AN INVESTIGATION
OF THE GENETIC RELATIONSHIPS
IN THE FLINFLON, MANDY, AND OISEAU RIVER ORE DEPOSITS.

by

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Introduction.

Previous Work, Acknowledgements, and Statement of Problem.

The geology of these deposits, and of the surrounding country, has been the subject of numerous investigations during recent years. Among those who have published results of their investigations are, F.J.Alcock, E.L.Bruce, E.M.Burwash, H.C.Cooke, G.Hanson, E.S.Moore, J.E.Spurr, R.C.Wallace, and J.F.Wright. A complete list of publications will be found in the appended bibliography.

The author is indebted to Professors R.C.Wallace and J.S. DeLury for their aid and direction in this investigation; to Mr. T.Creighton, of The Pas, who supplied samples from the drill-cores, and plans and sections of the Flinflon ore-body; and to Mr. D.J.Birse for samples from the Oiseau river district.

The purpose of this investigation was to determine, as far as possible, the different ore minerals occurring in the deposits, and their relations to one another and to the surrounding rocks. About thirty samples from the Flinflon, thirty-five from the Oiseau river district, and eight from the Mandy were polished and examined. In preparation and study of the sections the methods as outlined by Davy and Farnham[1] were followed.

1. Davy, W.M. and Farnham, C.M. 'Microscopic Examination of the Ore Minerals'. McGraw-Hill, New York, 1920.

Part 1. THE FLINFLON-MANDY AREA.

Introduction.

Location and Means of Access.

The Flinflon ore-body is situated at the southeast end of Flinflon lake, in township 67, ranges 29 and 30, west of the principal meridian. It lies on the Saskatchewan-Manitoba boundary, the major portion being in the latter province. Flinflon lake is 68 miles N.N.W. from The Pas. The Mandy ore-body is about 4 miles southeast of the Flinflon, on the west side of the northwest arm of Schist lake (Fig.1).

The usual route to the area is by steamer from The Pas, up the Saskatchewan river and across Cumberland and Sturgeon lakes, to Sturgeon Landing; and from there by canoe through a series of streams and lakes. The total distance is about 190 miles, of which 130 miles can be travelled by steamer. There is also a winter sleigh-road, 90 miles long, direct from The Pas.

Topography.

The Flinflon-Mandy area lies within the Precambrian shield near its southwestern margin. Its topographic features are typical of the Precambrian in general. One of the chief of these is the low relief; seldom is a difference of elevation of 200 feet found between the highest ridges and the adjacent hollows. Looking from any elevation, one is struck by the very even skyline which meets the eye in every direction. In detail, however, it is found that the surface of the country is quite rough, being formed of numerous hummocks and ridges with intervening hollows. These depressions are usually occupied by lakes or muskeg swamps. The drift covering is thin, and bedrock outcrops on most of the hills and lake shores. The area lies in the drainage basin of the Sturgeonweir river, which flows in a southerly direction.

Geology.[2]

Table of Formations.

The following is a table of the rock formations occurring in the Flinflon-Mandy area, as determined by Alcock[2]:

Quaternary	Recent Pleistocene	River alluvials, peat Clay Till, sand, gravel
	Unconformity	
Palaeozoic	Ordovician	Dolomite
	Unconformity	
Precambrian	Basic intrusives	Dioritic dykes
	Acid intrusives	Granite and related rocks
	Basic intrusives	Lamprophyre Amphibolite Gabbro Peridotite
	Upper Missi series	Arkose Conglomerate
	Unconformity	
	Acid volcanics and intrusives	Flows, quartz-porphyry and rhyolite porphyry dykes, and fragmental volcanic rocks
	Basic volcanics and intrusives	Basic lavas, tuffs, agglomerates, irregular intrusive bodies, and derived schists

Geologimal History.

The first event of which there is record in the region was widespread volcanic activity. Great thicknesses of lavas poured out over the surface. Ellipsoidal structures found in them indicate that they were, at least in part, laid down under water.

2. Alcock, F.J.;G.S.C. Summary Report, 1922, Part C.

Pyroclastic fragments, now found as tuffs and agglomerates, were deposited between successive lava flows. Acid rocks, belonging to the same period, were intruded into the lavas and tuffs in the form of dykes and sills. They are quartz and rhyolite porphyries.

A period of deformation and intrusion followed. The country was uplifted and a new cycle of erosion was inaugurated. The rocks of this period are not present in the Flinflon-Mandy area, but are developed to the north of the area in the region surrounding Kisseynew lake.

Two series of sediments, the Missi series, with earth movements and an erosion interval separating them, were then laid down. The lower of these does not occur in the Flinflon-Mandy area. The Upper Missi series consists of arkoses and conglomerates. These have subsequently been metamorphosed and altered to mica gneisses and schists, and quartzites.

Following the sedimentation came a long period of folding and intrusion. The early intrusives were basic - lamprophyre and gabbro dykes, which cut the sedimentary and older rocks. They were immediately followed by the intrusion of large granite batholiths. During this intrusion the country was greatly uplifted and folded. In the later stages of cooling of the granitic magma solutions carrying iron, copper, and zinc sulphides were given off and, locally, replaced the older rocks, forming ore lenses such as the Mandy and Flinflon. In other places solutions carrying silica travelled along fracture planes and gave rise to gold-bearing quartz veins. At this stage small dioritic dykes, a few feet wide and several hundred feet long, were also formed. Following this period of folding and intrusion came a long period of erosion. The mountains were gradually eroded until finally a flat-lying country of low relief rising gently back from the sea took their place.

Then Paleozoic, and possibly Mesozoic, seas invaded the country and laid down a series of sediments. During the Tertiary the region was once more above the sea and undergoing erosion. Much of the sedimentary rocks was eroded.

The last important event in the geological history of the region was the advance of great ice-sheets from the northeast. As they moved over the country they removed nearly all of the Paleozoic sediments and considerable thicknesses of the underlying Precambrian rocks, and dropped debris irregularly over the country.

Ore Deposits.

The Flinflon Ore-body.

The Flinflon ore-body is situated at the southeast end of Flinflon lake (Fig.1). The property was located in 1915 and the following year diamond-drilligg operations were commenced. In all forty-four holes were drilled with a total footage of over 25,000 feet. Some simking and drifting was also done on the property. In all about 16,000,000 tons of recoverable ore were proven up.

On the surface the ore-body has a length of 2,600 feet (Fig.2), and at a depth of 900 feet it has a length of over 1,000 feet. The greatest width is 400 feet, but this includes some lenses of unmineralized rock (Fig.3). At the 900 foot level it has narrowed to 35 feet. The strike of the ore-body is north 30 degrees west, and the dip is from 60 to 70 degrees northeast. Boring records show that it pitches slightly to the south.

The ore-body lies in amygdaloidal greenstones. During the intrusion of the granites the greenstones suffered intense pressures with accompanying movements and shearing. Some beds of the greenstones apparently were more sheared than others, and probably represent the softer volcanic tuff beds interbanded with the more massive lava flows. Because of the greater shearing the mineralizing solutions were able to penetrate and replace these these beds more readily than the massive ones. Several lenses, or 'Horses' of unminaralized greenstone occur in the ore-body. They represent less sheared phases in the general shear zone.

The principal minerals in the ore-body are pyrite, sphalerite, and chalcopyrite. Assays show that gold and silver are present. They occur in such small quantities that they do not appear in sections under the microscope. Arsenopyrite, galena, and magnetite also occur. Only the first of these was recognized in the sections examined. Small amounts of native copper are reported from the upper part of the deposit. Besides the foregoing minerals, pyrrhotite, heretofore unmentioned in connection with this deposit, was found in considerable quantities in a number of the sections.

From the study of the polished sections, supplemented by a number of thin sections, the process of metallization appears to be as follows; (1) The sheared rock was penetrated by solutions which deposited pyrite in large amounts, with minor amounts of arsenopyrite and, possibly, quartz. (2) Later solutions penetrating the rock deposited chalcopyrite, sphalerite, pyrrhotite, and quartz.

That quartz is later than the pyrite is clearly shown by the fact that it replaces pyrite (Fig.7), and in many cases it encloses or is intergrown with chalcopyrite and sphalerite.

Chalcopyrite, sphalerite, and pyrrhotite are contemporaneous with one another as is shown in many cases by their graphic intergrowth (Fig.8).

The ore consists of two distinct types known as the solid sulphides and disseminated ore. The solid sulphides consist of chalcopyrite, pyrite, sphalerite, a little pyrrhotite, and minor quantities of country rock, quartz , and carbonates. It occurs as a distinct lens in the central part of the ore-body. In places it extends to the hanging-wall while in others, particularly near the top, it is separated by a thin layer of disseminated ore. The disseminated ore consists of country rock impregnated with sulphides. Pyrrhotite was not observed in the latter type of ore.

The country rock is chiefly chlorite schist. Locally it is sericite or talc schist. One specimen from the disseminated ore was analyzed chemically with the following results;

SiO_2	-	39.18
Al_2O_3	-	7.39
Fe_2O_3	-	10.31
CaO	-	7.15
MgO	-	16.37
K_2O	-	.78
CO_2	-	11.29
Combined H_2O	-	3.92
Hygroscopic H_2O	-	.04
S	-	2.66
Cu	-	.78
Zn	-	.28
		100.15

Combining the above results by using a 'Mead's' calculator the following minerals and their percentages were obtained;

Sphalerite. ZnS	-	.42
Chalcopyrite. $CuFeS_2$	-	2.25
Pyrite. FeS	-	4.78

Carbonates { $CaCO_3$	-	12.77
Carbonates { $MgCO_3$	-	10.86
Sericite.	-	6.61
Chlorite (Fe).	-	8.89
Chlorite (Mg).	-	19.45
Talc.	-	13.10
Quartz.	-	19.29
		98.42

This deduced composition agrees closely with the mineral composition as observed in thin section.

The Mandy Ore-body.

The Mandy ore-body is situated about 4 miles southeast of the Flinflon, on a point on the west shore of the northwest arm of Schist lake (Fig.1).

