshaw and Isle Maligne.

PHYSIOGRAPHY

The area lies mainly within a strip of relatively low ground that is known as the "upper Saguenay region".

The relief within the map-area is about 800 feet, the highest points being in the northeastern part, and the lowest along Saguenay river, which cuts across the southwestern corner and is about 200 feet above sea-level at this point.

Two distinct types of topographic surfaces are recognizable. One type, best developed in the southeastern part of the map-area, is almost

horizontal, except where cut into by existing streams, or interrupted by terraces. Elsewhere, the area is hilly. The hills are generally rounded and, in plan, irregular. They become higher towards the north.

The hilly areas are mostly underlain by Precambrian igneous rocks, with an irregular cover of glacial drift, though some hills are formed completely of morainal material.

The flat, plain areas are covered by unconsolidated sediments evidently deposited during a post-glacial marine invasion. The flats extend up valleys into the hilly areas, as would be expected under such circumstances. These areas are farmed, except where the soils are too sandy or are not well drained. The plain areas shown on the accompanying map are those covered by clay and sand.

The streams draining the area are generally youthful, with rapids and lakes in the hilly regions, but, where they flow across the unconsolidated sediments, they are more nearly graded, though there are waterfalls and rapids wherever bed-rock or boulders are encountered.

GENERAL GEOLOGY

With the exception of two small areas of Palaeozoic limestone, all the consolidated rocks in the map-area are Precambrian igneous rocks. Anorthositic rocks underlie the larger part; gabbros, syenites, and granites are found in the remainder.

TABLE OF FORMATIONS

CENOZOIC	Recent and Pleistocene	Stratified clay, sand and gravel Till and glacial outwash
	Unconformity	
PALAEOZOIC	Ordovician	Limestone (Trenton?)
	Unconformity	
PRECAMBRIAN	Post "anorthosite" intrusives	Pegmatite Syenite and granite Gneissic granite
		Intrusive contact
		Basic syenite Quartz syenite
		Intrusive contact
		Coarse (ophitic) gabbro and anorthositic gabbro
		Intrusive contact
		Fine to medium-grained gabbro
	Intrusive contact	
	"Anorthosite" series	Anorthosite, gabbroic anorthosite, gabbro

PRECAMBRIAN

Anorthosite Series

The rocks of the anorthosite series range in composition from anorthosite to gabbro, with anorthosite and gabbroic anorthosite (ten to twenty per cent dark minerals) as the most common types. All these rocks appear to be closely related, and no marked difference in age was observed.

The weathered surface of the anorthosite is invariably white, but fresh surfaces vary from black to white, and are commonly mauve. The grain size is highly variable from place to place, even in one exposure. A very coarse-grained facies is common in the southeastern section of the map-area, with crystals of feldspar in places up to nine inches in length. Although much of the anorthosite is coarse-grained and inequigranular, much of the map-area is underlain by a medium- to fine-grained anorthosite, with scattered porphyroblasts of plagioclase about an inch across. In places, this type of anorthosite has a fine-grained, sugary texture, resembling that of a sandstone. The most common dark minerals in the anorthosite are pyroxene, olivine, and magnetite.

With increasing content of dark minerals, the anorthosite grades into gabbroic anorthosite in which pyroxene and olivine are the most common ferromagnesian minerals. Crystals of pyroxene up to twelve inches long occur in places, notably in the southeastern part of the area. Westward, olivine appears to be the dominant dark mineral, generally occurring as lenticular grains, which impart a layered aspect to the rock, but rounded crystals and subhedral masses, up to four inches across, are common. The olivine is almost invariably

surrounded by a fringe of a bright green mineral. Much of the gabbroic anorthosite is distinctly banded, with layers of anorthositic gabbro alternating with those of anorthosite. In places, the ferromagnesian minerals become so abundant that the rock is a true gabbro; such gabbros are generally well banded, as a result of compositional differences in the various layers. The anorthosite series appears to be the oldest in the area, because it is either intruded, or overlain, by all the other rock-types.

