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PRELIMINARY REPORT ON SURPRISE LAKE AREA, ABITIBI-EAST COUNTY

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PRELIMINARY REPORT

ON

SURPRISE LAKE AREA

ABITIBI-EAST COUNTY

BY

A. N. DELAND

QUEBEC
1953

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Abitibi-East County

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INTRODUCTION

Location

The Surprise Lake area, examined and mapped by the writer during the summer of 1953, lies in Abitibi-East county, about 240 miles northwest of Quebec city and some 35 miles southwest of Chibougamau lake. It is bounded by latitudes 49°15' and 49°30' North and by longitudes 74°45' and 75°00' West. The map-area includes parts of Druillettes, Hazeur, Langloiserie and Pambrun townships, and comprises nearly 200 square miles. The adjoining areas to the east and to the north were mapped, respectively, by Grenier (1) and Lyall (2) in the summer of 1952.

Means of Access

The area is easily accessible. The St. Félicien-Chibougamau highway passes about 30 miles east of the map-area. Several aviation companies with seaplane bases located near the highway provide aerial transportation. The flight distance to the map-area ranges between 40 and 60 miles depending on the location of the air-base used.

Windy, Caopatina and Surprise lakes offer excellent landing places, and all parts of the area are easily accessible by canoe from one or other of these lakes. There are three short portages along Opawica river, which links Caopatina and Windy lakes. A single longer portage of 6,500 feet offers a second, more direct although more laborious, passage between these two lakes. There is but one short portage between Caopatina and Surprise lakes. The long bays of Surprise lake were very helpful in covering the southern part of the area.

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(1) GRENIER, Paul E., Preliminary Report on Gamache Area, Abitibi-East County; Que. Dept. Mines, P.R. No. 284, (1953).

(2) LYALL, H.B., Preliminary Report on the Brongniart-Lescure Area, Abitibi-East County; Que. Dept. Mines, P.R. No. 285, (1953).

Topography

The topography of the map-area is typical of this part of the Canadian Shield. The area is only 20 miles or so west of the height-of-land that separates the Hudson Bay and St. Lawrence River drainage basins. About half the area is covered by lakes, and much of the remainder is swampy or low ground.

The general altitude is about 1,200 feet above sea-level, but the local relief is of a small order. Most of the few scattered hills rise only 100 feet or so above the surrounding country. A notable exception is the hill about one mile from the western boundary and a similar distance north of the centre line of Langloiserie township. This hill, on which the Department of Lands and Forests has erected an observation tower, rises 550 feet above the level of Surprise lake within a distance of a mile.

The local relief in that part of the area north of Surprise lake is considerably less than in the south. This is probably due to the underlying gneissic rocks south of the lake being more resistant than the lavas and sedimentary rocks that form the bedrock in the northern part of the area.

Pleistocene and Recent deposits, which mantle much of the area, have modified the drainage to some extent but the basic topography comparatively little.

The area drains northward into Opawica river and thence westward and northward into James bay, through Waswanipi and Nottaway rivers.

GENERAL GEOLOGY

General Statement

All the consolidated rocks of the map-area are of Precambrian age. The northwestern half is underlain by an assemblage of typical Keewatin-type rocks. These consist mainly of altered lavas (basic to acidic in composition) and sedimentary rocks, with pyroclastics and intermediate to basic intrusives making up the remainder. The southern part of the area is underlain by gneissic granite which forms two separate belts. The remaining rocks consist of hornblende and biotite gneisses and schists which the writer at present believes to be only more highly metamorphosed facies of the Keewatin-type lavas and sedimentary rocks, into which they grade transitionally. These gneisses and schists form belts that are the westward continuation of ones mapped farther to the east by Gilbert (1) and Grenier (2) who, respectively, tentatively classified them as "Grenville-type" and "rocks of undetermined age". A few diabase dykes, probably of late-Precambrian age, cut the gneissic granite in the southeastern corner of the area.

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(1) GILBERT, J.E., Preliminary Report on Rohault Area, Abitibi-East and Roberval Counties; Que. Dept. Mines, P.R. No. 267, (1952).

(2) GRENIER, Paul E., op. cit.