The ore-body is in the form of an irregular lens (Fig.4), 225 feet long and a maximum of 40 feet in width. The longer axis parallels the strike of the schist and greenstone bands. The lens dips from 75 to 80 degrees to the east and pitches sharply to the south. The central part of the deposit consisted of high-grade chalcopyrite ore surrounded by sphalerite and pyrite (Figs. 4, 5, and 6). This central lens of chalcopyrite had a length of 100 feet and a maximum width of 12 feet on the surface. At the 100-foot level it widened to over 18 feet. This lens has been mined and 25,000 tons of the rich copper ore were removed and shipped to the smalter at Trail, B.C. The average values in the lens were; copper, 19 per cent; gold, 0.1 ounce per ton; silver, 2.5 ounces per ton.

The country rock is made up of alternating bands of massive greenstone and chlorite schist. The ore-body lies in one of the schistose zones. Bruce[3] is of the opinion that prior to mineral-

3. Bruce, E.L. 'Chalcopyrite Deposits in Northern Manitoba'. Economic Geology, Vol. XV. No.5, 1920.

ization drag folds were produced in the less competent schistose rocks and that there was considerable shearing, with the greatest amount of fracturing at the troughs and crests of the folds. It is in one of these sheared drag folds that the deposit occurs.

The metallic sulphides in the ore-body were deposited in the following order: pyrite and arsenopyrite; chalcopyrite and sphalerite. (Fig.10) Galena was found in only one of the sections examined. It appears to be contemporaneous with, or later than the chalcopyrite and sphalerite.

The only gangue mineral determined was quartz. It was, apparently, deposited after the pyrite and earlier than, or contemporaneous with the chalcopyrite and sphalerite. (Fig.9) Remnants of an older gangue associated with, and replaced by the pyrite, were noted. These are, in most cases, few and small. Calcite and dolomite have been reported also, but neither was determined in the sections examined.

Summary and Conclusions.

The Flinflon and Mandy ore-bodies were deposited in sheared volcanic rocks by sulphide-bearing solutions. Granite does not outcrop near the ore deposits. However, it is possible that it is quite close below the deposits. In places the granite is found to contain iron and copper sulphides. This, and the fact that the deposits contain quartz, gold and silver leads to the opinion that the granite was the source of the deposits. At first only pyrite and arsenopyrite were deposited, and while deposition was going on movements in the shear zones continued. The solutions then became richer in copper and zinc, and chalcopyrite, sphalerite and pyrrhotite replaced the broken pyrite and unreplaced rock. Some quartz was also deposited during this stage.

In the Mandy nearly pure chalcopyrite was deposited in the later stages of deposition. Spurr[4] is of the opinion that the central lens of the Mandy ore-body is a vein-dyke, formed by the intrusion of a highly cupriferous magma into the other sulphides. Hanson[5] believes also that open space filling was important in the later stages of deposition. On the other hand Alcock, Bruce, and Wallace believe that the deposit was entirely formed by replacement.

Spurr believes that the banding occurring in the sulphides could have been formed only by plastic flow. Hanson believes that selective precipitation of the chalcopyrite by pyrite was the cause, as pyrite occurs in the chalcopyrite bands and not in the sphalerite. Others believe that they were formed by selective replacement due to the character of the rock.That this last explanation may be true is shown quite clearly in specimens from similar deposits in the Oiseau river district (Figs, 13 and 15), where replacement has evidently taken place along the planes of schistosity.

The fact that older gangue minerals occur as inclusions, mainly in the pyrite, and that the pyrite is broken and replaced by chalcopyrite, sphalerite, and quartz leads the writer to the opinion that replacement was the only process involved. In the sections examined the evidence for replacement is conclusive. It is possible, however, that this would be altered by the study of a larger number of selected samples.

4. Spurr, J.E. "The Ore Magmas". Ch. 2. (McGraw-Hill) 1923.

5. Hanson, G. 'Some Canadian Occurrences of Pyritic Deposits in Metamorphosed Rocks'. Econ. Geol.,Vol. XV, No.7, Nov., 1920

6. Wallace, R.C. 'Relationships in Mineral Deposits in North-western Manitoba' Econ Geol., Vol.XX, No.5, August,1925.

Part 2. THE OISEAU RIVER AREA.

Introduction.

Location and Means of Access.

The area of mineralization that will be dealt with in this discussion is located 12 to 15 miles east and north of the easternmost end of lac du Bonnet, or about 80 to 85 miles, in the same direction, from Winnipeg. The area includes the central northern part of township 17, range 15, east of the principal meridian (Fig.11). The mineralized area lies on the north side, and within two miles of Oiseau, or Bird river.

The area is easily accessible. The route is by the Canadian Pacific railway from Winnipeg to Lac du Bonnet, across lac du Bonnet to Bird River settlement by boat, and thence up Oiseau river by canoe. Several rapids occur in this river necessitating one portage of about one mile and four shorter ones.

Topography.

The area has the typical aspect of the glaciated Precambrian Shield. In general the surface is even and with low relief. In detail, however, it is found that the surface is hummocky. The hummocks, or ridges, vary from 10 to 100 feet in elevation above the surrounding country. Intervening hollows are, in most cases, occupied by muskeg swamps. The general direction of drainage in the region is slightly south of west.

Geology.

Table of Formations.

The following is a table of the geological formations in the Oiseau River map-area as given by Wright[7]:

Quaternary	Post-Glacial	Stratified lake Agassiz clay and sand.
	Glacial	Gravel, sand, boulders, and boulder clay.
	Great unconformity.	
Precambrian	Plutonic intrusives.	Pegmatite.
		Microcline-granite and granite-gneiss (pegmatite cuts oligoclase-granite, and microcline-granite grades into oligoclase granite.
		Oligoclase-granite and Granodiorite (relations not determined)
		Diorite, syenite, granodiorite porphyry, and quartz porphyry (relations not determined).
		Gabbro and amphibolite (cut by microcline-granite).
		Amphibole-peridotite.
	Intrusive contact.	
	Sedimentary-Volcanic complex.	Arkose, quartzite, and greywacke apparently conformable with trachyte, dacite, and andesite.
		Beds of chert, quartzite, slate, metargillite and various tuffs are locally interbedded with the above groups.
		Quartz-mica schist with local conglomerate beds.

Geological History.

The following is a summary of the geological history of the region as given by Wright:

7. Wright, J.F. Can. Geol. Survey, Summary Report, 1924, Part B.

"In Oiseau River map-area, as in most areas within the southwestern rim of the Canadian Shield, the Geological formations are divisible into a very recent group of unconsolidated gravel, sand, and clay, and a very old group of metamorphosed sediments, lavas, and of deep-seated intrusives. The recent unconsolidated materials were deposited during and immediately after the retreat of the late Pleistocene ice-sheet, and they partly cover or, in some quite large areas, completely cover, the older underlying solid rocks.

The bedrock group is Precambrian and can be divided petrographically and structurally into two main divisions, the older of which consists of a thick series of sediments and lavas, and the younger of deep-seated intrusives (peridotites to granite) which cut the lavas and sediments. The sediments are quartzose, and originally were argillaceous and ashy sandstone. The lavas are intermediate in composition - trachytes and andesites. In places the lavas and sediments are interbedded and form one apparently unbroken series. However, in some localities sedimentary types predominate, and in others volcanics are the most abundant, and in such cases it is difficult to determine their age relations. These rocks also vary considerably as regards the degree of metamorphism exhibited and all variations ranging from slightly metamorphosed to highly metamorphosed schists were noted. The beds now stand vertically or dip steeply and this, combined with their metamorphic character and the presence of large drift-covered areas, makes it almost impossible to determine positively the detailed structural geology of the map-area.

The plutonic rocks cut the lavas and sediments as dykes, bosses, and batholiths, and vary in mineral composition from basic to acidic. For the most part they are massive, although outcrops of gneissic granite were noted. A microscopic study of thin sections of the basic varieties furnishes evidences of much chemical alteration and granulation. Fairly acidic microcline granite almost surrounds the volcanic-sedimentary series, and along a considerable part of the contact zone there are numerous inclusions of sediments or lavas in the granites, and many small bosses and dykes of granite cutting the sediments. Also, within the areas of sediments and lavas, there are intrusive masses of basic to intermediate rocks. The basic intrusives are cut by the granite."

Ore Deposits.

The most important mineral occurrences are found in a belt of andesite lavas and tuffaceous sediments on the north side of Oiseau river extending from the west end of Oiseau lake to the east end of lac du Bonnet. In discussing these Wright says, "The areal association of some of these deposits with dykes and bosses of peridotite and gabbro cutting the lavas is noticeable and suggests that such deposits and the basic rocks are connected in origin. Other mineral occurrences are a long distance from known outcrops of the basic intrusives and are more closely related to the granite-andesite contact, which suggests that the area adjacent to this contact, as well as the areas of peridotite and gabbro, should be carefully examined by prospectors."

The several deposits are described separately below.

a) The Devlin-Chance group.

The ores studied from this group were taken from the Devlin claim, L 171-124, the Chance claim, L 166-124, and the Copper Platte claim, L 168-124. (See map Fig.11).

The deposits occur in andesitic lava beds close to the southern edge of a large area of granite. Elongated bodies of peridotite and gabbro have invaded the andesite in several places. The strike of the volcanic rocks, of the schistosity locally developed in them, of the granite contacts, and of the longer axes of the basic intrusives is approximately east-west.

The sulphide deposit on the Devlin claim is in the southwestern part and extends westward into the adjoining Martin fraction, L 183-124. The mineralized zone is along the granite-andesite contact, and has a length of about 800 feet. The width varies from 2 to 75 feet.

Examination of polished sections, under the microscope, shows that the ore minerals are chalcopyrite, pyrrhotite and magnetite. These have apparently been deposited at nearly the same time, the magnetite, if anything, being older than the other two. Testing with di-methyl glyoxime showed the presence of nickel in all of the specimens. No pentlandite could be found in any of the sections, and it is assumed that the nickel is present as nickeliferous pyrrhotite.

The abundant magnetite (Fig.12) has probably been derived from the ferro-magnesians of the basic rocks either by alteration or solution in intruding magmas and subsequent deposition along with the sulphides. Burwash[8] found that sulphides occur as accessories in the basic rocks, and he believes that the intruding granite magma dissolved large quantities of these rocks. From this solution the sulphides were concentrated and deposited near the granite contact after the outer shell of the batholith had solidified.