Fine- to Medium-grained Gabbro

A thin, tabular body of gabbro, trending north-northeast, occurs along the eastern margins of Taché and Labrecque townships, throughout most of the length of the map-area. In the south, it is about 4,000 feet wide but narrows down northwards. The rock is typically fine- to medium-grained, with a buff weathered surface and a dark greenish-grey fresh surface. Much of the rock is comparatively rich in magnetite, enough being present to affect the compass considerably. The gabbro is intrusive into the anorthosite, as is shown by numerous dykes of gabbro penetrating the anorthosite and by inclusions of anorthosite in the gabbro.

Coarse (ophitic) Gabbro and Anorthositic Gabbro

Several narrow bodies of these rocks strike north and northeast through the area. They are coarse-grained and are characterized by a subophitic texture, with tabular laths of feldspar in a matrix of magnetite, olivine, or pyroxene. Much of it is comparatively rich in magnetite, containing about twenty per cent of that mineral, but in many places, olivine and pyroxene are the

dominant dark minerals. Biotite is present in many places, especially in the magnetite-rich facies. Detailed features at the contact show that this rock is intrusive into the anorthosites; it also cuts across the band of medium-grained gabbro but is penetrated by the granite and syenite.

Quartz Syenite

A rock-type exposed in the northwestern part of the area, in Labrecque township north and south of Labrecque lake, is typically coarse-grained and porphyritic, with phenocrysts of potassic feldspar set in a matrix of feldspar, dark minerals, and quartz. The quartz is invariably bluish and somewhat opalescent. Inclusions show that this quartz syenite is younger than the anorthosite; the quartz syenite is, however, intruded by a later gneissic granite.

Basic Syenite

A large body of this rock occurs in the southeastern part of Bégin township. The rock is medium- to coarse-grained and is brown on the weathered surface. It consists of about 60 per cent potassic feldspar and 40 per cent dark minerals, chiefly magnetite. Some facies of what is believed to be the same rock contain large phenocrysts of plagioclase. Inclusions of anorthosite in the basic syenite show that the syenite is the younger, but it is intimately intruded by later syenite and granite.

Gneissic Granite

A portion of the northwestern part of the map-area, in Labrecque township, is underlain

by a body of granite that is about two miles wide along the north boundary, but that narrows southwards and finally pinches out about one mile south of Labrecque lake. The rock is coarse-grained and normally consists of 80 to 90 per cent pink feldspar and quartz, with biotite as the predominant dark mineral. The ferromagnesian minerals are generally aligned, imparting a gneissic banding to the rock.

The gneissic granite is intrusive into both the anorthosite and the quartz syenite, but its relation to the other rocks could not be determined. It is believed to be of approximately the same age as the granite-syenite complex, but the two intrusives have a different appearance and are nowhere seen in contact with each other.

Syenite and Granite

A large area of pink syenite, grading into granite, occurs in the southeastern part of Bégin township and the northern part of Bourget, where it is intimately associated with the basic syenite. The rock is typically pink, coarse-grained, and somewhat inequigranular. The syenitic facies has about 80 per cent pink feldspar. The quartz content varies considerably, so that the rock grades from syenite, through quartz syenite, to granite. Towards the contact with the anorthosite, the rock becomes more heterogeneous, the content of dark minerals increases, and a pronounced banding, parallel to the contact, becomes apparent. The anorthositic rocks within a mile from the contact with these acidic rocks are cut by numerous granitic dykes that are as much as one-quarter of a mile wide. This feature, the metamorphism of the anorthosite at the contact and the inclusions of anorthosite, proves that

the syenite and granite are younger than the anorthositic rocks. Granite dykes also penetrate the coarse (ophitic) gabbro and the basic syenite, showing that the syenite-granite complex is one of the latest intrusives in the area. No contact of these rocks with the quartz syenite or gneissic granite is exposed.

Pegmatite

Granite and syenite pegmatites, occurring as dykes that are generally about two feet wide but not continuous for long distances, cut all the rocks so far described. All the pegmatite dykes contain abundant pink feldspar; quartz occurs in some, generally graphically intergrown with feldspar. White plagioclase feldspar is present in some of the dykes, and, in a few pegmatites, there are books of muscovite and biotite.