Table of Formations

CENOZOIC	Recent and Pleistocene	Sand, gravel, glacial till
Great unconformity		
LATE-PRECAMBRIAN	Keweenawan (?)	Diabase dykes
Intrusive contact		
EARLY-PRECAMBRIAN		Gneissic granite, pegmatitic granite, aplite
	Intrusive contact	
	Keewatin (?)	Biotite paragneiss Hornblende gneiss Amphibolitized lavas Sedimentary rocks Gabbro and diorite sills Basalt and andesite, some rhyolite, a few pyroclastics

Keewatin (?)

About two-thirds of the map-area is underlain by Keewatin-type rocks.

These consist mainly of basaltic and andesitic lavas and associated sedimentary rocks. The lavas form three east-west trending belts, the sedimentary rocks two intervening belts. Rhyolitic lava crops out in one small area along the northern boundary. Small exposures of pyroclastic rocks are found here and there interstratified with the lavas. Concordant bodies of gabbro and diorite are widely distributed throughout the belts of lava; all but a few of these are too small to be shown separately on the accompanying map.

More highly metamorphosed facies of these lavas and sedimentary rocks are described separately in this report. The lavas, in places, grade eastward into amphibolitized lavas and these, in turn, into hornblende gneisses. Similarly, with higher grade metamorphism, the sedimentary rocks become biotite paragneiss. It is stressed, however, that no definite boundaries exist between these various facies; the changes in rock types are transitional, and the limits indicated on the accompanying map are arbitrary.

Basalts and Andesites

These rocks are exposed in three east-west trending belts. The broadest band, about five miles wide, underlies the northernmost part of the map-area and is the extension of similar rocks mapped to the east and north by

Grenier (1) and Lyall (2), respectively. Two much narrower, parallel belts, a mile or less wide, lie in the west-central part of the area.

The andesitic and basaltic flows are almost everywhere interstratified and so cannot be shown as separate units on the accompanying map. The intermediate flows are more abundant than the basic ones. Both have been considerably metamorphosed and are generally slightly schistose.

A dark green weathered surface is typical of both types of flows. On fresh surface, the basalt is from dark green to black whereas the andesite is somewhat lighter in colour. These rocks are fine- to very-fine-grained and much altered, and it is thus difficult to identify accurately their mineralogical compositions. Both types seem to be composed largely of grey feldspars and hornblende, with the basaltic rocks carrying a greater percentage of amphibole; development of chlorite is a prominent feature.

Pillow lavas are common and well exposed along the shores of Windy lake. The structure is best developed in the andesitic flows. Most of the pillows are about one foot long although some are as much as six feet. Some have been stretched and badly deformed, but most of them could be used for top determinations. Pillows with vesicular borders are well exposed on the central islands of Windy lake.

In the more massive varieties of lava, some rounded or slightly elongated amygdules, up to one-quarter inch in diameter and filled with broken quartz, are preserved. At a few places the massive, coarse-grained andesite has good porphyritic texture. Most of the phenocrysts, which generally make up from ten to twenty per cent of the rock, have been stretched and deformed, although here and there a rectangular one is preserved. The phenocrysts are composed of creamy feldspar and may be up to an inch and a half long.

Rhyolite

A narrow belt of rhyolite lava is well exposed west of Windy lake and close to the northern boundary of the map-area. It is the extension of the band of similar rock mapped to the north by Lyall (3). The rhyolite flows are easily differentiated from the andesites and basalts. The rock weathers a distinctive cream or very light grey; on fresh surface it is light grey with a greenish or bluish tinge. Grey feldspars compose more than 90 per cent of the rock. Small phenocrysts of glassy quartz are scattered throughout the aphanitic groundmass. These flows are generally massive and resistant to weathering. Suggestions of pillow structures were found but these are nowhere as well developed as in the andesites.

Pyroclastics

A few scattered exposures of tuff and agglomerate are found here and there interstratified with the lava flows, but they are not indicated separately on the accompanying map.

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(1) GRENIER, Paul E., op. cit.
(2) LYALL, H.B., op. cit.
(3) LYALL, H.B., op. cit.

The tuffs are fine-grained and schistose, and break into slabs parallel to the bedding. They are creamy white to black, depending on their composition which varies from feldspathic to basic. The tuffs are finely laminated, indicating that they are waterlain.

Exposures of black-weathering agglomerate are found close to where the Druillettes-Hazeur township line meets the northern boundary of the map-area. Up to half the rock consists of feldspathic fragments, from one-quarter inch to four inches in length, that have been stretched parallel to the east-west schistosity. The fragments are set in a dark grey groundmass that is probably the equivalent of a basic tuff. No bedding was seen in these rocks.