8. Burwash, E.M., Rep. Ont. Dept. Mines, Vol XXXII, 1923.

Replacement of the sheared rock seems, in part, to have followed the planes of schistosity, giving rise to more or less regular, narrow, alternate bands of ore and rock (Fig.13).

The deposits on the Chance claim occur near the granite contact and run eastward into the Copper Platte claim.

Ore minerals determined microscopically are, chalcopyrite, pyrrhotite, and pyrite. The pyrite occurs as a few small grains and is earlier than the others. In some specimens (Fig.14) pyrrhotite is the only sulphide present. Apparently there is a considerable amount of nickel present in the pyrrhotite as a heavy precipitate was obtained on testing with di-methyl glyoxime.

The chalcopyrite and pyrrhotite replace the gangue minerals along cracks and planes of schistosity giving the same banded appearance as above. (Fig.15).

Wright also determined chalmersite and pentlandite from this deposit, but neither was observed in the sections studied.

b) The Wento group.

The ore-body on this claim occurs towards the northwest corner. Mineralization has taken place mainly in andesite or dacite lavas. These lavas have been locally metamorphosed and altered to chlorite schist. They are cut by hornblende-gabbro, quartz-porphyry, and granite.

The sulphides occur as lens-shaped masses of solid sulphides or in small stringers and bunches disseminated through the schistose rock. The sulphides consist of pyrrhotite, chalcopyrite, chalmersite, and sphalerite. Besides these magnetite was observed in some of the sections. An interesting feature of this deposit is the large amount of chalmersite which occurs (Fig.16). It is found associated with both pyrrhotite and chalcopyrite, but usually with the latter. Its color, by reflected light, is a slightly paler yellow than the chalcopyrite and it is often difficult to distinguish them. Sphalerite is a very minor constituent, and occurs as small grains in the chalcopyrite. In some specimens it does not occur at all.

In all of the sections examined there is no doubt that the deposit was formed by replacement. Gangue is enclosed and penetrated by the ore minerals (Figs. 17 and 18), and various stages from partial to nearly complete replacement of the gangue were observed. The sulphides appear to have been deposited at, or about, the same time. Nickel is apparently absent from this deposit as none of the specimens gave a precipitate when tested with di-methyl glyoxime.

c) The Cup-Anderson group.

The deposits in this claim occur near the northwest corner. The deposits occur in jointed and schisted, tuffaceous and quartzose sediments. Abundant red garnets occur in the finer-grained, more schistose beds indicating that there has been considerable recrystallization of this material. According to Wright, chalcopyrite replaces garnet, therefore the mineralization followed the recrystallization and regional metamorphism.

The ore-body strikes about north 80 degrees west and the dip is vertical or steeply to the north. The commercial ore has been traced for a distance of about 400 feet, with a width of 25 to 40 feet.

The ore-minerals are chalcopyrite, pyrrhotite, chalmersite and sphalerite. Of these chalcopyrite is the most abundant. Chalmersite and pyrrhotite are not so abundant as in the Wento deposit. Sphalerite is present in about the same amount as in the Wento. No nickel could be detected in specimens from this deposit. Silver occurs in small amounts, as in all of the deposits, but but no silver mineral could be determined under the microscope.

As in the foregoing cases this deposit was undoubtedly formed by replacement. In all the sections examined the ore minerals have replaced the gangue. The sulphides here are also contemporaneous with one another.

d) Other Prospects.

Besides the three groups described above a number of samples from several minor deposits, in the region, were examined.

(1) Bloom claim. This deposit occurs near the eastern end of Shatford lake (See map, fig. 11). It is exposed at only one place by a small prospect pit. The deposit is in sheared andesite, cut by pegmatite and granite, with the main granite body a few hundred feet to the south.

Arsenopyrite and magnetite are the only ore minerals and only the latter in the sections examined.

(2) More claim. This claim is situated north of the northeast bay of the east end of lac du Bonnet, in sections 7 and 18, range 13, township 17.

A shaft has been sunk to a depth of about 20 feet in andesite lava, but no commercial body of ore was found. Under the microscope it appears that only a very small amount of mineralization has taken place. Chalcopyrite and pyrrhotite occur as small grains filling cracks.

(3) Hunter claim. This claim is in section 1, range 14, township 18. The deposit is in andesite close to the granite contact. Minerals determined under the microscope are, pyrrhotite, chalco-

pyrite, pentlandite, magnetite, and polydymite. Magnetite occurs as small scattered grains. Pyrrhotite is by far the most abundant. It is cut by veinlets and irregular patches of pentlandite.(Fig.19 Alteration products of pentlandite appearing along the edges are probably polydymite.

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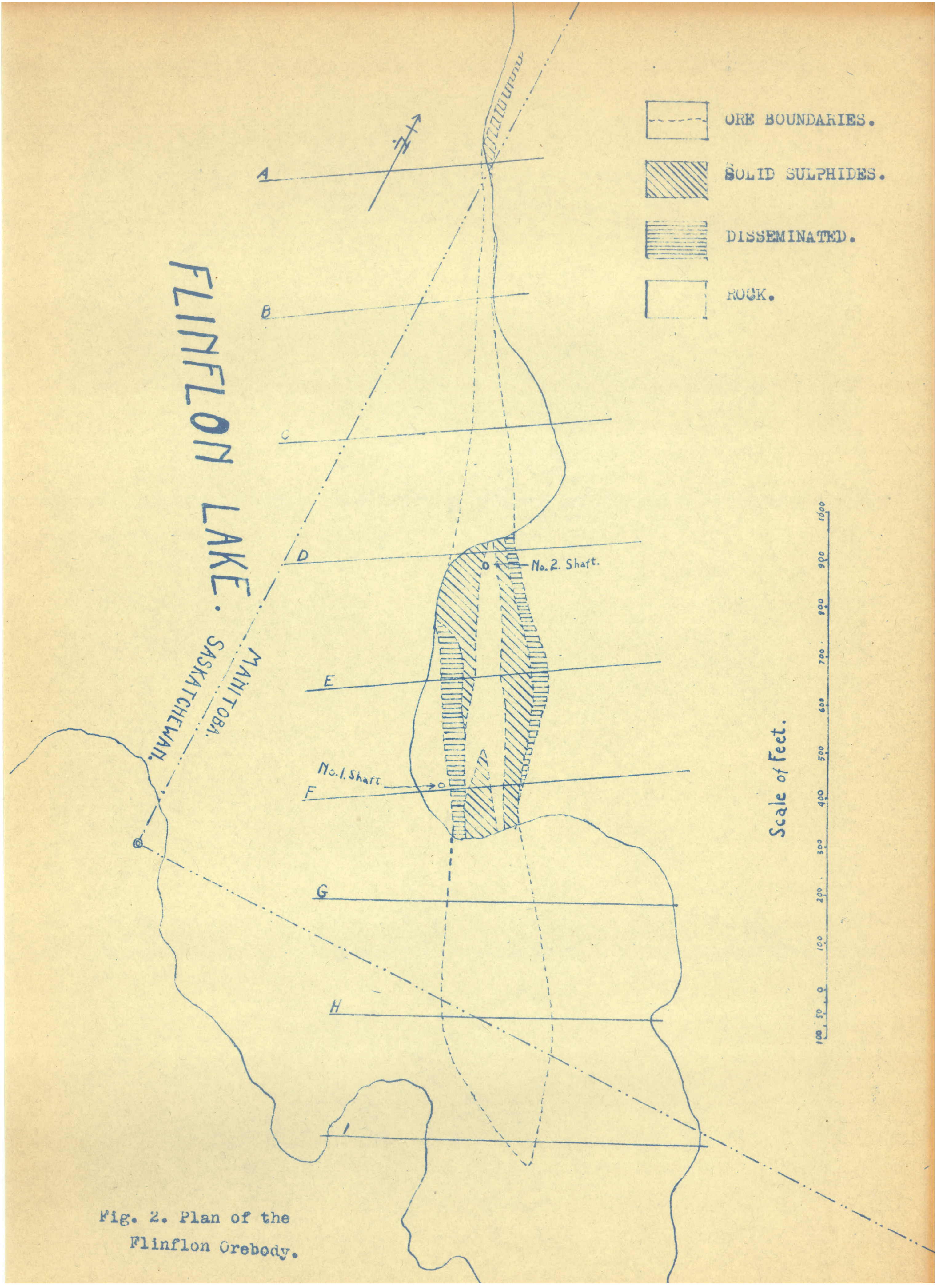


Fig. 2. Plan of the
Flinflon Orebody.

