CANADA

DEPARTMENT OF MINES AND RESOURCES

MINES AND GEOLOGY BRANCH

BUREAU OF GEOLOGY AND TOPOGRAPHY

GEOLOGICAL SURVEY

SHERRIDON

WEST OF PRINCIPAL MERIDIAN

MANITOBA

MAP 862A

Scale, 1/63,360 or 1 Inch to 1 Mile

Miles 0 1 2 3

Approximate magnetic declination, 15°30' East.

PUBLISHED, 1946.

LEGEND

ARCHÆAN AND/OR PROTEROZOIC

KISSEYNEW GNEISSES

- 13 — *Granite, granite-gneiss; pegmatite*

CREE LAKE INTRUSIVE ROCKS
(Post-Sherridon; relation to post-Sherridon, Kisseynew gneisses uncertain)

- 12 — *Oligoclase granite*
- 11 — *Anorthosite, anorthositic gabbro*
- 10 — *Garnetiferous metagabbro, peridotite*
- 9 — *Pyroxenite*

POST-SHERRIDON

- 8 — *Stratiform, granitoid oligoclase-quartz gneiss*
- 7 — *Stratiform and stratified "granitized" gneiss, including lit-par-lit and irregular injection gneisses; minor hornblende and biotite gneiss*
- 6, 6a — **6**, *Stratified quartz-feldspar-biotite-garnet gneiss; minor hornblende gneiss* **6a**, *conglomerate*
- 5 — *Hornblende-plagioclase gneiss, in part garnetiferous; pseudo-diorite*

SHERRIDON GROUP

- 4 — *Hornblende-plagioclase-garnet gneiss, in part pseudo-diorite*
- 3 — *Gneissic quartzite, feldspathic quartzite; biotite, hornblende, and garnet-bearing quartzites; granitized equivalents; minor hornblende gneiss; small bodies of granite, granite-gneiss, pegmatite, and of* (11)

PRE-SHERRIDON

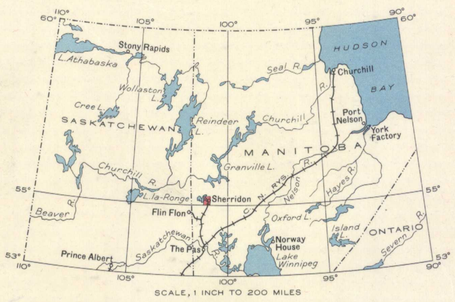
- 2 — *Hornblende-plagioclase gneiss; pyroclastic breccia; part may be intrusive*
- 1 — *Stratiform quartz-oligoclase-biotite-garnet gneiss*

Copper-zinc orebody (exposed, top projected vertically to surface)
Test Pit
Fault
Bedding (horizontal, inclined, dip unknown)
Foliation (inclined, dip unknown)
Schistosity, gneissosity (inclined, dip unknown)
Direction of plunge (indicated by arrow)

Road and buildings
Road not well travelled
Trail, portage or winter road
Power transmission line
Stream (position approximate)
Marsh
Reef or small island
Height in feet above mean sea-level 1087'

Geology by J. D. Bateman and J. M. Harrison, 1943.

Base-map from surveys by the Topographical Survey, 1943, with aerial photographs taken by the Royal Canadian Air Force, 1929 and 1943. Cartography by the Drafting and Reproducing Division, 1945.



SCALE, 1 INCH TO 200 MILES

DESCRIPTIVE NOTES

Most of the rocks in the map-area are crystalline schists and gneisses, and form a part of the great area of Kisseynew gneisses north and east of Flin Flon in northern Manitoba and Saskatchewan. The gneisses are predominantly of sedimentary origin, having been derived from such rocks as quartzite, arkose, and greywacke, through the intimate intrusion of granitic and pegmatitic material. The process of metamorphism is, in places, so far advanced that the resulting gneisses have lost their sedimentary structures and have become granitic in appearance. The different beds consist of various proportions of quartz, oligoclase, feldspar, biotite, and garnet, with accessory magnetite and hornblende. These minerals represent a common denominator resulting from the granitic metamorphism of various types of sediments.

