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PRELIMINARY REPORT ON CAPE SMITH - WAKEHAM BAY BELT, NEW QUEBEC

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PROVINCE OF QUEBEC, CANADA

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PRELIMINARY REPORT

ON

CAPE SMITH-WAKEHAM BAY BELT

NEW QUEBEC

BY

ROBERT BERGERON



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by

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INTRODUCTION

The most northern region of New Quebec is a peninsula bounded by Hudson bay on the west, by Hudson strait on the north, and by Hudson strait and Ungava bay on the east. The northern part of this peninsula is traversed from west to east by a belt of rocks corresponding to those of the Labrador Trough or Geosyncline. This, the Cape Smith-Wakeham Bay belt, has an area of roughly 6,000 square miles. Its length is 235 square miles. Its width varies from a maximum of 60 miles, along the shore of Hudson bay, to a minimum of 8 miles, on the shore of Hudson strait.

The belt derives its name from localities at its western and eastern ends. Cape Smith is the western tip of Smith island, which lies off the east coast of Hudson bay and hence outside the Province of Quebec. The island is some 675 miles north of Moose Factory on James bay and 120 miles south of the northwestern tip of Ungava peninsula. The eastern end of the belt is at Wakeham and Joy bays on Hudson strait.

Following the discovery of nickel and other base metals in the Cape Smith-Wakeham Bay belt within the last three years, the Quebec Government granted mineral exploration licenses to 32 companies in 1957. Also, in the summer of 1957 the Quebec Department of Mines undertook a broad reconnaissance of the Cape Smith-Wakeham Bay belt and of a good part of the ground south of Hudson strait and north of the belt. Efforts were directed mainly to locating the southern and northern boundaries of the zone; to mapping at a scale of two miles to one inch three north-south zones, 4 to 6 miles wide, across the eastern, central, and western parts of the belt; and to the study of the country north of the central part of the belt. This last project consisted of four traverses spaced about 20 miles apart and extending from the central portion of the belt to Hudson strait.

Esker lake was used as the central base of operations. This lake is located about 20 miles east of the centre of the belt, and is suitable for all types of float-equipped airplanes. It is about 46 miles south of Hudson strait and 1,100 miles north of Montreal. An airstrip about 3,500 feet long was built 8 miles northwest of Esker lake, along the southeastern shore of Spartan lake.

The climate of this northern part of the province is arctic with short and cool summers. In 1957, Esker lake was free of ice on the 14th of July. The last two weeks of July were pleasant and warm with day temperatures ranging between 60 and 75 degrees. The night temperatures stayed around 45 degrees. The weather in August was poor. There was no heavy rainfall, but almost every day was foggy and the first snow fall was recorded on August 13th. Patches of snow remaining from the winter of 1956-57 were still visible during the first week in September, indicating that snow never entirely left the district in 1957.

The topography reflects the structure of the underlying rocks. The belt is characterized by northeast and east trending ridges underlain by volcanic and intrusive rocks separated by usually narrow and deep valleys underlain by sedimentary rocks and, in many places, occupied by shallow rivers and lakes. The hills rise to about 1,000 feet above sea-level in the western part of the belt and to about 2,000 feet in the eastern part. The elevation of Esker lake is 1,470 feet above sea-level.

Outcrops are numerous in the portion of the belt west of Esker lake and along the southwest coast of Hudson strait.

The last continental ice sheet moved across the eastern and central parts of the Cape Smith-Wakeham Bay belt in a general northerly direction, whereas it moved in a general westward direction in the western part of the belt. This northern part of the Province is characterized by depositional rather than erosional glacial forms. Eskers are numerous and much of the surface of the belt is covered either by boulder fields or by frost-riven bedrock. The last consists of hummocks of large angular blocks which make walking difficult and dangerous.

GENERAL GEOLOGY

The Cape Smith-Wakeham Bay belt consists of younger Precambrian sedimentary, volcanic, and intrusive rocks. These rest unconformably to the south over older (Archean) granites and granitic gneisses, and appear to grade northward into more metamorphosed rocks of the same general age as the rocks of the belt.