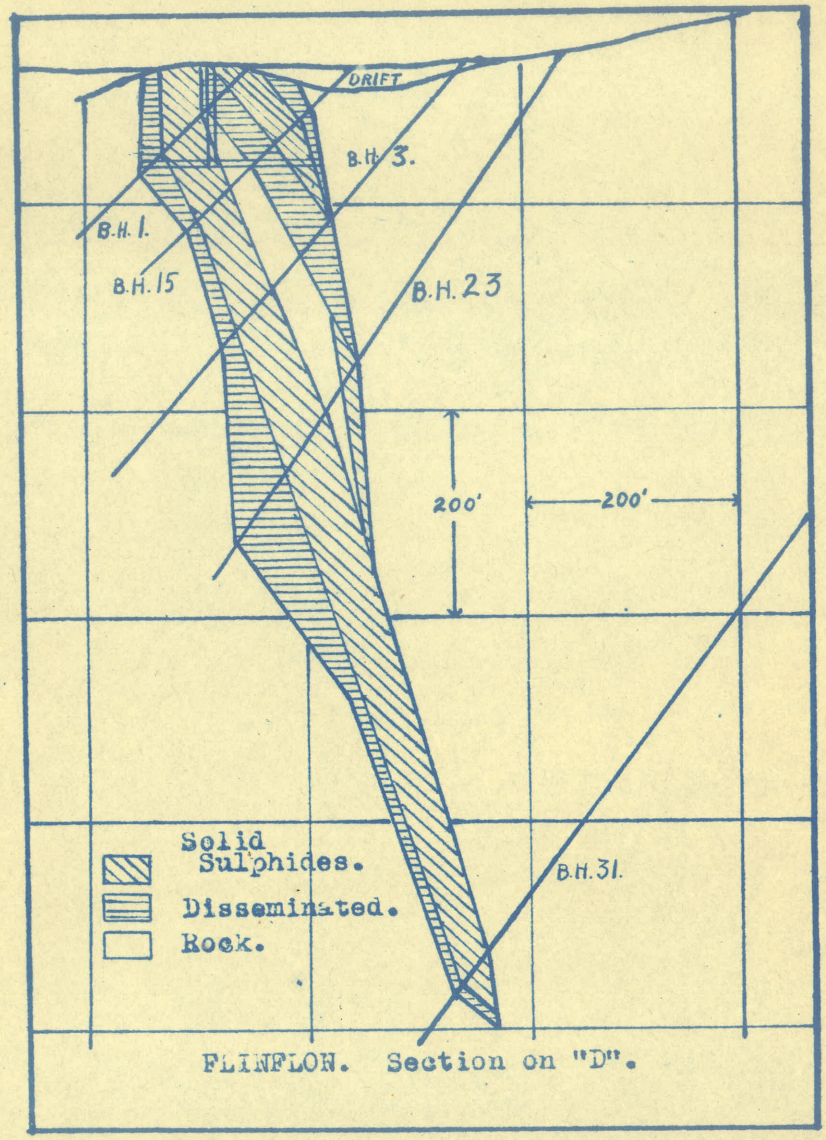


Fig. 3. - Section near No. 2 Shaft as

determined by diamond-drilling.

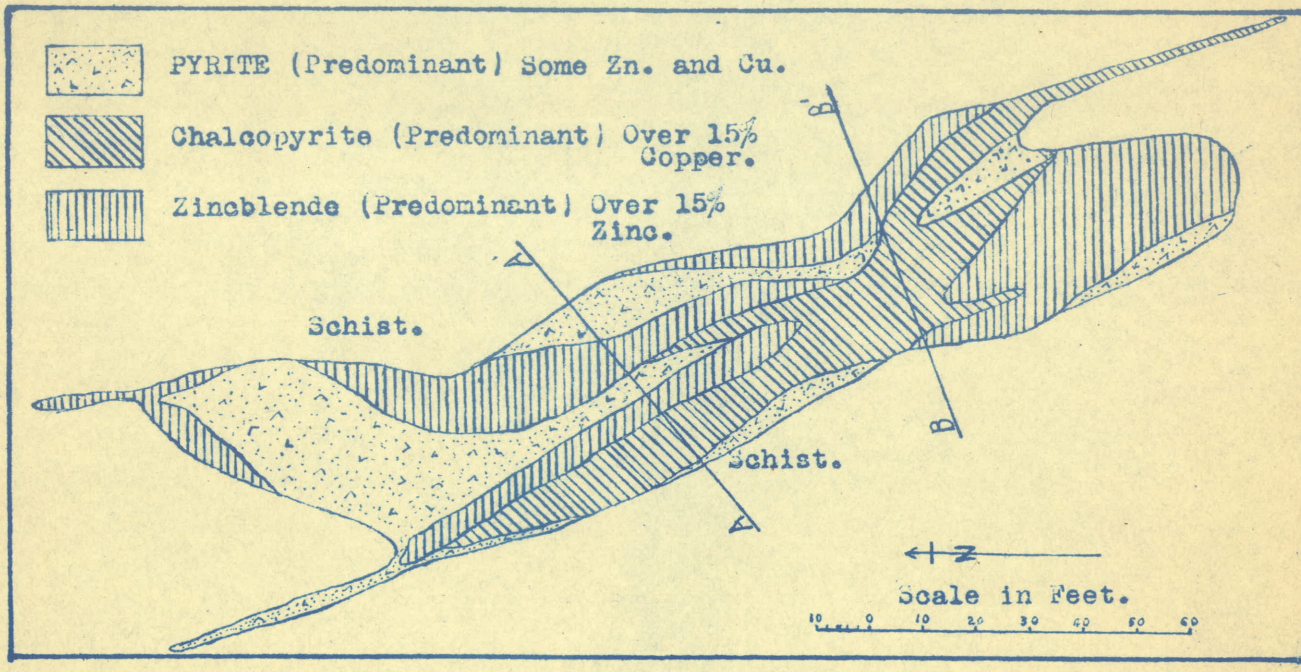


Fig. 4. Mandy mine. Surface Plan.

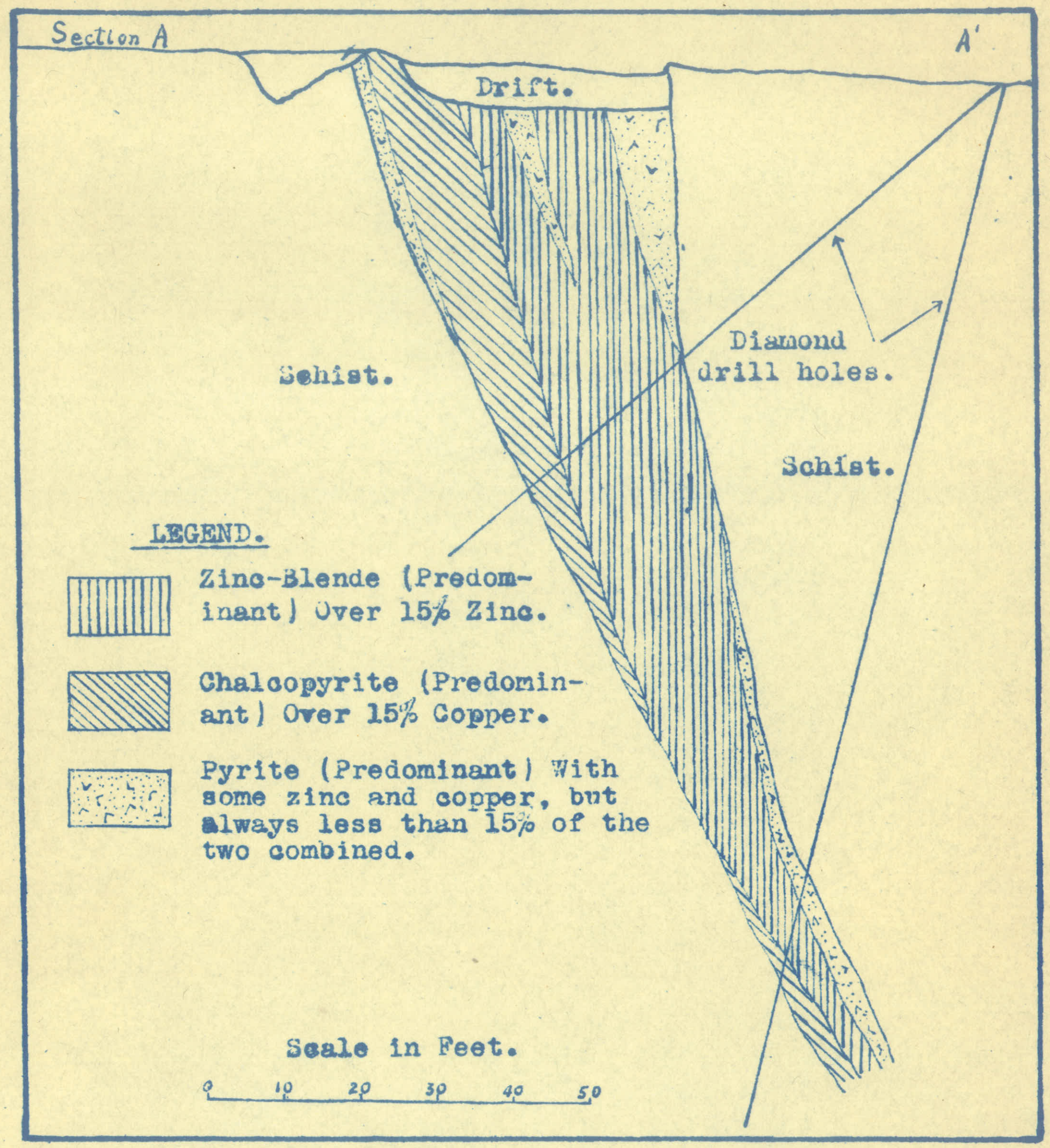


Fig. 5. Mandy mine. Vertical Cross-section A - A'.