Another exposure of agglomerate crops out at the tip of the long point extending from the east shore of Windy lake. Here, a band about 100 feet wide is bounded on the north by schistose basalt and on the south by pillowed andesite.

Gabbro and Diorite

Widely distributed throughout the lavas and intimately associated with them are sills and lens-like bodies of gabbro and diorite that, wherever observed, are conformable with the flows. These rocks were nowhere seen in contact with the sedimentary rocks. Most of these intrusive bodies are of small size; the largest single unit, about 1,500 feet wide and more than two miles long, is exposed along the central part of Windy lake. A few other lenticular masses are shown separately on the accompanying map; there are, in addition, many small sills from ten to twenty feet wide.

One type of these rocks is dark grey to black and massive, with a characteristic rough weathered surface. The rock has a good igneous texture and is fine- to medium-grained. It consists mainly of hornblende and grey feldspars and so is closely similar in composition to the surrounding lavas.

A fine-grained schistose variety can easily be confused with the medium-grained schistose andesites and basalts.

Sedimentary Rocks

Two separate belts in the central part of the map-area are underlain by sedimentary rocks. These belts intervene between the three bands of volcanic rocks described previously. Both trend slightly south of east. The northern zone, less than a mile wide at the western boundary, broadens eastward to a width of three and a half miles at Caopatina lake. The exposed part of the southern band is more constant in breadth, being about two and a half miles wide.

No unconformable relationship was noted between the sedimentary rocks and the adjacent volcanics. It appears that the two are interstratified and of the same general age.

These sedimentary belts consist largely of a well bedded, regular assemblage of alternating light coloured feldspathic rocks and dark slates. The individual layers are from three to six inches thick. Differential weathering

has accentuated the banding even more, with resistant feldspathic layers standing five inches higher than adjacent softer slates. The rock of the feldspathic beds is usually massive, very fine-grained, and similar in hand specimen to the rhyolitic lava. The slaty layers are well laminated and fissile, and the rock is fine-grained and black.

South of Caopatina lake a few narrow bands of magnetite-rich sediments were found interstratified within this assemblage.

Conglomerate is well exposed on some of the islands in the southern part of Caopatina lake. The groundmass is fine-grained and varies from a light grey feldspathic rock to a darker hornblende-rich rock. The pebbles usually make up about one-quarter of the rock but in one exposure they account for 60 per cent. Most of them are from one to two inches long but some are as much as six inches long and three inches wide. Some of the pebbles are feldspathic, others are rich in hornblende. This conglomerate occurs along a zone of shearing and many of its original characteristics have been obliterated. The pebbles have been stretched and are now elongated parallel to the schistosity; in places the boundary between the fragments and the groundmass is not sharp. No evidence of bedding was seen in any of the exposures.

The sedimentary rocks of both belts grade eastward into biotite paragneiss. The series of exposures along the south shore of Caopatina lake show this transition very well. The sedimentary assemblage along the southwest part of the lake displays no bands that are rich in biotite, although scattered flakes of this mineral have developed in these rocks. Here, too, gneissic structure is lacking. Farther eastward, along the central part of the lake, biotite becomes concentrated within certain bands. Still farther eastward, bands rich in biotite are just as abundant as feldspar-rich layers. Near the eastern boundary of the map-area the sedimentary rocks have become completely changed over to biotite paragneiss. This rock is described separately in a subsequent section of this report.

Amphibolitized Lavas

The rocks classed as amphibolitized lavas are diversified. The group includes some lavas in which the development of long needles of hornblende is very pronounced, some amphibole schist and, finally, amphibole gneiss. These rocks are believed by the writer to represent an intermediate stage in the transformation of typical Keewatin-type lavas into true hornblende gneiss.

Four bands of these rocks have been mapped separately on the accompanying preliminary map, namely: at the eastern boundary of the map-area, south of Caopatina lake; at the outlet of Surprise lake; and two belts extending westward from the southern part of Surprise lake to the boundary of the area.

The most abundant type of rock is similar, in many respects, to the basalts and andesites described previously. Pillow, vesicular and amygdaloidal structures are, however, noticeably absent, and the colour of the rock is slightly darker. The most distinguishing feature, though, is that the amphibolitized lava has well developed, long, thin, black needles of hornblende which stand out conspicuously on the greenish weathered surface. Although most of the needles are about half an inch long, they are everywhere randomly oriented.