PALAEOZOIC

Ordovician Limestone

A fine-grained, well-bedded, buff-grey, fossiliferous limestone is found at two places. One occurrence is in the southeastern part of Bégin township, along the west flank of a hill about one and one-half miles south of Nazaire lake. Here, the limestone apparently overlies the basic syenite, but the contact is not exposed. The other exposure is in the eastern part of Labrecque township, about one and one-half miles south of the northern boundary of the map-area, where a few small outcrops occur. At the latter locality, one of the exposures of limestone is separated from granite by a vein of white, coarsely crystalline calcite. This vein probably occupies

a fault along which the limestone was downthrown. The limestone is rich in fossils and is probably of Trenton age.

CENOZOIC

Pleistocene and Recent

Till and outwash deposits, overlain by stratified clay, sand, and gravel, are of widespread occurrence in the area. Bouldery moraine and glacial outwash are present on most of the hilly parts. Almost all the low, flat country is covered by stratified clay, sand, and gravel. The clay, which is best exposed along streams cut into the plain, is fine, bedded, but not varved, and is poorly consolidated. It is generally overlain by coarse, cross-bedded sands, with numerous gravelly patches, but in some places the sand covering is absent.

The clay and sand seem to have been deposited in a large body of water, probably during a post-glacial marine invasion of the area.

STRUCTURE

In many places, the rocks of the anorthosite series show a distinct banding, expressed by the parallel arrangement of the ferromagnesian minerals. In places, this merely consists of subparallel lenticles of ferromagnesian minerals; elsewhere, notably in the olivine-bearing facies, the rocks are distinctly banded, with layers of relatively pure anorthosite alternating with layers of gabbroic anorthosite and gabbro. Such layers are generally fairly well-defined, although

tending to be discontinuous along their strike. Where the ferromagnesian minerals are not abundant, banding is not easily seen. The attitude of the banding tends to be rather irregular, but over most of the area the strike is about N.15°E., with a steep dip either to the east or to the west, but there are many exceptions, and low dips occur in many places. The banding in the medium-grained intrusive gabbro, in the granite-syenite, and in the gneissic granite, is generally steeply dipping and, as far as could be determined, parallel to the contacts with the anorthosite.

Dresser (1) has suggested that the northern limit of the "upper Saguenay region" is a fault. The postulated fault should pass through the northeastern corner of the map-area, but no pronounced scarp is present in this locality, and no evidence pertaining to the presence or absence of a fault could be found.

The preservation of Palaeozoic sediments is believed to be the result of down-faulting, because the limestone occurs below the general surface of the Precambrian. This is further corroborated by the exposure in Labrecque township where flat-lying limestone is separated from granite by a vertical calcite vein that probably occupies a fault-surface.

ECONOMIC GEOLOGY

Mineral deposits known to occur in the area are mica, calcite, and titaniferous magnetite. Parts of the last-mentioned deposits are rich in apatite.

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(1) Dresser, J.A., Part of the District of Lake St. John, Quebec; Geol. Surv. Can., Mem. 92, 1916, p. 7.

Mica

Granite and syenite pegmatites are very common throughout the area, but they contain mica only at a few places. The main occurrences of mica-bearing pegmatites are:-

Lot 30, range IV, Bégin township: (one-half mile east of Canton Bégin). This occurrence is on the south end of lot 30, just north of the abandoned road that follows the line between ranges III and IV. Pegmatite, cutting the anorthosite country rock, is exposed for a length of 35 feet and has an average width of one foot. It consists of quartz and pink and white feldspar, throughout which books of muscovite and biotite are scattered. The muscovite constitutes about three per cent of the pegmatite and averages about three-eights of an inch thick and one and one-half inches across. Some blasting has been done and a quantity of mica extracted.

Lots 30 and 31, range V, Bégin township: (two miles north of Canton Bégin). This pegmatite occurs along the north end of the lots, and is about a mile from the nearest gravelled road. The dyke is exposed, partly by trenching, for a length of 230 feet, has an average width of three feet, and strikes N.70°W. The pegmatite consists of quartz and feldspar, with scattered books of muscovite, averaging one to two inches across, and generally less than one and one-half inches thick. As a whole, the pegmatite contains less than five per cent of muscovite. Sufficient excavation has been done to show the extent and nature of the deposit, and some mica has been extracted.