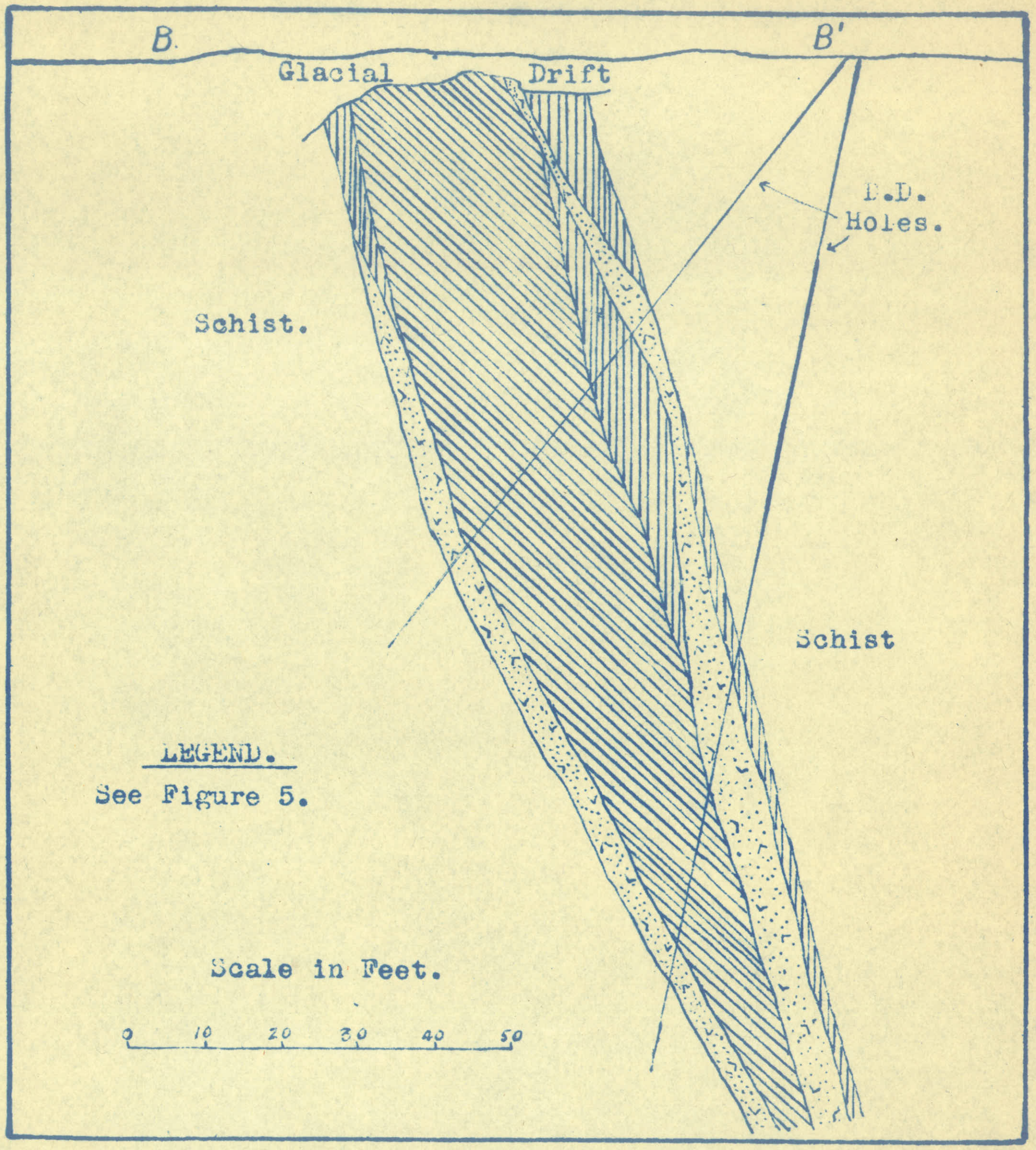


Fig. 6. Mandy mine. Vertical cross-section B - B'.

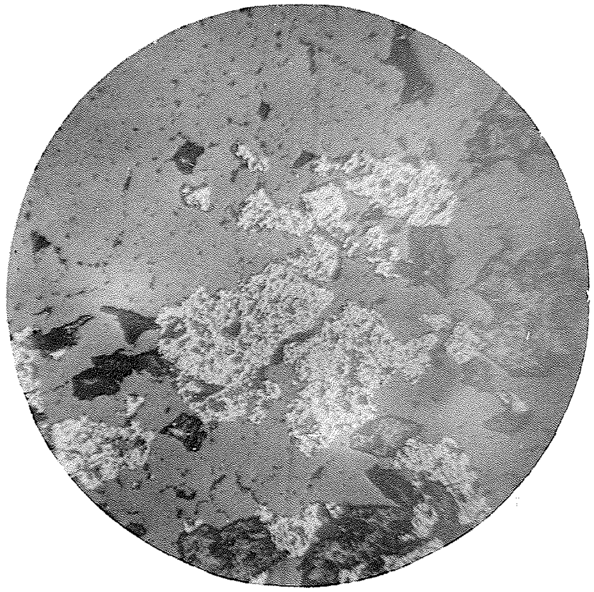


Fig. 7. Flinflon. Quartz (grey) replacing pyrite (white). X 60.

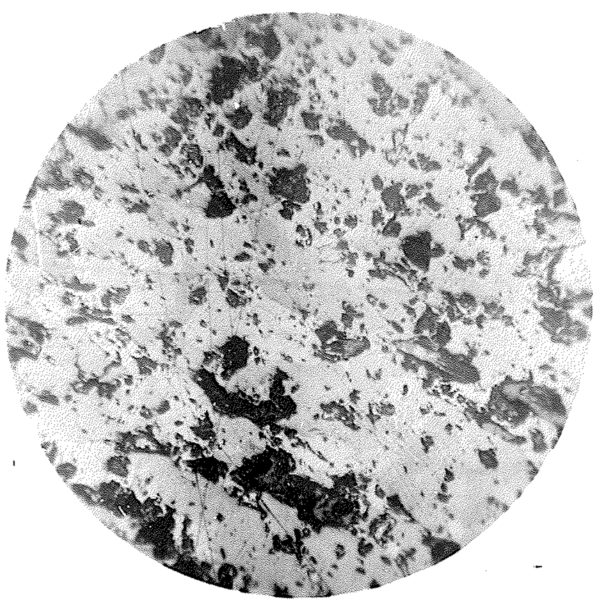


Fig. 8. Flinflon. Showing graphic intergrowth of Chalcopyrite (white) and sphalerite (light grey). X 60.

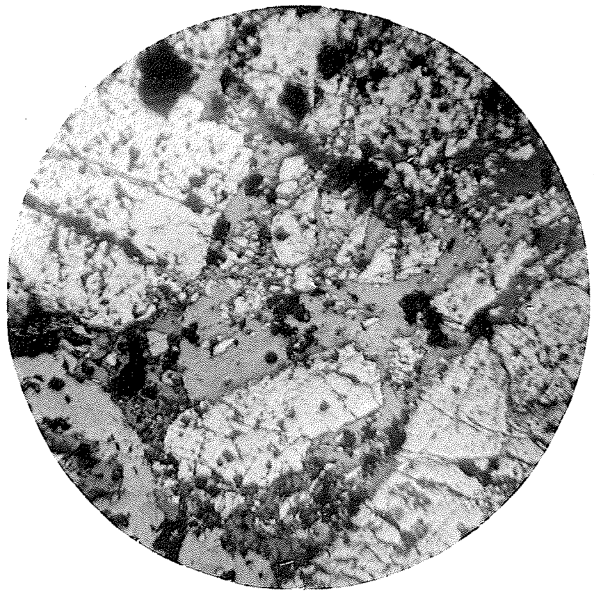


Fig. 9. Mandy. Veinlets of sphalerite and quartz (grey) penetrating pyrite (white). X 60.

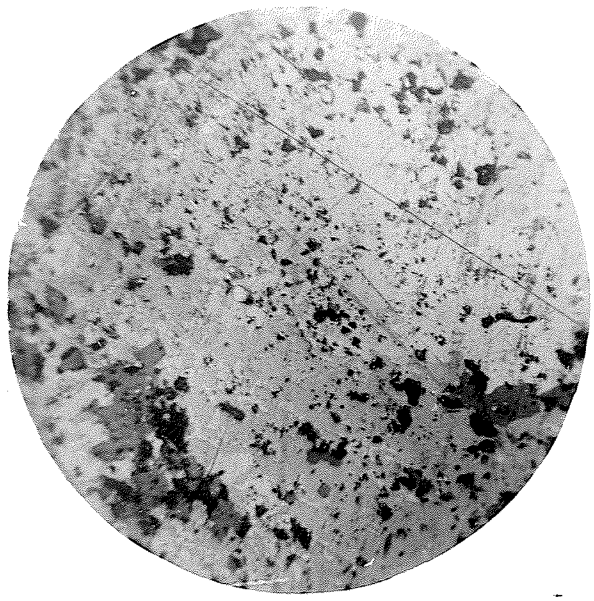


Fig. 10. Mandy. Showing intergrowth of chalcopyrite (white) and sphalerite (light grey). X 60.

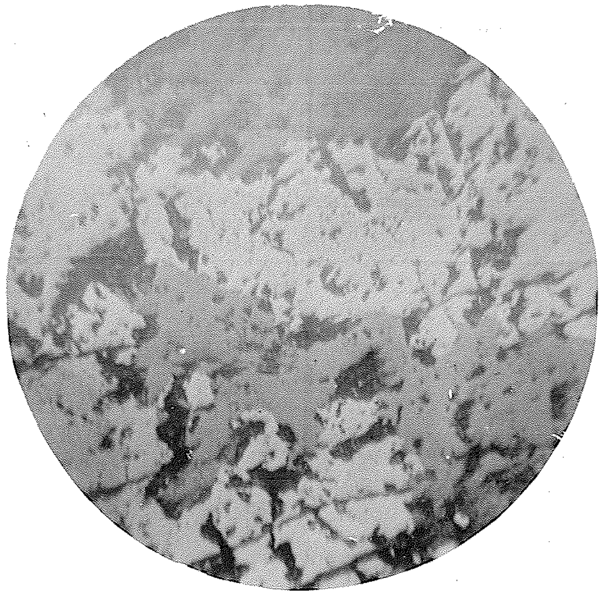


Fig. 12. Devlin claim. Showing magnetite (light grey) in gangue (dark grey). X 60.

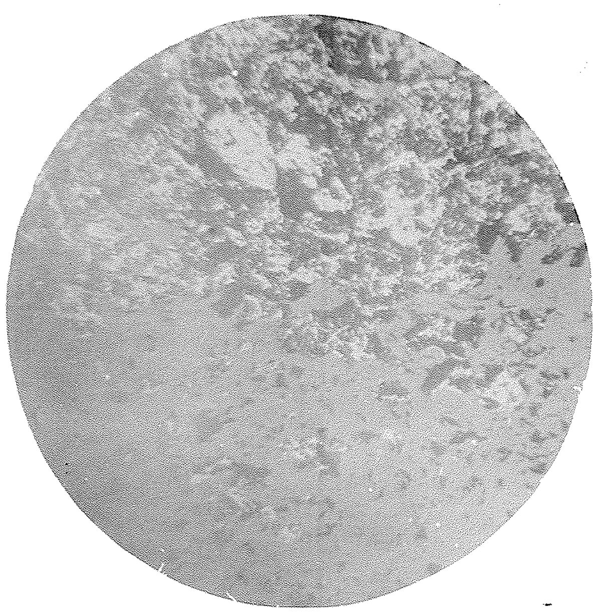


Fig. 13. Devlin claim. Showing contact between replaced and unreplaced gangue. Grey - gangue. White - magnetite, pyrrhotite, and chalcopyrite. X 60.

