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CANADA
DEPARTMENT OF MINES AND RESOURCES
MINES AND GEOLOGY BRANCH

GEOLOGICAL SURVEY
PAPER 39-3

PRELIMINARY REPORT

MACKAY LAKE AREA, SASKATCHEWAN

BY
M. L. Keith

OTTAWA
J. O. PATENAUDE, I.S.O.
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
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Illustration

Preliminary map—MacKay Lake, Saskatchewan.

MacKay Lake Area, Saskatchewan

LOCATION AND ACCESS

The district examined comprises an area of about 170 square miles, immediately north of Lac la Ronge. Limits of the map are longitude 104° 45′-105° 00′ and latitudes 55° 15′-55° 30′. Bear Island, near the southwest corner of the map-area, is 17 miles by water from La-Ronge post office, on the west shore of Lac la Ronge. The settlement of Stanley is 8 miles east of the eastern boundary.

Stanley is 115 miles northwest of Flinflon, and can be reached via Amisk Lake and Sturgeon-weir and Churchill Rivers. La-Ronge is 140 miles north of the railway at Prince Albert. A good motor road extends from Prince Albert, 65 miles north, to the south end of Montreal Lake. From this point Lac la Ronge may be reached by water via Montreal Lake and Montreal River, although this route has been very difficult for the past few years owing to the low water-level in the river. An extension of the motor road is projected, from the south end of Montreal Lake to Lac la Ronge, and construction was completed as far as the north end of Montreal Lake in the autumn of 1938. At present the most convenient way of reaching the area is by aeroplane.

From Lac la Ronge all points in the area may be conveniently reached by canoe. The easiest route is from Waden Bay through Lynx Lake to Sulphide Lake, involving four portages with a total length of ½ mile. A second route begins northeast of Bear Island and passes through two, small, unnamed lakes between Lac la Ronge and Sulphide Lake. Over this route there are three portages, with a total length of 1½ miles. From Stanley there is a circuitous canoe route to Hebden Lake, in the northeast corner of the area.

GENERAL CHARACTER OF THE REGION

MacKay Lake area lies entirely within the Canadian Shield, the southern boundary of which passes through Lac la Ronge. The relief is low, but a few granite ridges rise as much as 300 feet above the level of the lakes. The northeasterly trend of the lakes and ridges is controlled by the structure of the rocks and by the direction of glacial movement.

With the exception of a small area between Contact and Hebden Lakes, and a still smaller area north of Hebden Lake, both of which are covered by sand and boulder till, the rocks over most of the region have only slight overburden, and good exposures are abundant. Muskegs are fairly common, some attaining a length of 1 mile and a width of as much as ½ mile, but these were dry enough during the season of 1938 to be crossed on foot.

A good stand of poplar and birch (average diameter 7 inches, maximum 12 inches) was encountered south of the tip of Waden Bay. There is a

second considerable stand (maximum diameter 10 inches) immediately west of the northern end of Sulphide Lake. The conifers have been repeatedly destroyed by fires, but there is some good spruce on the main peninsula of Sulphide Lake. A few large spruce and pine, over 2 feet in diameter, were observed between Hebden Lake and the chain of lakes immediately to the southeast. The younger spruce here have an average diameter of about 8 inches. There have been more recent fires around MacKay Lake and no stands of timber remain.

GENERAL GEOLOGY

Consolidated rocks of the area are all Precambrian. A chronological subdivision follows:

Post-Wekusko.....	Quartz-diorite porphyry Granitic intrusives: granite, syenite, pegmatite Basic intrusives: hornblende gabbro, anorthosite
Wekusko group....	Sediments: micaceous schists, quartzite, greywacke, garnet-gneiss Volcanic rocks: hornblende schist, altered basalt, andesite, and rhyolite; some intercalated sediments

Within MacKay Lake area there is no evidence of an unconformity between the volcanic rocks and the sediments. The structure suggests that the sediments to the southeast overlie the main volcanic series. The volcanic rocks include a considerable amount of sedimentary material, particularly south of MacKay Lake, and around and northwest of Hebden Lake. Most of the intercalated sedimentary bands in these areas are small.