In some places the hornblende needles are much smaller, and abundant enough to make up 90 per cent of the rock. The needles are much better aligned and the rock is termed 'amphibole schist'. This type is best exposed at the falls at the outlet of Surprise lake, and there are other good exposures in the scuthwest corner of the map-area, along the trail leading to the forest observation tower.

Here and there within the belts of this group of rocks are exposures of coarse-grained amphibole gneiss. The rock is black and heavy, and individual mineral grains range up to half an inch in diameter. It is composed essentially of hornblende and plagioclase, the former predominating. This amphibole gneiss is probably a more metamorphosed facies of the intrusive bodies of gabbro and diorite found throughout the belts of lavas.

Hornblende Gneiss

Hornblende gneiss outcrops in two narrow, east-west trending belts - a short one northeast of Surprise lake, and a longer one traversing most of the map-area south of the main body of that lake. There are, in addition, a few remnants within the bodies of gneissic granite, and occasional bands of it are found interstratified with the biotite paragneiss.

The hornblende gneiss is black, fine- to medium-grained, and has well developed gneissic structure. The rock consists essentially of hornblende, with smaller amounts of grey feldspars (up to 10 per cent) and garnet (up to 15 per cent). Lenses of quartz paralleling the gneissic structure are common; they were probably injected during the period of intrusion of the gneissic granite.

The rock of both belts grades westward into the amphibolitized lavas described above. This hornblende gneiss is believed to be a highly metamorphosed facies of the lavas, with the amphibolitized lavas forming a transitional type between the two.

Biotite Paragneiss

Biotite paragneiss forms the eastward extension of the two belts of sedimentary rocks previously described and underlies, as well, a narrow belt immediately north of the band of hornblende gneiss in the southern part of the map-area.

The rock consists essentially of biotite, creamy grey feldspars and quartz. Relic bedding is indicated by the very regular alternation of bands rich in biotite with others rich in light-coloured minerals. In a few places the rock contains reddish garnet (up to 20 per cent) and this mineral, where present, is concentrated along certain layers, further accentuating the already pronounced banding. The rock is fine- to medium-grained and schistose; in some exposures an original laminated structure is reasonably well preserved.

The biotite paragneiss is believed to be the strongly metamorphosed equivalent of the sedimentary rocks described previously.

Intrusive Rocks

Gneissic Granite, Pegmatitic Granite and Aplite

About one-third of the map-area is underlain by granitic rocks that are intrusive into the Keewatin-type formations. They are found entirely in the southern part of the area, where they form two separate zones - one along the southern boundary, the other cutting across the central part of Surprise lake.

About 90 per cent of these rocks consists of grey gneissic granite; the remainder is pink pegmatitic granite and aplite which are only a late-stage differentiate of the main intrusion.

The gneissic granite is composed essentially of feldspars, quartz, biotite and hornblende, with secondary epidote and chlorite. In most of the rock, biotite is the dominant mafic mineral, although in places biotite and hornblende are equally abundant, and occasionally the latter is more plentiful. Disseminated sulphides are present in places, especially near the contaminated borders of the intrusive masses. The rock is generally medium-grained, though some facies are coarser. Gneissic structure, which is the result of the segregation of the various rock forming minerals into layers, is generally well developped.

The pink granite facies is best exposed on the southwest tip of the large island in Surprise lake. It is usually in the form of either coarse-grained pegmatitic granite or of fine-grained aplite dykes. The pegmatitic facies occurs as irregular lenses and blebs in the grey granite. It consists essentially of orthoclase, plagioclase and quartz with, in places, muscovite and small specks of magnetite and pyrite. The aplite is fine-grained and has a sugary texture.

Diabase

Four separate exposures of diabase occur in the southeastern corner of the map-area. Three of these line up along the direction N.30°E., and are probably portions of one dyke which could well be the continuation of one mapped by Grenier (1) in the area to the east. The dyke is from 150 to 300 feet wide, and in most places forms a resistant ridge.

The rock of these dykes is black, massive and heavy, and has a characteristic ophitic texture. It consists essentially of feldspars, hornblende and pyroxene. It varies from medium-grained near the centres of the dykes to fine-grained close to the contacts.

These dykes intrude the gneissic granite, and cut across the structure of the older rock. The diabase is the youngest consolidated rock found in the map-area, and may be of Keweenawan age.