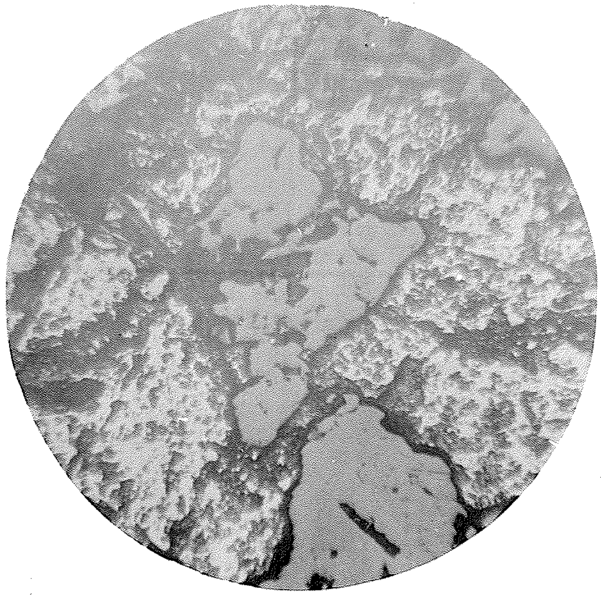


Fig. 14. Chance claim. Pyrrhotite (white) replacing gangue (grey). X 60.

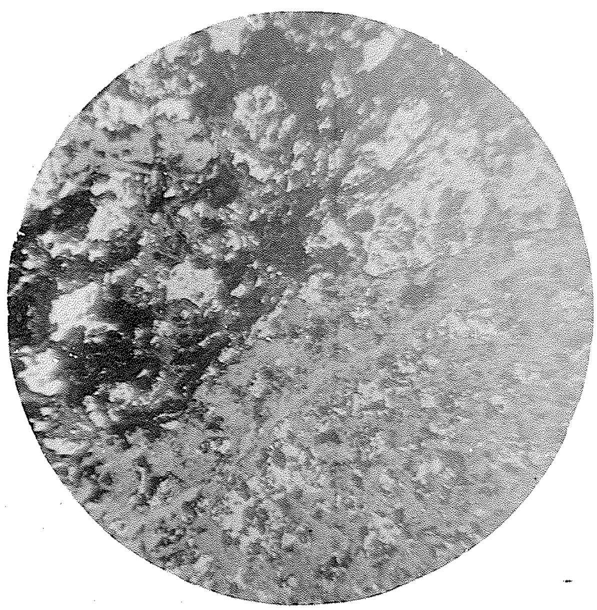


Fig. 15. Showing banding of sulphides (white) and gangue (grey). X 60.

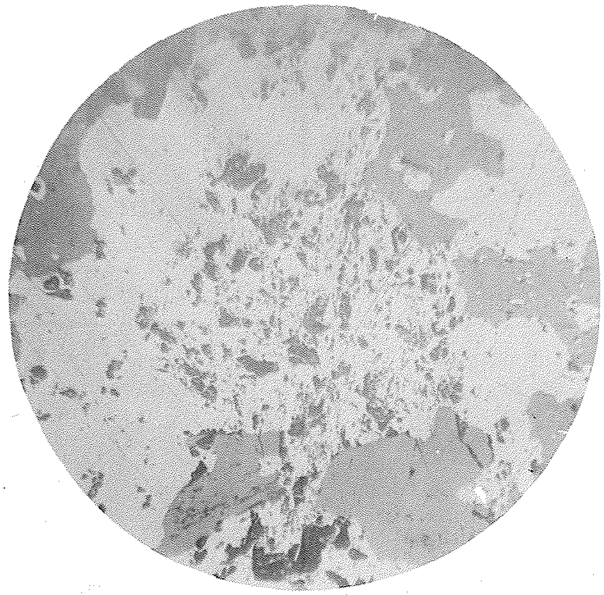


Fig. 16. Wento claim. Chalcopyrite and chalmersite (light grey) replacing gangue (dark grey). Chalmersite, in the centre, can be distinguished from chalcopyrite by the large number of small, dark pit-marks. X 60.

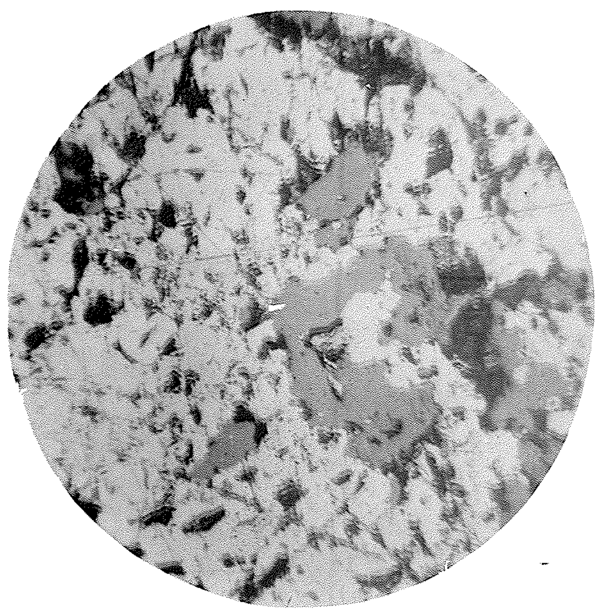


Fig. 17. Wento claim. Chalcopyrite and pyrrhotite (white) replacing gangue (grey). X 60.

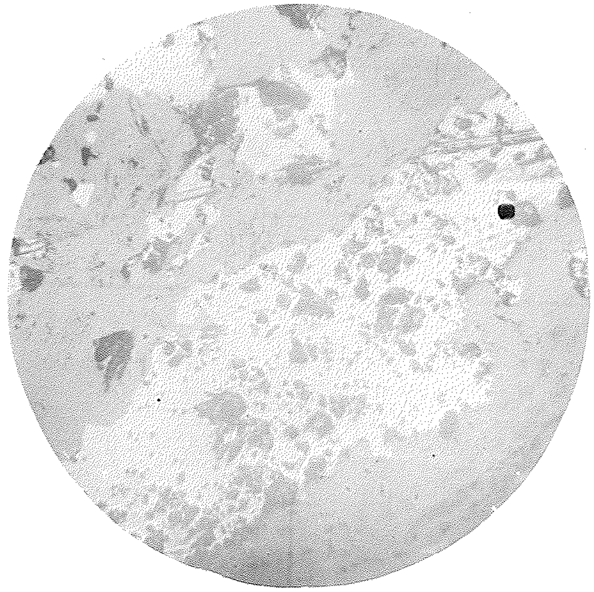


Fig. 18. Wento claim. Veinlet of chalcopyrite (white) cutting gangue (grey). X 60.

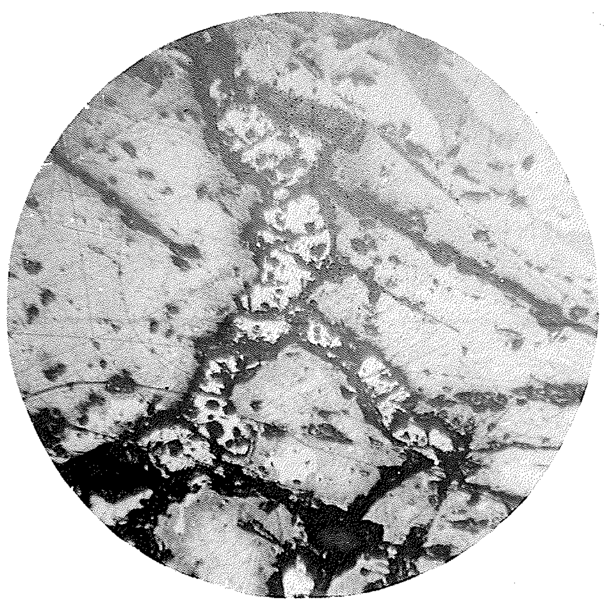


Fig. 19. Hunter claim. Veinlet of pentlandite (white) in pyrrhotite (grey). X 60.