Several narrow belts of hornblende-rich gneiss occur, mostly in the lower part of the Kisseynew group. These rocks consist of hornblende and andesine feldspar with more or less garnet and biotite. The hornblende gneisses represent metamorphosed basic igneous rocks, and are probably mainly of volcanic origin. In places they are massive and coarse-grained, resembling diorite, but more generally they possess a parallel foliation or stratiform structure that has been brought about by deformation during folding.

Throughout the Kisseynew gneisses it is commonly difficult to distinguish between true bedding and bedded-like or stratiform structures that have resulted from later foliation. In the Sherridon map-area the two structures are essentially parallel, the secondary foliation corresponding to the original bedding, even around the noses of plunging folds. It seems probable that recrystallization was controlled by primary bedding structures, for in places it has resulted in an intensification of stratification. On the map a symbol for foliation is used to indicate rock structures that are not certainly due to bedding, but that resemble bedding, and are described as stratiform. Such stratiform foliation is developed in some igneous as well as the sedimentary rocks and must, therefore, be a result of deformation.

The oldest rocks in the map-area lie in the centre of the Sherritt Gordon structure and pre-date the Sherridon group in which the orebodies occur. They consist of stratiform quartz-oligoclase-biotite gneiss (1), which weathers buff and contains many garnetiferous beds. It is overlain by dark green hornblende-plagioclase gneiss (2) that is locally garnetiferous. The hornblende gneiss may be thinly foliated, but is generally massive and without visible structure. Part of it contains light-coloured lenticular fragments and was probably a volcanic breccia.

The Sherridon group (3, 4) lies in places upon Sherridon basic gneiss (2), but elsewhere upon still older sedimentary gneiss (1). This may be due to thinning out of the basic hornblende gneiss along its strike, or it may represent an erosional unconformity at the base of the Sherridon. The Sherridon consists of a group of distinctive white to grey quartzites interbedded with dark green to black hornblende-plagioclase gneisses that are metamorphosed volcanic flows. The different beds contain abundant quartz and various minor amounts of feldspar, biotite, hornblende, and garnet. They have a distinctive gneissic texture that is emphasized by the quartz, which stands out in relief on weathered surfaces. This feature alone serves to distinguish the Sherridon quartzites from any other rocks in the area. The hornblende gneisses (4) are most abundant east of the Sherritt Gordon West orebody. Remnants of pillow structures were observed in them, but the rock is generally so thoroughly recrystallized that it resembles diorite, except that it may contain abundant garnet.

The Sherridon group probably represents the lower part of the Kisseynew gneisses. This is partly indicated by evidence outside of the map-area at Weldon Bay near the east end of Kisseynew Lake. There a section overlying Archæan greenstones resembles in many respects the Sherridon group. The rocks at Weldon Bay, however, are much less metamorphosed, and are also strikingly similar to the Missi sediments near Flin Flon, even to containing scattered pebbles throughout the beds.

The Sherridon group is overlain by dark green hornblende-rich gneiss (5) that is in sharp contact with the distinctive Sherridon quartzites. The hornblende gneiss is succeeded by widespread metamorphic types characteristic of the prevailing Kisseynew gneisses of the district. They vary from recognizable stratified rocks (6) to others of similar origin that have been so injected by granite and pegamtite that the bulk of the rock is intrusive and, for mapping purposes, is classified as "granitized" gneiss (7). Magnetite and garnet are common in the granitic material associated with these gneisses. In addition there are granitoid gneisses (8) that resemble granite or granodiorite in the hand specimen, but that have a stratiform structure similar to that of the bedded gneisses. They probably represent sedimentary gneisses in an advanced state of granitization.