Two maps accompany this report. One, the Bilson Lake map, at a scale of 2 miles to one inch, illustrates the geology of a north-south band across the Cape Smith-Wakeham belt in the vicinity and south of Bilson lake. The geology of the Bilson Lake area is typical of that of most of the belt. The second map, at a scale of 16 miles to one inch, shows the boundaries of the belt and some of its more important structural features.

THE BILSON LAKE AREA

A five-man party consisting of two geologists and three assistant-geologists spent two weeks mapping the Bilson Lake area. This area, some 30 miles east of Hudson bay, is approximatively bounded to the west by longitude $77^{\circ}15'$, to the east by a line comprised between longitudes $76^{\circ}40'$ and $76^{\circ}45'$, to the north by Kovic river, and to the south by a line trending parallel to the Korak river and 3 to 4 miles south-east of it. The area includes about 800 square miles. The traverses were spaced 2 to 4 miles apart.

General Geology

The consolidated rocks of the Bilson Lake area may be divided into two series. The older series is composed of moderately folded and metamorphosed sedimentary and volcanic rocks with some gabbro and diorite sills, the whole resting unconformably to the south over granites and granitic gneisses. The second series consists of pillowed lavas with some interbands of sedimentary rocks and sills of gabbro and peridotite.

About 4 miles south of Lanyan lake, more metamorphosed parts of the second or younger series have been thrust over less metamorphosed parts of the same series. The north contact of the belt in general is gradational from quartz-biotite schists to quartz-biotite paragneisses. Such gradation is not readily apparent in the Bilson Lake area. Here, a sharp contact is found between a band of amphibolite and the paragneisses, but quartz-biotite paragneisses are present locally to the south of the amphibolite.

Basal Complex

The rocks south of the Cape Smith-Wakeham Bay belt are for the most part grey-weathering, pink, generally gneissic granite. The gneissic structure, which usually is faint but may be pronounced, trends about S.80°E. In places, the granite grades into granodiorite.

Lower Series

No part of this series was seen resting directly on the basement rocks in this area. But it is known from observations outside the area that the south contact of the belt is an unconformity.

Table of Formations

PLEISTOCENE	Glacial sand and gravel, erratics
LATE PRECAMBRIAN	Gabbro and peridotite
	Pillowed green andesite and basalt Pillowed grey and whitish andesite and plagioclase-rich andesite
	Conglomerate, quartz-biotite schist, mica schist, arkose, granitized sedimentary rocks
	Angular Unconformity
	Diabase dyke
	Gabbro and diorite sills
	Massive, sheared and chloritized lava, some tuffs
	Shale, slate, phyllite with some mica schists, dolomite, iron formation
Unconformity	
EARLY PRECAMBRIAN	Granite and granitic gneisses

The series consists of about equal amounts of dark green or grey, massive, sheared, chloritized lavas and of fine- to medium-grained black or dark gabbroic and dioritic sills, with about 10 per cent of sedimentary rocks. The sedimentary rocks occur at the base of the series and as narrow bands associated with the volcanic and intrusive rocks. They include black shales and slates, black or dark grey phyllites, mica schist, dolomites, ferruginous shales and slates, and iron formation. This last outcrops along the north shore of the small lake southwest of Granite lake. It consists of interbedded chert and hematite-rich chert layers.

In the southeastern corner of the Bilson Lake area, a diabase dyke dipping vertically and striking S.45°W. cuts across all other rocks. Its chilled border

is black and finely intergranular; towards the centre, the rock becomes progressively coarser and is composed of more than 75 per cent of brown augite.

Upper Series

The upper series consists essentially of pillowed lavas with gabbro and peridotite sills and sedimentary rocks. This series rests unconformably over the lower one and its base is marked by a conglomerate.

The central part of the Bilson Lake area is a high plateau underlain by lavas with a few gabbro sills. The plateau is bounded on the southeast by a scarp which, just northwest of the Chukotat river, is up to 800 feet high. It is bounded on the northwest by a fault scarp. This plateau is one of the most striking morphological features of the Cape Smith-Wakeham Bay belt for it extends from Hudson bay to a few miles east of Esker lake. At the latter locality it conforms more or less with the general elevation of the district.