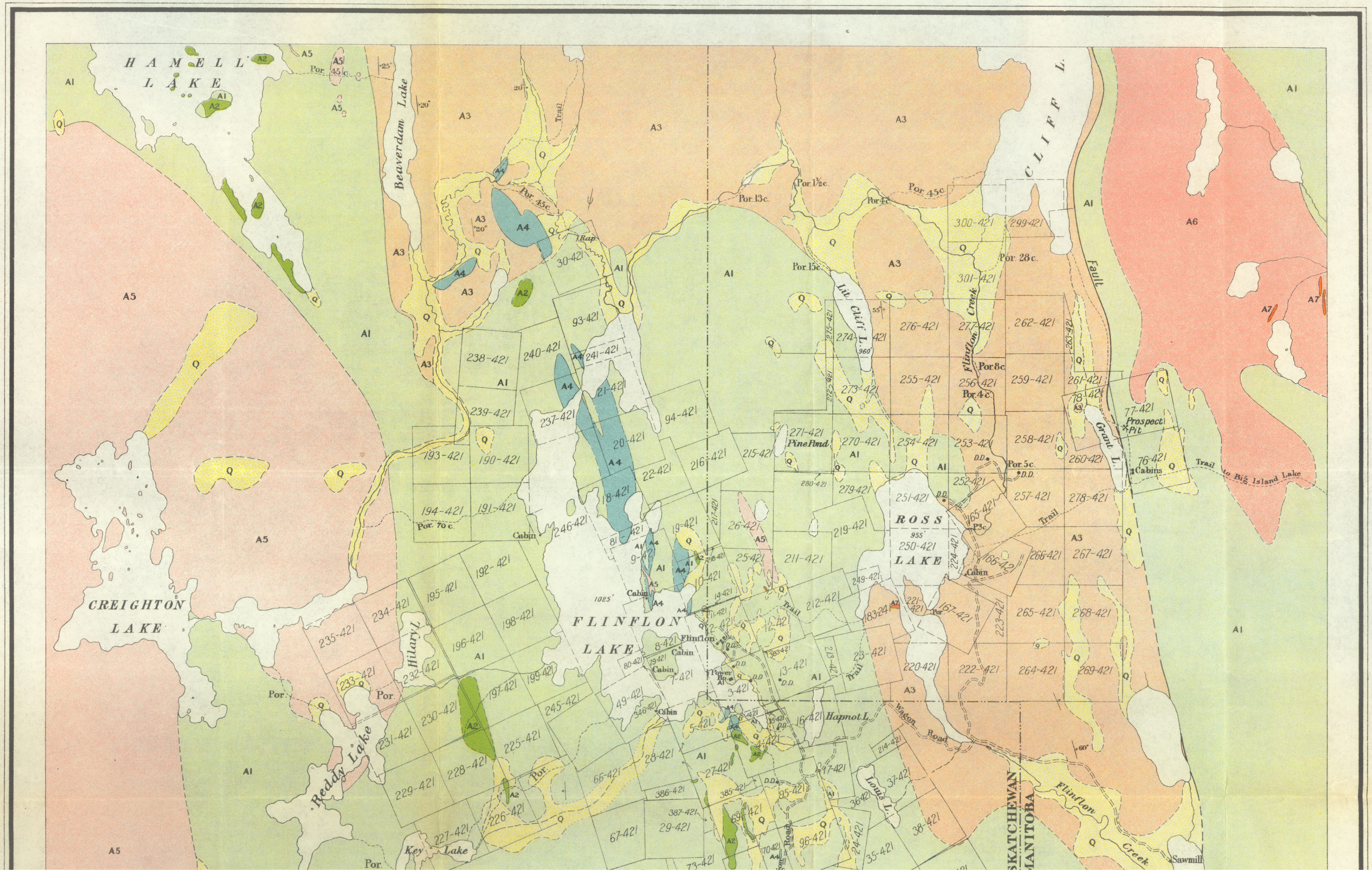
Canada
Department of Mines

HON. CHARLES STEWART, MINISTER; CHARLES CAMSELL, DEPUTY MINISTER.

GEOLOGICAL SURVEY

W. H. COLLINS, DIRECTOR.

Issued 1925



LEGEND

QUATERNARY

Q — *Recent alluvium, swamp deposits and glacial drift*

PRECAMBRIAN

A7 — *Basic intrusives*

A6 — *Porphyritic granite*

A5 — *Granite and related rocks*

A4 — *Lamprophyre, amphibolite, gabbro, peridotite.*

A3 — *Arkose and conglomerate*

Unconformity

A2 — *Acid volcanics and intrusives*

A1 — *Basic volcanics and intrusives*

Symbols

Geological boundary

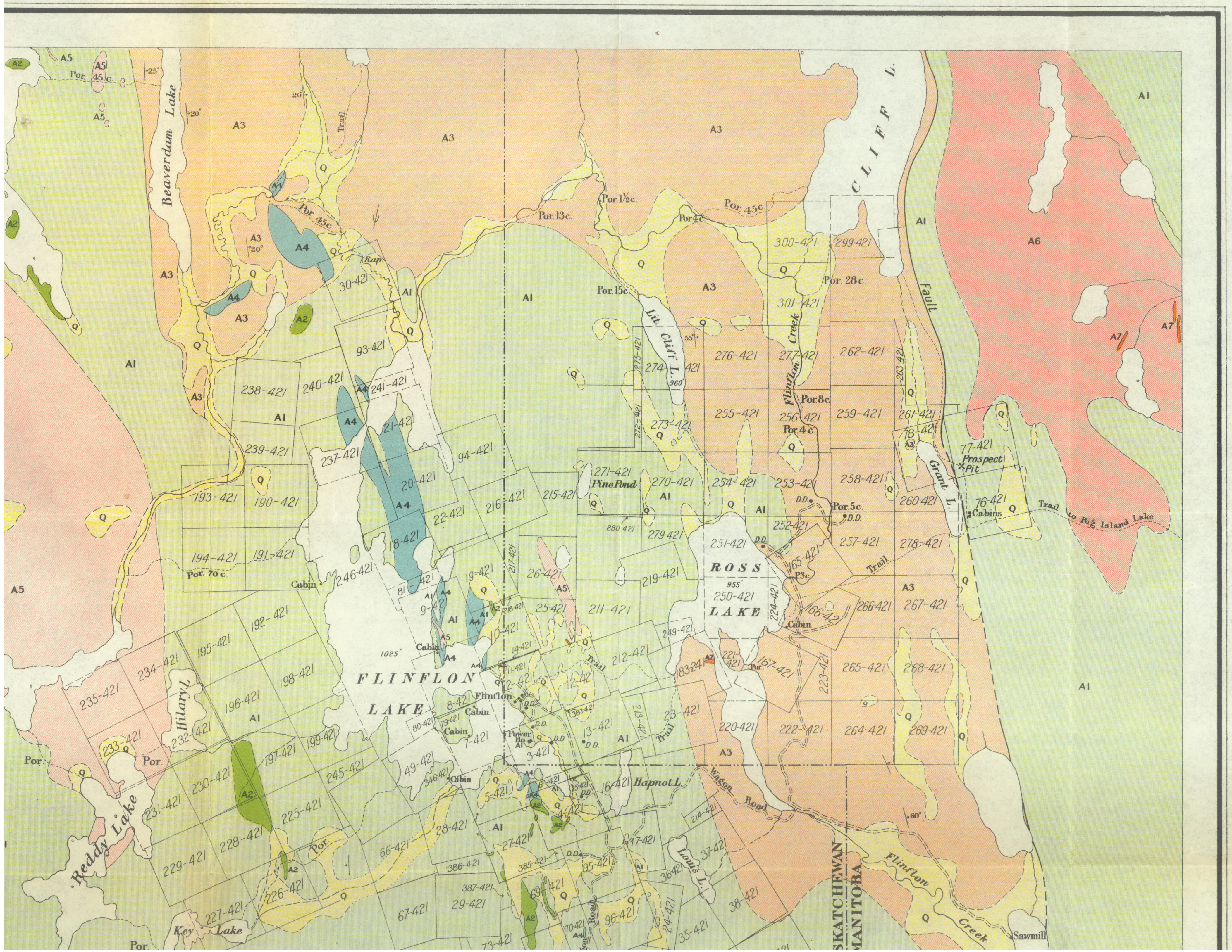
Canada
Department of Mines

Hon. Charles Stewart, Minister; Charles Camsell, Deputy Minister.

GEOLOGICAL SURVEY

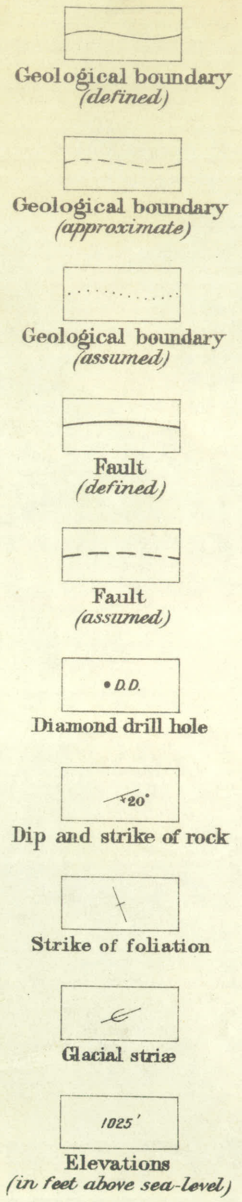
W. H. Collins, Director.

Issued 1925



LIST OF SURVEYED MINERAL CLAIMS.

No. of Claim.	Name.	No. of Claim.	Name.
2 - 421	Unique	199 - 421	Rag Doll
3 - "	Apex	200 - "	Deer
4 - "	Peerless	201 - "	Star Fr.
5 - "	Victoria	202 - "	Manitoba No. 4
6 - "	Surprise Fr.	203 - "	Caribou
7 - "	Nancy	204 - "	Manitoba No. 1
8 - "	Killarney	205 - "	Manitoba No. 2
9 - "	Pontiac	206 - "	Manitoba No. 3
10 - "	Extension	207 - "	Rainbow
11 - "	Snowshoe Fr.	208 - "	Lynx Fr.
12 - "	Lakeview	209 - "	Marten
13 - "	Outlook	210 - "	Pipe Fr.
14 - "	Sunshine Fr.	211 - "	Fort Pitt
15 - "	Combination Fr.	212 - "	Holy Smoke
16 - "	Burke	213 - "	Rainbow Fr.
17 - "	Portola	214 - "	Two Bits
18 - "	Munroe	215 - "	Schenley Fr.
19 - "	Eola	216 - "	Amaryllis
20 - "	Deer Lodge	217 - "	Craiggi Fr.
21 - "	Podunk	218 - "	Grizzly Fr.
22 - "	Del Monte	219 - "	Fortune Teller
23 - "	Nora	220 - "	The Pas No. 28
24 - "	Royal Cazaza	221 - "	" " " 27
25 - "	Flin Slam	222 - "	" " " 15
26 - "	La Salle	223 - "	" " " 16
27 - "	Crown	224 - "	" " "" 17
28 - "	Climax	225 - "	Victory
29 - "	Liskeard	226 - "	Bee
30 - "	B. M. Junior	227 - "	Steel King
31 - "	Turkey Track	228 - "	Devil's Own
32 - "	Marcasite	229 - "	Don't Care
33 - "	Dolomite	230 - "	Firefly
34 - "	Stannite	231 - "	Damifino
35 - "	Malachite	232 - "	Little Eva
36 - "	Limonite	233 - "	Clara
37 - "	Hematite	234 - "	Booze Hound
38 - "	Azurite	235 - "	Emma
39 - "	Stibnite	237 - "	Sky Pilot
40 - "	Calcite	238 - "	Six Bits
41 - "	Magnesite	239 - "	Cold Coin
42 - "	Maybe	240 - "	Four Bits
43 - "	Ryan	241 - "	Togo Fr.
44 - "	Old Safety	245 - "	Devil Chaser
46 - "	Eagle	246 - "	Darning Needle
47 - "	Elk	249 - "	Fog
48 - "	Pike	250 - "	The Pas No. 26
49 - "	Wapus	251 - "	" " " 25
50 - "	Mandy	252 - "	" " " 18
51 - "	Brutus	253 - "	" " " 19
52 - "	Blende	254 - "	" " "



C. O. Senécal, *Geographer and Chief Draughtsman*

Publication Nº 1994

FLINFLON LAKE AREA

MANITOBA AND SASKATCHEWAN

Scale, $\frac{1}{31,680}$ or 1 Inch to $\frac{1}{2}$ Mile

Miles: 1 ¾ ½ ¼ 0 1 2

Kilometres: 1 0 1 2 3 4

Sources of Information

Geology by F. J. Alcock, *1922.*

Base-map from surveys by F. J. Alcock, *1922, and the* Department of the Interior.