Volcanic Series

Regionally there is no sharp separation of types, although rhyolitic lavas are more abundantly developed to the northeast, and there are some finely bedded grey tuffs southwest of Sulphide Lake. The most widespread rocks are dark, altered equivalents of basalt and andesite, commonly strongly foliated, and with original structures and textures destroyed. In the few cases where ellipsoidal structure is preserved, it almost invariably strikes and dips parallel to the foliation. The typical basic volcanic rock is a fine-grained hornblende schist with minor quartz, biotite, and intermediate plagioclase. In some specimens the feldspars are partly altered around their borders to fine-grained white mica and epidote, but on the whole the rocks are fresh. Soft, green chlorite schists are comparatively rare. The rhyolites are fine-grained, both massive and foliated rocks that weather brownish grey to buff, and are glassy brown to grey on fresh surfaces. They consist essentially of quartz, muscovite, and oligoclase, in order of abundance, and usually contain minor microcline and biotite.

A narrow band of agglomerate follows the eastern side of Contact Lake, but does not reach Hebden Lake. From the northeast arm of MacKay Lake a series of distinctive trachyte flows can be followed northward to the northern boundary of the area. These rocks are characterized by laths of andesine (up to three-quarters inch in length) in a dark, fine-grained, foliated groundmass of biotite, hornblende, and quartz, with minor plagioclase and orthorhombic pyroxene.

Adjacent to granite contacts, and in some places away from contacts, the hornblende schist becomes very coarse grained, and biotite disappears in favour of hornblende and pyroxene. In extreme cases a coarse, feather amphibolite is developed, with hornblende crystals up to 6 mm. in diameter.

North of the central part of MacKay Lake a dark contact rock was encountered, which consists of radiating masses of amphibole and pyroxene in a coarse-grained, cordierite-quartz groundmass. Cordierite forms about 60 per cent of the rock and gives it a smoky blue colour on fresh surfaces.

Sedimentary Series

The most extensive sediments are in the southeast, along and immediately north of the north shore of Lac la Ronge, where there is a series of parallel bands of clastic rocks and injection gneiss in the granite. There are smaller areas of sedimentary rocks west of Lake A and MacKay Lake, and northeast of MacKay Lake. The predominant rocks are medium- to fine-grained arkose, greywacke, and micaceous quartzite. Some arkose conglomerate was encountered on the islands in Lac la Ronge, in the extreme southeast corner of the area. Narrow bands of slate occur northeast of Bear Island.

The most widespread rock is a rusty, grey biotite schist, consisting essentially of quartz, oligoclase-andesine, and brown biotite. In places hornblende and garnets have developed in bands. This latter characteristic, and the generally lighter colour of the sedimentary schists, are the most useful criteria for distinguishing these rocks from the volcanic rocks in the field. The sediments where most greatly altered are easily confused with the lavas. To the north the sediments intercalated with the volcanic rocks are commonly garnetiferous gneiss.

Basic Intrusives

The basic intrusives are found around the border of the Lake A-Contact Lake granite mass, and also at the borders of granite bodies intruding volcanic rocks north and west of MacKay Lake. The principal types are hornblende gabbro, gabbro-diorite, and anorthosite. In places the first two of these grade into granite, and this fact and their positions suggest that they may be a border phase.

The typical rock is a hornblende gabbro, composed of medium- to coarse-grained labradorite, hornblende, pyroxene, and biotite, with accessory ilmenite and magnetite, and in some specimens a minor amount of secondary zoisite. Some of the more highly altered phases are easily confused with the coarse, metamorphosed basic volcanics, but the latter can usually be distinguished by their foliation, by the tendency of the hornblende to segregate into bunches, or in other cases by a characteristic "feather amphibolite" texture. The gabbroic rocks, on the other hand, have an even-grained, granitic texture and are not foliated. They are mottled grey on weathered surfaces.

Anorthosite is developed in a relatively small area on the islands and eastern shore of Lake A. This is a very coarse-grained rock (feldspars to 5 mm. diameter), made up of labradorite (about 90 per cent), pyroxene, hornblende, and biotite, with accessory ilmenite. No contacts were observed between this rock and the adjacent granite to the east.

Granitic Intrusives

Granitic intrusives constitute almost half of the exposed rocks of the area. There is no conclusive evidence that the various masses are of different ages, but the gneissic granite east of MacKay Lake includes blocks of an earlier, pink, massive granite, and some of the granites are texturally and mineralogically distinct from others. In the southwest the intrusives are mostly fairly coarse, pink, biotite-hornblende granites, characteristically massive away from contacts, and becoming more gneissic adjacent to the intruded sediments. North of Bear Island there is a coarse, grey, porphyritic granite, low in quartz, and containing orthoclase phenocrysts up to one inch in length. In the extreme southeastern corner of the area there is a dark, gneissic quartz diorite. The above rocks are cut by fairly abundant pegmatite dykes, which usually strike normal to the gneissosity of the granite.