Other occurrences - Small pegmatite dykes with a little mica occur on lot 34, range IV, Bégin township, lot 46, range VII, Bourget township,

and at a few other places; but in none of these exposed dykes is mica present in sufficient amounts to warrant exploitation.

Titaniferous Magnetite

Titaniferous magnetite deposits occur in the anorthosite series. Most of them are located in what is known as the St. Charles deposits, of which a detailed map was prepared during the course of the investigations described by this report.

The St. Charles Deposits

Parts of these deposits have been known for more than 50 years, but so far no mine has been established. They are of interest because of the large quantity of material available, and the high apatite content of part of the deposits.

The outcrops occur on lots 44 and 47, range I, Bourget township, and can be reached by a bush-road branching off at lot 45 from the gravelled road running between ranges I and II, or by canoe along Saguenay river. Most of the ground in this locality is heavily bush-covered.

The titaniferous magnetite bodies are irregularly distributed in medium-grained, granular anorthosite. The parts with abundant exposures of titaniferous magnetite can be more or less separated into two areas: the first covers the southern third of lots 44 and 45; the other, the central parts of lot 46 and adjacent lots. Outcrops are by no means confined to these areas, and within each area the exposures are scattered and separated by drift or anorthosite. It is

believed that most of the magnetite forms exposures because it is more resistant to erosion than the anorthosite.

The outcrops on the southern third of lots 44 and 45 occur partly on the steep banks of Saguenay river. This locality is the site of the original St. Charles "mine". Most of the material in these outcrops consists of coarse-grained, titaniferous magnetite, with numerous grains or masses of rusty-weathering olivine. Apatite occurs in small amounts, except in the outcrops adjacent to a trench on lot 45. Large quantities of titaniferous magnetite, with an estimated tenor of 35 to 45 per cent iron and 12 to 20 per cent titanium oxide, are available in this area.

The exposures on the central parts of lot 46 and adjacent lots are mostly of the apatite-rich variety and consist of medium- to fine-grained aggregates of titaniferous magnetite and apatite, with much olivine. Much of the material is estimated to contain 15 to 25 per cent apatite (by volume).

The mapping shows that the titaniferous magnetite bodies, although dyke-like, are not continuous, and in places they terminate against, or in, anorthosite. Caution must be used in extrapolating geological boundaries across areas without exposures.

Detailed mapping shows that the strike of the deposits is generally north-south, but the attitude could not be determined with any certainty. Some outcrops show indications of a low dip, whereas in others the dip is steep, and in one place an apparent fold structure is present.

The St. Charles deposits warrant careful consideration in view of the demand for titanium and for phosphorous, which is characteristic of parts of the deposit. Exploitation may be more attractive because of the proximity of hydro-electric power.

Other Titaniferous Magnetite Deposits

Other exposures of titaniferous magnetite encountered are shown on the accompanying map. All those outside the St. Charles deposits, with the exception of one exposure south of Saguenay river, are small, being less than three feet wide and mostly without visible apatite. The small outcrop south of Saguenay river is similar to that directly opposite, on the north shore, and consists of a coarse-grained aggregate of titaniferous magnetite and olivine, with little or no apatite. This occurrence doubtless represents an extension of the St. Charles deposits, and more material may be found farther south, on the trend of the deposits.

Calcite

Several veins of calcite are exposed on the northern end of lots 9, 10, and 11, range VI, Labrecque township, adjacent to the gravelled road that follows the line between ranges VI and VII. The veins are generally small and occur close to the contact of limestone and granite. The largest vein, which occurs on lot 9, is exposed for a length of 80 feet and is about five feet wide. It seems to dip steeply and is between limestone and granite. The calcite is white, coarsely crystalline, and contains inclusions of fossiliferous limestone. The veins have been explored by trenching and two diamond-drill holes.

Miscellaneous

Parts of the anorthosite and some of the granite seem to be suitable for building or monument stone, but so far no quarries have been opened in the area.

The bedded clays are not utilized at present, but large quantities of them are readily available. The best soils are developed where these clays form the surface of the land.

Sand and gravel are found throughout the area and are extensively used for road-building.