CANADA

DEPARTMENT OF MINES AND RESOURCES

MINES AND GEOLOGY BRANCH

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SNOW LAKE

MANITOBA

(Map and Descriptive Notes)

BY

J. M. Harrison

OTTAWA

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Illustration

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INTRODUCTION

Snow Lake lies about 30 miles north and slightly west of Wekusko station (Mile 81) on the Hudson Bay Railway. A truck road 12 miles long connects Wekusko with the south end of Wekusko (Herb) Lake. From there Snow Lake can be reached by canoe, at high water, by way of Snow Creek, with six short portages, or, at low water, by way of Anderson Lake, with about $2\frac{1}{2}$ miles of portage. Most of the canoe routes through the map-area involve much portaging, but much of the area can be reached conveniently by aircraft operating from Channing or Cold Lake.

Detailed geological mapping of the area was begun in 1944, and present information is subject to revision. The accompanying map is intended mainly as an aid to prospectors. It is a pleasure to acknowledge the information and assistance given by men with interests in the area, particularly Mr. Frank Ebbutt, Howe Sound Exploration and Development Company; Dr. N. S. Beaton and Mr. A. C. Mosher, Northern Canada Mines, Limited; Dr. M. H. Frohberg, Macassa Gold Mines, Limited; and Mr. G. N. Moore, Consolidated Mining and Smelting Company, Limited. Capable and willing assistance in the mapping was given by Messrs. H. J. Kristjanson, J. F. Donoghue, W. J. Musick, H. Greely, and D. B. MacKinnon.

GEOLOGY

All consolidated rocks in the area are of Precambrian age. Rock types are numerous and structures are complex. Nearly all formations contain some garnets; nearly all are gneissic; and in the northern part of the area the rocks are typical of the Kisseynew gneisses.

The oldest rocks in the area are greenstones (1) and acid volcanic rocks (2). South of Snow Lake the former consist of massive and pillowed flows, flow breccias, explosive breccias and tuffs, minor rhyolite, and some recrystallized intrusions probably related to the extrusive rocks. West of Snow Lake the greenstones are gneissic, are granitized in places, and are commonly garnetiferous. North from Cook Lake they become feldspathic and gradually acquire a foliated structure that superficially resembles bedding. North from the south end of Squall Lake the greenstones are dominantly hornblende gneisses. The acidic rocks (2) consist of flows and breccias and some siliceous sedimentary beds. These are recrystallized rocks carrying conspicuous hornblende and biotite.

Garnet gneisses (3) and staurolite schist with interbedded garnet gneisses (4) overlie the greenstones and rhyolites with apparent unconformity. The staurolite schist is a brownish grey rock containing varying amounts of staurolite crystals in widely different sizes. Some have been noted that are 6 inches or more in length, whereas others are too small to be seen with the unaided eye. Remnants of argillite, from which the staurolite schist formed, are exposed in a few localities near the contact of the schist with other rocks. North of Snow Lake the staurolite schist fingers out into well-bedded garnet gneisses that weather brownish grey and contain lilac-coloured garnets. North from the northeast end of Squall Lake staurolite becomes scarcer in the much narrowed belt of schist and its place is taken by coarse, reddish, well-crystallized garnets that continue to lend a distinctive appearance to the rock (4a). Some layers of hornblende gneiss within the garnet gneiss are apparently altered lavas or tuffs.

A few small outcrops of conglomerate were observed north of Chisel Lake. The matrix is fine-grained and black, resembling hornblendite, and the pebbles and boulders consist of granite, greenstone, rhyolite, garnet amphibolite, and other rock types. This may be the youngest rock in the area, but its relations to the others are unknown.

Grey to pinkish grey, fine-grained, siliceous and feldspathic volcanic rocks (5) overlie the staurolite schist along the east side of Snow Lake. Many exposures show flow banding, some are bedded, and the rocks contain numerous angular fragments similar in composition to the groundmass. In a few places they contain rather basic fragments. All types are locally garnetiferous, and in most places they are markedly gneissic. At the east edge of the map-area they apparently interfinger with fine-grained, well-bedded, siliceous, sedimentary rocks (5a).

Sparsely garnetiferous basic tuffs and breccias (6) overlie the staurolite schist (4) at the north end of Snow Lake, and for about a mile farther north. The tuffs and breccias are mainly coarse-grained, poorly stratified rocks that locally contain fragments as much as 18 by 24 inches in exposed dimensions. Most of the fragments are more acidic than the matrix, though the latter is composed of numerous small fragments of hornblende and feldspar. The northern margin of these rocks is marked by very fine-grained, well-bedded, green tuff. The basic assemblage is interfingered bluntly with acid breccias (5), indicating that they formed about the same time. Both the acid and basic volcanic rocks are intruded by hornblendite, diorite, and feldspar porphyry, which are related to the basic breccias.