Conglomerate (6a) was found in several localities in the Kisseynew gneisses. In the south part of the map-area are thick beds of conglomerate, the pebbles and boulders of which are almost all of quartz with disseminated magnetite. Near the outlet of Bartlett Lake and again on Big Island are relic conglomerates. At the latter locality the pebbles are mostly of quartz and granitic rocks. This conglomerate is not near the base of the Kisseynew complex and, so far as is known, is stratigraphically above the Sherridon formation. In this respect it would correspond with the conglomerate at Weldon Bay, which lies above what is believed to be the equivalent of the Sherridon.

In the vicinity of Cree Lake and to the northeast the Sherridon and older formation are cut by intrusive rocks that form a related sequence from ultrabasic to granitic types. These include coarse-grained, black to rusty weathering pyroxenite (9) along the northeast shore of Cree Lake, and black to dark green massive peridotite and hornblende metagabbro (10) northeast of the lake. The latter rock locally carries abundant garnet. Between Cree and Found Lakes are bodies of anorthosite and anorthositic gabbro (11) that consist principally of plagioclase feldspar with more or less pyroxene, hornblende, carbonate, titanite, and scapolite. Narrow lenses of calcite and rusty weathering carbonate may be found in these rocks, and are believed to be the result of widespread carbonatization. Actually the present mineral assemblage of these rocks might be derived from the metamorphism of either impure limy quartzites or anorthositic intrusive rocks; and it is possible that either one or both types are present. The youngest member of the sequence is a buff-coloured oligoclase granite (12) that is locally sheared and rusty weathering. The Cree Lake intrusive rocks are considerably altered, and the pyroxenite and anorthosite have a decayed appearance. The anorthosites, in particular, are foliated and it is probable that all were involved in at least part of the folding of the enclosing rocks.

The younger granite and granite-gneiss (13) is characteristically pink, and commonly has some faint stratiform structures that correspond in attitude to the bedding in the sedimentary gneisses. The granite is relatively undeformed, and was intruded after the main folding had occurred. Most of it forms small sills or larger bodies that conform to the trend of the structure in the sedimentary gneisses. Crosscutting contacts of the granites with the older rocks are rare, and most of the granite may be said to form concordant intrusions. Pegmatite, presumably related to the granite, is widespread throughout the area. It is the ordinary variety of pink pegmatite, but may contain small masses of magnetite as much as a pound or more in weight.

The rocks of the area are folded complexly as a result of several periods or stages of deformation. Throughout the map-area the prevailing dips of the formations are north and east, the fold axes being overturned respectively to the south and west. Bedding and foliation normally dip at angles of between 10 and 50 degrees. Several of the folds are isoclinal, but many are open and, as a result of overturning, steep dips are found on one limb with abnormally low dips on the other. Dips other than in the prevailing directions generally indicate the steeper limb of an open fold, which, as a result of overturning of the fold axis, becomes vertical and then reverses in dip as the nose of a plunging fold is approached.

Folded folds, such as the anticline encircling Found Lake, are probably common, but are difficult to recognize. Another stage of folding is represented in a great fan fold that comprises the Sherritt Gordon structure. The most common folding, however, is along north-south axes that swing easterly in the north part of the map-area. Few faults were recognized; the most important is one that extends north through Molly Lake and shows a relative displacement to the south on the west side.

The structural picture at Sherritt Gordon resembles a large drag-fold, but is rather the result of an uplift across a series of northerly trending folds overturned to the west. The uplift has effected a reversal of the prevailing northward plunge of the folds. It commences as a gentle flexure near Cold Lake and extends eastward between the Sherritt Gordon East and West orebodies, swinging northeastward across Found Lake and northward across Cree Lake. North of Found Lake it steepens and is a definite anticline. It becomes the principal fold northeast of Cree Lake, where it supersedes the main syncline on the east, the latter dying out to the north. As a result the syncline plunges southward to near the south end of Molly Lake, where the prevailing northward plunge is resumed. The combined effect of these folds has resulted in an anticlinal dome or structural "high" at Sherritt Gordon, in which the older formations of the Kisseynew gneisses, and possibly pre-Kisseynew, Archæan rocks, have been exposed.