Within the Bilson Lake area, the lava flows are well pillowed green andesite and basalt and grey or whitish andesite and plagioclase-rich andesite. The flows dip north at 25 to 35 degrees. Intercalated with the lavas are a few gabbro sills and minor bands of shales and silstones. A conglomerate of terrestrial origin was found at the base of the series, resting on gabbro on a cliff face about 400 feet above the level of the Chukotat river. The conglomerate consists of rounded fragments of the lower series and of the basement complex cemented by silica and iron oxide. The conglomerate dips 20 degrees to the north, whereas the gabbro on which it rests contains intercalated lenses of sedimentary rock that dip 65-70 degrees to the north. Thus, a major unconformity between the two series is indicated.

North of the plateau, moderately to strongly metamorphosed facies of the upper series have been thrust over less metamorphosed facies. A scarp 600 to 800 feet high marks the trace of the thrust fault, the rocks to the north being more easily eroded than those to the south.

North of the plateau, also, gabbros and lavas grade into amphibolites. The gradation from an intermediate to a higher metamorphic grade is also observed in the mica schists which with arkoses and quartzites are the rocks of sedimentary origin commonly found in that part of the Bilson Lake area. These rocks finally grade into paragneisses, a feature which makes it difficult in general to place a contact between the rocks of the Cape Smith-Wakeham Bay belt proper and the paragneisses to the north. However, in the Bilson Lake area, the contact has been set between the paragneisses and a thick band of amphibolite which forms a conspicuous ridge across the area.

Peridotites were found along the northwest and southeast shores of Bilson lake.

The rocks of the lower series are moderately folded. Those of the upper series south of the thrust fault form a monoclinical structure dipping about 30 degrees north, but the rocks north of it have been more intensively deformed and occur within a synclorium in which peridotite is the youngest rock.

The most important structural feature of the area is the thrust fault bordering the plateau to the north. The fault plane was not seen in the field, but the absence of folding south of the fault and the increasing degree of folding northward

from the fault suggest that the stresses were coming from a general north direction and that the fault plane is dipping north. Schistosity along the scarp about 20 miles east of the Bilson Lake area suggests that the fault plane has a dip in that locality of about 45 degrees to the north.

Economic Geology

Massive sulphides were found at a few localities within the area, particularly in the lower series. The most important sulphide zone is within a sedimentary band between two gabbro sills north of the Chukotat river. Here, lenses of massive pyrrhotite with some chalcopyrite and possibly some pentlandite occur in black graphitic slates.

THE CAPE SMITH-WAKEHAM BAY BELT

General Geology

As the geology of the Bilson Lake area appears to be typical of the geology of most of the Cape Smith-Wakeham Bay belt, only the most important lithological and structural features of the belt as a whole will be outlined in this part of the report.

The pillowed lavas and associated sills and sedimentary rocks of the upper series remain, south of the thrust fault, relatively undisturbed as far east as the general Esker Lake area. But from that area to Wakeham bay, they become progressively more and more complex, folded and probably faulted. A few peridotite and olivine gabbro sills are associated with the pillow lavas in the central and eastern portions of the belt in addition to the gabbro sills already described in the Bilson Lake area.

As mentioned above, the lower series in the Bilson Lake area contains about 10 per cent of sedimentary rocks. This proportion increases eastward from that area. In places, great thickness of sedimentary rocks are found. South of the Povungnituk range, from the basal unconformity to a point roughly one mile north of the eastern end of Nituk lake, a section 10,575 feet thick was measured. This section included 785 feet of volcanic rocks, with slates, phyllites, schists, dolomites, dolomitic shales, quartzite, and ferruginous rocks of various nature. East of the Bilson Lake area, peridotites are found within both the lower and upper series, and there are irregular bodies as well as sills of intrusive rocks.