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(1) GRENIER, P.E., op. cit.

C E N O Z O I C

The greater part of the map-area is mantled with glacial till of varying thickness. This consists mostly of coarse gravel, with occasionally finer gravel and sand. No clay was seen. The sand deposits are numerous, but they are small and scattered. The greatest extent of sand and gravel occurs along the northeast shore of Surprise lake and on the eastern part of the long island in that lake.

Low drumlin-like ridges extend southwestward into the northeast part of Caopatina lake. They are elongated in a direction between S.30°W. and S.40°W. Glacial grooves and striae in several parts of the map-area indicate that the ice moved along the direction S.35°W., and stoss and lee topography show that the last movement of the ice-sheet was southwestward.

STRUCTURAL GEOLOGY

Folds

The Keewatin-type lavas and sedimentary rocks and their metamorphosed equivalents all have a general east-west trend. The schistosity seems everywhere to be parallel to the flows, bedding and banding. Throughout the map-area these formations dip steeply to vertically, and it is evident that they have been tightly folded. The locations of the fold axes can, however, be little more than speculated upon.

In the northern belt of lavas, pillow structures indicate that the flows face south. As the formations dip steeply north, however, they must here be overturned. Farther southward, in the northern belt of sedimentary rocks and biotite paragneiss, most of the beds dip south, but no top determination was obtained in these rocks.

The gneissic structure in the granites of the southern part of the map-area also has a general east-west trend. Near the borders of the intrusive bodies it is regular and everywhere parallels the contact, but away from the margins it tends to be more irregular.

Shear Zones

The sedimentary and volcanic rocks are sheared in many places particularly at the contact between lava flows and gabbro-diorite intrusives. Most of the shear zones trend easterly, parallel to the strike of the formations; they vary in width from 10 to 50 feet. Only one shear zone was noticed in the gneissic granite and it strikes somewhat east of north.

No evidence of major faulting was found in the map-area.

Most of the joints mapped dip very steeply or vertically; they are best developped in the areas underlain by granite.

ECONOMIC GEOLOGY

General Statement

During the past several years considerable prospecting has been carried out in this and nearby map-areas. During the summer of 1951, with the discovery of showings in the Brongniart-Lescure area (1) to the north, activity in this map-area increased, and most of the northern half has since been staked. Most of the development work carried out so far has consisted of trenching and blasting. Although, as far as the writer is aware, no discovery of importance has as yet been made in the area, conditions appear favourable for the finding of deposits of interest.

Sulphide mineralization is widespread throughout the lavas and sedimentary rocks and, to a lesser extent, in the hornblende and biotite gneisses. Disseminated sulphides, mainly pyrite, are very common in the gabbro-diorite intrusive bodies.

Most of the observed shear zones show at least some sign of mineralization, pyrite and chalcopyrite cheifly. In many of them hydrothermal action has strongly carbonatized and silicified the rock. Many of the most favourable looking shears occur at the contacts between gabbro-diorite bodies and the intruded lavas. Assays of samples taken from three such zones gave traces of copper and silver. Some of the stronger shears and mineralized exposures are indicated on the accompanying map.

Bands of talc up to two inches wide were found in one exposure on the west shore of Windy lake. They occupy the noses of drag folds in schistose andesite.

A few narrow beds of magnetite-rich rock occur in the sedimentary series on the south shore of Caopatina lake. An assay of this material gave almost 40 per cent iron. The paucity of exposures in this part of the area is a hindrance to prospecting, but it is of interest to note that difficulty was encountered in running compass lines, due to strong magnetic attraction on the needle.

Deposits of sand and gravel are abundant throughout the area. These materials are suitable for road and railway construction and other building purposes.

Recommendations

The area is a favourable one in which to prospect for mineral deposits.

As most of the observed mineralized zones occur in the lavas, gabbro-diorite intrusives, and sedimentary rocks, it is believed that these formations warrant more attention from the prospector than do their more metamorphosed equivalents the hornblende and biotite gneisses, although the latter rocks should not be neglected.

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(1) LYALL, H.B., op. cit.

The northern belt of lavas, particularly in the vicinity of Windy lake where there are numerous mineralized shear zones, should be carefully investigated. The sedimentary rocks between Caopatina and Surprise lakes also carry sulphide mineralization and appear to be worthy of the prospector's attention. The possibility of finding concentrations of iron ore in these rocks immediately south of Caopatina lake should not be overlooked.