The Lake A-Contact Lake mass and the granites north of MacKay Lake are not noticeably distinct from those on Lac la Ronge, but are characterized by their border of gabbroic rocks, as previously described, and they grade in places to pinkish grey syenite.

The granites northeast of MacKay Lake are mostly pink and gneissic, and vary from fine-grained, aplitic types to coarse, porphyritic granite. One thin section of the fine-grained phase shows the principal feldspar to be oligoclase, with only minor orthoclase.

The stock between the arms of Hebden Lake and extending to the east is a medium-grained granite containing 10 to 15 per cent muscovite. This rock is strongly sheared around its borders, and in these sheared border phases aplite dykes and quartz veins have been disrupted, and their fragments, ovoid in cross-section, give the rock on a flat outcrop surface the appearance of a conglomerate.

Quartz-Diorite Porphyry

Elongated stocks and dykes of quartz-diorite porphyry cut most of the other rocks of the region. No porphyry dykes, however, were observed in the Lake A granite, or in the granites to the southeast. This does not necessarily imply that these granites are younger than the porphyry. West of Hebden Lake some porphyry bodies cut across the contact between granite and volcanic schist. Very few porphyry dykes were seen in the sedimentary schists and gneisses. The porphyries occur principally in the volcanic rocks around and northeast of Sulphide Lake, around the northern rim of the gabbroic border of the Lake A granite, and along the granite contact west of Hebden Lake.

On the main peninsula of Sulphide Lake a light grey porphyry, representative of most of the rocks of this group, cuts an older, dark porphyry characterized by phenocrysts of zoned, acid plagioclase in a groundmass of quartz, plagioclase, and greenish brown biotite. The younger porphyry contains phenocrysts of quartz and oligoclase-andesine (not zoned), in a groundmass of quartz, plagioclase, and brown biotite. This rock weathers pinkish buff except for the phenocrysts, which are usually white on weathered surfaces. Some of the porphyries are foliated and so altered that they are easily confused with the acid volcanic rocks. The porphyry

intrusions had very slight contact effect on the intruded rocks, although some of the larger bodies contain horses of coarse, hornblende-biotite schist, similar to that developed by contact action of the granite on the basic lavas. There is usually a concentration of pyrite and carbonate in the rocks immediately adjacent to the porphyry.

MINERAL DEVELOPMENTS

Some prospecting was done in MacKay Lake area as early as 1918, principally for base metal deposits, and eleven claims were staked along the line of small lakes southeast of Waden Bay. They were not under active development in 1938, and no information was available as to the nature of the discoveries. In 1929 some prospecting was done for base metals around Sulphide Lake and to the northwest.

More recently interest in the area was revived by the discovery, in April 1937, of a small, gold-bearing quartz vein, on the north arm of Sulphide Lake. A total of 179 claims were staked along the belt of volcanic rocks extending from Lynx Lake to Hebden Lake, and active development was in progress on several groups of claims in the summer of 1938.

S and O Group

The first important discovery of gold was made on claim No. 3 of this group, and staking was done in June 1937. A considerable amount of surface trenching and stripping and a total of 712 feet of diamond drilling, principally on No. 3 claim, have been done.

At the main showing (No. 3 claim), on the northwest side of the northern central peninsula of Sulphide Lake, narrow quartz veinlets occur in quartz diorite porphyry, adjacent to inclusions of altered lava, near the contact of the porphyry with basic lavas on the northwest. The inclusions are 2 to 5 feet in width and consist of dark biotite schist with large cubes and masses of pyrite. The porphyry contains disseminated pyrite and minor sphalerite, and, according to the available assays, some gold. In thin section the porphyry is seen to consist of phenocrysts of fresh oligoclase in a groundmass of plagioclase and minor quartz, with carbonate and chlorite developed in fractures and around boundaries of the other minerals. Most of the porphyry contains abundant small cubes of pyrite.

At the discovery pit on the lake shore a biotite schist inclusion bends sharply through an angle of 65 degrees. An indistinct foliation in the porphyry parallels the bent inclusion, as also do quartz veinlets in the foliated porphyry, and the main vein broadens in the bend to a thickness of one foot. There is also a marked concentration of pyrite, sphalerite, and chalcopyrite at this point, and the highest obtained gold assays occur in the vein where it widens at the bend. Exploration trenches extend for 350 feet northeast of the discovery pit and expose several biotite schist inclusions. Bordering these there are discontinuous quartz veinlets, mostly less than 3 inches in width and none longer than 10 feet. Some small quartz gashes occur away from the biotite schist inclusions.