Copper and zinc are the only metals that have been found in commercial quantities in the map-area. Gold occurrences, which are common in the Archæan greenstone areas to the south, are rare throughout the area of Kisseynew metamorphism.

In contrast with the Flin Flon district, where the copper-zinc ores are associated with pyrite, copper and zinc mineralization in the area of Kisseynew gneisses is accompanied by pyrrhotite. There are two types of mineral deposits in the area: (1) barren sulphide deposits consisting of pyrrhotite with a little pyrite and insignificant amounts of chalcopyrite and sphalerite; and (2) copper-zinc orebodies consisting largely of pyrrhotite, but with appreciable amounts of chalcopyrite and sphalerite and a little pyrite. These two types have close structural and genetic relationships, and as pyrrhotite and pyrite are the earlier formed minerals, it is likely that both types were identical at one stage in their evolution; whereas at a later stage some of the pyrrhotite deposits were sufficiently mineralized with chalcopyrite and sphalerite to form orebodies.

Most of the sulphide deposits lie beneath narrow depressions or under lakes that occupy such depressions at intervals.

The greatest number of sulphide deposits has been found in the Sherridon group, although elsewhere in the area pyrrhotite and copper-zinc sulphides do occur in younger Kisseynew formations. Deposits are generally found in the impure quartzite members of the Sherridon group, especially near the contact of such rocks with dark hornblende gneisses. Shearing and fracturing has been localized near such contacts because the rocks on either side have offered different degrees of resistance under stress, and in this way fractures and channelways were provided that guided and confined the sulphide deposition derived from some igneous source beneath.

Most of the structures suitable for mineralization are localized in an area of intricate folding. The Sherridon group, being at or near the base of the Kisseynew gneisses, and thus in the vicinity of rocks having different physical characteristics, responded more violently to regional folding than did the overlying gneisses. Furthermore, the formations immediately above and below the Sherridon group as well as those comprising it form a greater variety of rock types than is found elsewhere in the area, and, as a result of differences in relative competency, have tended to localize folds and fractures in them during deforming movements. For these reasons the Sherridon provides the most favourable host rocks for mineral deposits.

There is a close association of pegmatite with many of the sulphide deposits. Pegmatite intrudes all members of the Kisseynew gneisses throughout the district, but is more prevalent along zones of weakness, such as contacts between hornblende gneiss and quartzite of the Sherridon group. The Bob Lake deposit is almost completely enclosed in pegmatite, which is also present, although less obvious, in association with some of the barren pyrrhotite deposits. The time of intrusion of the pegmatite is earlier than the pyrrhotite mineralization, and it may have ascended the same channelways along which the sulphides later came. In some instances the pegmatitic intrusions accommodated themselves by bending the hanging-wall outward; in other places they burst through into the hanging-wall, tapering off into the country rock. Pegmatite is shattered where it is associated with sulphide deposits.

The East and West orebodies of the Sherritt Gordon mine are together one of the longest sulphide deposits in the world, having a combined total length of almost 16,000 feet, of which 3,600 feet, between the two orebodies, carries no ore. As a cross-axial uplift passes through this barren interval it is probable that the two orebodies formed a single one before being reduced to the present erosion surface. The main orebodies have an average width of about 15 feet. The East orebody is approximately 250 feet deep, whereas the West orebody is 500 to 800 feet deep and rakes northward to a maximum depth below surface of about 1,500 feet. The West orebody tends to flatten out down the northward rake, due possibly to an internal fold in the Sherridon group. A relatively pure quartzite member forms the foot-wall (overturned hanging-wall) of the ore, whereas hornblende gneiss is generally on or near the hanging-wall. In the West orebody, particularly, there were subsidiary orebodies containing up to one-half million tons, which occurred as bulges or offsets into the hanging-wall. These offset deposits are almost entirely in pegmatite. The boundaries of the ore are relatively sharp and are somewhat better defined on the hanging- than on the foot-wall. The ore consists chiefly of pyrrhotite containing quartz nodules and more or less chalcopyrite and sphalerite, the East orebody being higher in zinc.