Massive greenstone flows (7) overlie the staurolite schist (4) north of the basic breccias and tuffs (6). They are dark green, mainly fine-grained rocks and contain considerable amounts of related diorite. These rocks are probably about the same age as the basic pyroclastic rocks (6).

Well-bedded, rather fine-grained, garnetiferous greywacke (8) overlies the greenstones (7) and grades into arkose towards Herblet Lake. Garnetiferous arkose also occurs southeast from McLeod Lake where it overlies the staurolite schist (4). It is believed that the greenstones (7) thinned out to the northeast along the arm of a subsidiary anticline that has been faulted out.

Minor basic intrusions or volcanic rocks associated with greywacke and arkose (8) are probably equivalent in age to the underlying greenstones (7), and are typical garnetiferous Kisseynew hornblende gneisses (7a). Some rocks of this type are interbedded with the garnet gneisses (3) and are included with them.

Hornblende- and biotite-bearing, garnetiferous, granitic and syenitic gneisses (9) intrude only the oldest formations of greenstones and acid volcanic rocks (1, 2). They are highly metamorphosed, and contain hornblende chiefly where greenstone has been assimilated.

A large basic intrusion (10a) between Chisel and Cook Lakes extends north to Varnson Lake. It consists of serpentinized peridotite, hornblendite, pyroxenite, gabbro, diorite, and a little quartz diorite. All are somewhat altered, the more basic parts to a greater degree than the more acid phases. A large number of dykes and sills of hornblendite and a few of gabbro and diorite (10b) cut all rock types so far described. They are probably all related to the large basic intrusion (10a), though some may be related to the greenstones (1, 7) they intrude. One outcrop of orbicular garnet gabbro (10c) was found in an area surrounded by staurolite schist (4).

Granite (11) containing large amounts of granitized inclusions is the youngest rock in the area. Near File Lake it contains a fairly well-defined zone of medium-grained, massive, garnet granite (11a). The granite north of Squall Lake occupies a dome, and though locally gneissic, contains undeformed pegmatites that also cut the surrounding gneisses (3, 7a). Sills of hornblendite that cut these gneisses have been deformed by the doming.

STRUCTURE

Folds

Folding in the area mapped is pronounced, and a number of structures have been outlined. South of Snow Lake the older volcanic rocks (1, 2) occupy a broad syncline whose axis strikes slightly east of north between Anderson and Threehouse Lakes to Snow Lake. West of Snow Lake the structure is obscure, but an adjacent anticline appears to have its axis near Cook Lake, perhaps marked by the granite (11) at that lake. The Threehouse-Anderson syncline is cut off at Snow Lake by another syncline of which the basal member is the staurolite schist (4). The axis of this syncline strikes somewhat north of east from Squall Creek through Herblet (Little Herb) Lake. Mapping so far has produced no evidence for a fault through Snow Lake between these synclines, so it is assumed that staurolite schist overlies the older volcanic rocks unconformably. The sedimentary rocks (8) around McLeod Lake are folded into a northeast-plunging syncline that is, apparently, subsidiary to the Little Herb syncline. The granite (11) north of Squall Lake marks the crest of a dome whose long axis strikes slightly east of north. The domical uplift buckled the structures to the east and west. West from the dome the formations (4 to 7) are folded into smaller anticlines and synclines.

Thus there appear to be three distinct periods of folding. The earliest is represented by the Threehouse-Anderson syncline and the Cook Lake anticline. This was followed by the formation of the Little Herb syncline, possibly accompanied by slipping along the unconformity, and, finally, by formation of the Squall Lake dome.

Faults

Faulting in the area is pronounced locally. Along the west bank of the west arm of Snow Lake is a scarp that dips steeply east and is marked by strong shearing and carbonatization. Mapping indicates a fault zone that dies out to the north and south and that consists of two or more faults _en échelon_. Apparently part of the faulting occurred at the unconformity. About half a mile southeast of McLeod Lake is a well-defined fault striking southwest. It ends abruptly at the staurolite schist (4) contact and swings sharply southeast along and near the upper contact of this schist. Along this contact, however, it is apparently a zone

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of faulting that passes southward into Snow Lake where it dies out in the staurolite-bearing rock. Part of this faulting may be due to slippage between formations during folding. Small faults appear to be common near the elbow of the outer greenstone fault. Apparently the anticlinal limb of a lesser fold on the north flank of the Little Herb syncline has been removed by this fault and only the McLeod Lake syncline remains. Presumably, too, the greenstones (8) that overlie the staurolite schist south of the fault pinched out along the faulted segment so that arkose (9) lies immediately above the staurolite schist to the north of the fault.

Just north of the west arm of Snow Lake a number of small east-west scarps are present in the staurolite schist. These probably represent small faults, and as such would account in part for the remarkable thickening of the schist in that section.