Selected specimens from the main pit were examined in polished section. These showed very coarse pyrite, and a smaller amount of

sphalerite around and within pyrite. The sphalerite contains minute laths of chalcopyrite, observable only under high magnification. Several small gold blebs are associated with sphalerite in irregular fractures in the quartz.

On the same group of claims, across the peninsula to the east of the showing described above, a large shear zone in volcanic rocks is exposed by an old prospect trench 200 feet long. The dark volcanic rocks are strongly sheared in a zone 150 feet wide. The sheared rocks weather rusty brown and contain scattered stringers of pyrrhotite and one central vein of pyrrhotite 3 feet wide. In section, under polarized light, a specimen from this central vein was observed to consist of pyrrhotite (to about 70 per cent), in a gangue of quartz and fragments of the wall-rock. Very minor amounts of sphalerite, pyrite, and chalcopyrite occur along irregular fractures in the pyrrhotite. It is reported that samples from the zone of shearing carried as high as $2 in gold to the ton. The zone is not exposed beyond the single pit.

On the S and O group, on the north side of the southwest arm of the lake, some work has been done on a contorted shear zone in dark hornblende schist. Prospect pits expose an irregular, mineralized zone with a maximum width of 12 feet at the lake shore, and narrowing rapidly to 1·5 feet at about 30 feet from the shore. Parts of this zone hold abundant arsenopyrite crystals oriented parallel to the foliation. No other metallic mineral was recognized. It is reported that gold was panned from the gossan at this showing, but this could not be confirmed even after prolonged roasting of selected material.

Socko-Tyon Group

This group was staked in May 1938. The main showing is on claim No. 2 of the Socko group, on the northwest side of the narrow central peninsula of Hebden Lake. Surface exploration and trenching clearly expose the showing.

Metallic minerals and small gash veinlets of quartz occur within a lens-shaped body of fine-grained, pink, oligoclase aplite intrusive into dark, hornblende-biotite schist. The aplite body is 380 feet long, has a maximum width of 130 feet, and strikes parallel to the shoreline and to the foliation of the volcanic schist. Both the foliation of the schist and the contacts of the aplite have an almost vertical dip.

Pyrite and arsenopyrite are fairly evenly distributed throughout the aplite, and there are in places spotty concentrations of galena and sphalerite. A random chip sample taken across the intrusive lens at its greatest width returned 0·005 ounce of gold a ton.

Lucky Strike Group

These claims were staked in October and November, 1937. Some surface assessment work was done in the summer of 1938, on a small island just off the tip of the northern central peninsula of Sulphide Lake. The showing consists of several vertical quartz veinlets striking north 32 degrees east in sheared porphyry. They contain scattered, small concentrations of pyrite, arsenopyrite, and minor chalcopyrite. It was reported that gold could be panned from gossan on the island.

A prospect pit exposes a rusty shear zone in the porphyry, on the shore of the mainland east of the island. This zone strikes south 73 degrees east and has a vertical dip. It is exposed only at the shore, where it has a width of 15 feet. There are several quartz stringers, ½ inch to 3 inches in width, near one side of the shear zone. The quartz is milky and contains a very little pyrite. Pyrite is fairly abundant in the shear zone.

Other similar zones were observed at several places on these claims. Those that are most strongly mineralized are within or near the quartz diorite porphyry. One such shear, on the south shore of the small lake between Sulphide and Lynx Lakes, contains pyrite and a small amount of arsenopyrite and chalcopyrite.

P.A.P. Group

Arsenopyrite was dscovered on these claims late in August 1938, about 1,500 feet southwest of the small lake between Sulphide and Preview Lakes. At the time of the examination about 70 feet of trenching had been completed. The most southerly trench showed a 10-inch quartz vein carrying about 50 per cent arsenopyrite, some pyrite, and minor amounts of chalcopyrite. The vein matter is reported to carry gold. In the next pit, 30 feet northeast, silicified greenstone carrying a considerable amount of disseminated arsenopyrite is exposed.

MacKay Lake Region

Some prospecting was done in the immediate vicinity of MacKay Lake in 1938, and a number of claims were staked. The prospectors did some trenching on the west shore of MacKay Lake, about three-quarters mile south of its northern end. A quartz vein was uncovered there, with an average width of 9 inches and an exposed length of 70 feet. The quartz contains irregularly distributed pyrite, pyrrhotite, and some sphalerite. A grab sample of vein material containing a concentration of the sulphides is said to have assayed less than $2 in gold.

Some work had also been done on the northeast arm of MacKay Lake, on a zone of rusty, brecciated, silicified rhyolite, partly recemented with quartz. Some pyrrhotite was observed, but no other sulphide. Gossan from this locality was roasted and panned with negative results.