North of the thrust fault and south of the paragneisses, in the central part of the belt, an important intermediate, basic and ultrabasic complex is present. The main rock types of this complex are diorite, gabbro, anorthositic gabbro, peridotite, norite, and meta-pyroxenite. These occur as thick sills and probably as irregular bodies. The rocks of this complex are underlain by meta-volcanic and meta-sedimentary rocks, the latter grading into a quartz-biotite paragneiss similar to the rock bordering the Cape Smith-Wakeham Bay belt to the north. Within a zone of variable width south of the paragneisses, the rocks are locally cut by granites. A small plug of granite has been found south of Lunar lake and dykes a few inches wide of a muscovite granite have been seen in numerous localities.

The unconformity at the southern contact of the belt was observed north of Grunerite lake where black slates and mica schists rest over a granitic gneiss. The trend of the sedimentary rocks in that locality is about east-west whereas the direc-

tion of the gneissic structure is N.60°E. In that general area, the contact is readily seen from the air owing to the presence near the base of the sedimentary rocks of a rusty-weathering schist consisting of about 90 per cent grunerite and 10 per cent garnet. The garnet crystals measure, on the average, 2 to 3 inches in diameter.

The unconformity between the lower and upper series has been traced with the help of aerial photographs west of the Bilson Lake area as far as Hudson bay and east as far as Chukotat lake. It has been mapped south of Esker lake along the north shore of the Little Povungnituk river.

The thrust fault described in the Bilson Lake area extends west of that area to Hudson bay and east as far as the area north of Wakeham lake. A fault scarp is visible from Hudson bay to a few miles northeast of Esker lake. East of that area, the scarp is much less noticeable, but it can be traced with the help of aerial photographs. It has been located in the field to the north of Raglan lake. In addition to this major break, many cross-faults with horizontal displacements varying from a few feet to a few miles have been seen in the field. None of these are indicated on the Cape Smith-Wakeham Bay map accompanying this report.

Economic Geology

Zones of sedimentary rocks replaced by massive sulphides and of gabbros with disseminated sulphides are quite widespread within the belt, particularly within the lower series in the central and western parts of the belt and within the upper series in the general area between Nuvilik lake and Raglan lake in the central-eastern part of the belt.

Within the lower series, the most striking gossans are found just north of the Chukotat river between Knight Harbour and Chukotat lake and in the area south of Esker lake a little distance north of the Little Povungnituk river. These mineralized zones are for the most part in sedimentary rocks near contacts with gabbros. Mineralized sheared zones in lavas have also been found. The most abundant sulphide is pyrrhotite, with which are associated pyrite, chalcopyrite and, in places, pentlandite.

The most important nickeliferous zones in the belt, those between Nuvilik and Raglan lakes, are within bands of black slates intercalated between a gabbro sill and a peridotite sill near the peridotite contact, or in the gabbro at the contact with peridotite.

A preliminary examination of the mineralized rocks found in these zones shows that the important nickel mineral, rarely visible in a hand specimen, is pentlandite. Chalcopyrite appears to be the main copper mineral. Most of the ore zones found to date grade 1 to 3 per cent nickel and about 2 per cent copper, but sections grading up to 7 per cent nickel have been found in drilling.

Zones rich in sphalerite and galena occur within sedimentary rocks west of Nuvilik lake.

CONCLUSION

It is not possible from this preliminary study done by the Quebec Department of Mines in the Cape Smith-Vakeham Bay belt during the summer of 1957 to assess to value of this area as a source of base metals. However, the work done to date by the mining companies has outlined some nickel-copper zones of good grade, and our work has shown that interesting mineralized zones occur in a large number of localities within the belt. These discoveries indicate that a serious study of the belt is warranted, even though the costs of exploration and drilling are very high in this remote part of the province.

Also, one sector of the belt has not been investigated as yet. This is the central portion north of the thrust fault where the complex of intermediate, basic, and ultrabasic rocks occurs. The small amount of work done in that part of the belt last summer was devoted mainly to locating the northern contact of the belt. Outcrops are relatively scarce in this area and only minor sulphide zones were seen. However, from the nature of the rocks, in particular the large proportion of ultrabasic units present, it is suggested that this area merits detailed investigation.