Evidence of faulting was found at a number of other places, but is too scanty for mapping purposes.

MINERAL OCCURRENCES

The only mineral of commercial interest so far discovered is gold. The most important prospect is the Nor-Acme deposit near the northwest corner of Snow Lake, where it is reported[1] that drilling has indicated about 5,000,000 tons of $6 ore. Most of the gold is associated with arsenopyrite, although this mineral was not seen in a brief examination of the Finlayson showing at Morgan Lake. Visible gold is rare in the fresh rock, though rather coarse particles are common in pannings of gossan over mineralized zones. Virtually all known deposits appear to be related structurally to folds rather than to faults, a characteristic of most commercial deposits in northern Manitoba. Most of the folds plunge at angles of less than 50 degrees; hence any plan for drilling should consider the rake of the deposit. The formations north and west of Snow Lake dip at angles of from 10 to 60 degrees, most of them dipping at about 45 degrees. South of Snow Lake dips are generally steeper, probably averaging 65 to 70 degrees. Near Cook Lake dips are more nearly vertical.

Most of the deposits in the area mapped occur in brittle rocks near their contacts with other less brittle rock types. Commonly, too, the rocks are sharply folded at these places. Thus, the Nor-Acme ore zone occurs in acid breccias (5) at a contact with basic breccias (6), where there is an abrupt swing in the trend of the rocks of the Little Herb syncline. Between McLeod and Squall Lakes a gold-bearing zone occurs in a sill of hornblendite (10b) that was intruded along the contact between staurolite schist (4) and garnetiferous arkose (8) near a point where the rocks in the Little Herb syncline are sharply bent. Northern Canada's No. 3 zone occurs in fine basic breccias (6) near their contact with staurolite schist (4) and greenstones (7). Here quartz veins cut across bedding and schistosity at an acute angle. At a number of places in the Snow group of claims mineralization occurs at the contact of extrusive greenstone and its intrusive equivalent; south of Snow Lake mineralization has been noted where small drag-folds are present. A short distance north of the northeast end of Squall Lake arsenopyrite occurs in what appears to be a small drag-fold. Northern Canada's "Photo find", south of the west end of Snow Lake, occurs in small draws in greenstone and may be related to faulting. The "Beaverhouse find" on a reef in Threehouse Lake appears to be related to a large drag-fold. The "Finlayson find" at Morgan Lake occurs in a rusted, pyritized zone in greenstone tuffs and breccias near their contact with diorite.

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(1) Nor. Miner, Nov.16,1944

In nearly all these gold deposits arsenopyrite is the dominant metallic mineral. At Nor-Acme it is accompanied by lesser pyrrhotite, pyrite, and very minor chalcopyrite, sphalerite, and, possibly, cubanite. Quartz is the main introduced gangue mineral; carbonate is later and in small amounts. The gold occurs chiefly as minute grains against crystals of arsenopyrite, but a minor amount is present in the carbonate gangue. At the Finlayson find pyrite is the most common metallic mineral, though noticeable amounts of chalcopyrite and sphalerite occur. At one gold showing south of Snow Lake gold values are associated with arsenopyrite and galena. Northeast of McLeod Lake some gold is said to have been found with chalcopyrite.

A number of zones of heavily pyritized rock occur in the older greenstones and rhyolite south of Snow Lake, and disseminated pyrite occurs at a number of places in the older granite (9). Locally a little chalcopyrite can be recognized in the pyritized zones, but gold values are said to be very low. Chalcopyrite occurs chiefly near the basic intrusion at Chisel Lake, and this body, too, contains minor accessory chalcopyrite. Considerable crumpling characterizes the rocks that enclose the intrusion, and rusted outcrops are common.

Suggestions to Prospectors

The foregoing remarks indicate that certain conditions favour gold mineralization in this area. Gold is associated mainly with arsenopyrite, and the best values are found with fine, needle-like crystals of that mineral. Mineralization occurs at or near contacts between different rock types, and is confined mainly to the more shattered, brittle rocks. The shattering appears to be related chiefly to sharp folds or to drag-folds. The effect of faulting is not yet clear, but some mineral deposition has occurred along minor fractures that may be connected with major faults. The sedimentary rocks (3, 4, 8) in the area mapped appear to have yielded by shearing rather than by shattering, and are, therefore, not regarded favourably. However, where they are intruded by sills of basic rock, the intrusion may act as a brittle member.

All gossan on weathered outcrops should be panned, but the presence of rather coarse gold in the tail from panned gossan, or from rock immediately below the gossan, should not be viewed too enthusiastically, for in many instances the fresh rock beneath contains only low values in very fine gold. Much of the weathering is pre-glacial and, as the glaciers moved to the south-southwest, most of the gossan now remaining occurs on the south and west sides of outcrops.