Map compilation by R. B. Yorston.

To accompany report by F. J. Alcock, in Summary Report, Part C. 1922.

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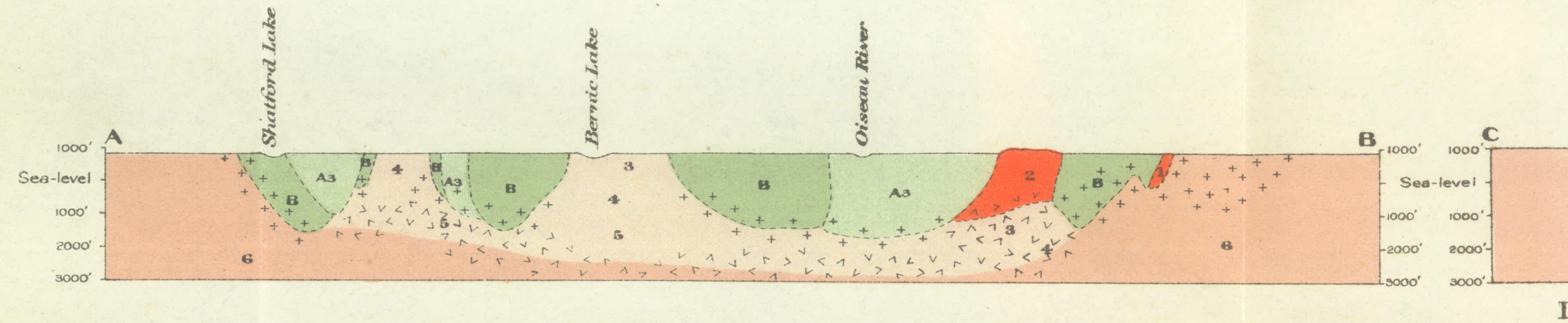
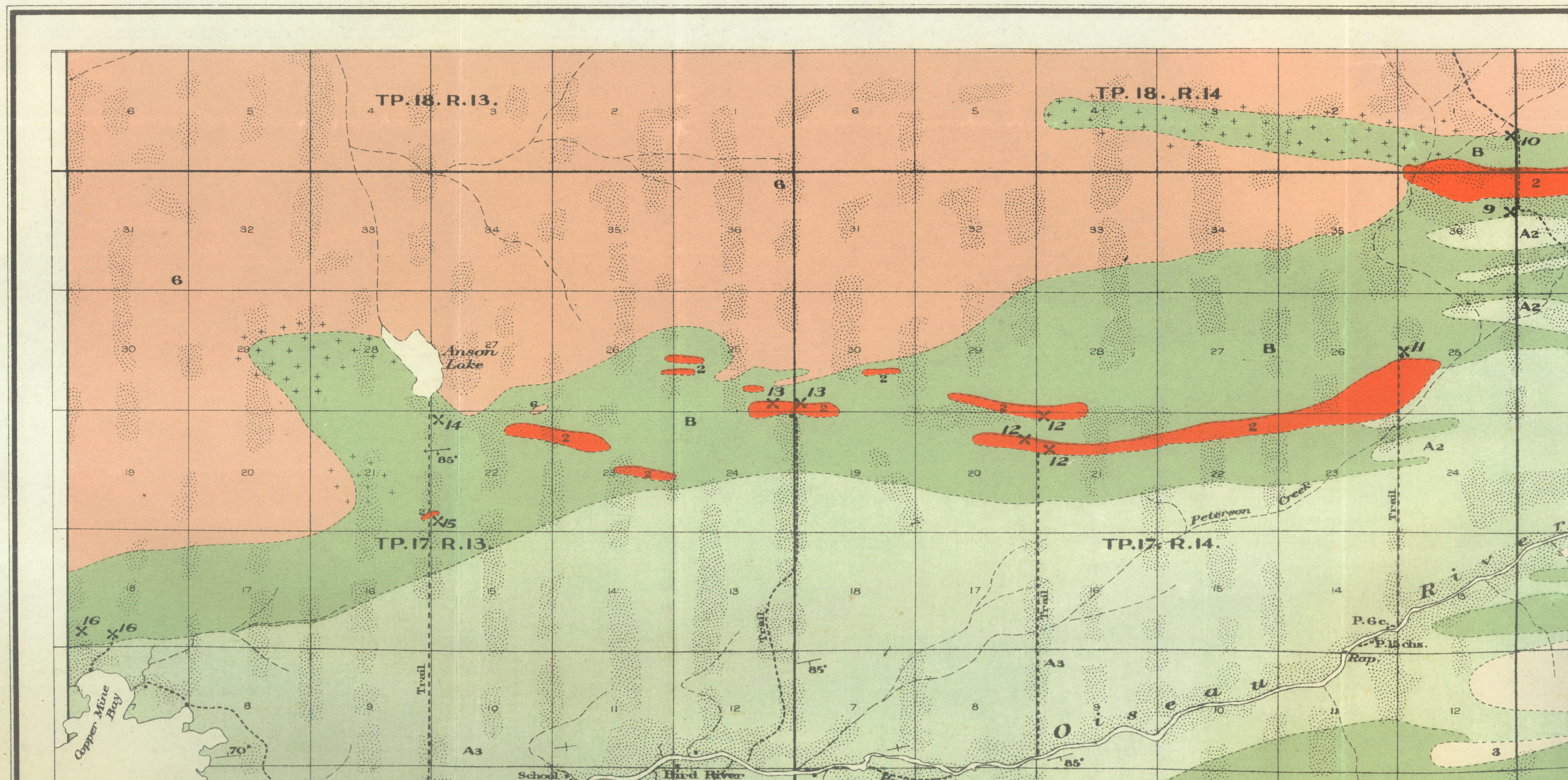
44 –	"	[illegible]	[illegible]	"	[illegible]
46 –	"	Eagle	246 –	"	Darning Needle
47 –	"	Elk	249 –	"	Fog
48 –	"	Pike	250 –	"	The Pas No. 26
49 –	"	Wapus	251 –	"	" " " 25
50 –	"	Mandy	252 –	"	" " " 18
51 –	"	Brutus	253 –	"	" " " 19
52 –	"	Blende	254 –	"	" " " 24
53 –	"	Galena	255 –	"	" " " 23
54 –	"	Four Aces	256 –	"	" " " 20
55 –	"	Cassius 2	257 –	"	" " " 11
56 –	"	Claudius	258 –	"	" " " 10
57 –	"	Papoose	259 –	"	" " " 9
58 –	"	Caesar	260 –	"	" " " 5
59 –	"	Julius	261 –	"	" " " 6
60 –	"	Cuprite	262 –	"	" " " 8
61 –	"	Chalcocite	263 –	"	" " " 7
62 –	"	Pyrite	264 –	"	" " " 14
63 –	"	Zircon	265 –	"	" " " 13
64 –	"	Anthony	266 –	"	" " " 12
65 –	"	Cassius	267 –	"	" " " 3
66 –	"	Wild Duck	268 –	"	" " " 2
67 –	"	Rose	269 –	"	" " " 1
68 –	"	Copper King	270 –	"	" " " 31
69 –	"	Oro	271 –	"	" " " 32
70 –	"	Weston	272 –	"	" " " 33
71 –	"	Mac	273 –	"	" " " 30
72 –	"	Kerr	274 –	"	" " " 29
73 –	"	Durand	275 –	"	" " " 34
74 –	"	Midnight	276 –	"	" " " 22
75 –	"	Bisbee	277 –	"	" " " 21
76 –	"	Maple Leaf	278 –	"	" " " 4
77 –	"	Beaver	279 –	"	" " " 35
78 –	"	Waverley	280 –	"	" " " 36
79 –	"	Triangle Fr.	298 –	"	Raven Fr.
80 –	"	Island	299 –	"	The Pas No. 39
81 –	"	Bulldog	300 –	"	" " " 38
93 –	"	Harris	301 –	"	" " " 37
94 –	"	Mandy 2	303 –	"	Manitoba No. 5
95 –	"	Zero	305 –	"	" " 13
96 –	"	Ray	306 –	"	" " 12
165 –	"	May 2	307 –	"	" " 11
166 –	"	Sunshine 3	308 –	"	" " 10
167 –	"	Bear Cat	309 –	"	" " 9
173 –	"	Hebron	310 –	"	" " 8
183 –	"	War Baby	311 –	"	" " 6
190 –	"	Alladin Sr.	312 –	"	" " 7
191 –	"	Alladin Jr.	346 –	"	Bill Fr.
192 –	"	Chicago	382 –	"	Chalet
193 –	"	June	383 –	"	Fox Fr.
194 –	"	Bulldozer	384 –	"	Tiny Fr.
195 –	"	Blackbird	385 –	"	Zero Fr.
196 –	"	August VII	386 –	"	Nora Junior Fr.
197 –	"	Cocktail	387 –	"	Hiawatha Fr.
198 –	"	New Baby	423 –	"	Ethel Fr.





LEGEND

QUATERNARY — RECENT AND GLACIAL

Mapped areas of muskeg, post-glacial Lake Agassiz stratified clay, and glacial drift

PRECAMBRIAN — PLUTONIC INTRUSIVES

7 — Acidic intrusives (pegmatite)

6 — Acidic intrusives (microcline-granite and granite gneiss)

3 4 5 — Intermediate intrusives
5, grey oligoclase-granite and (porphyritic) granite gneiss.
4, granodiorite and quartz porphyry.
3, diorite and quartz diorite.

1 2 — Basic intrusives
2, hornblende gabbro.
1, amphibole-peridotite.

B — Volcanics
(andesite, dacite, trachyte,

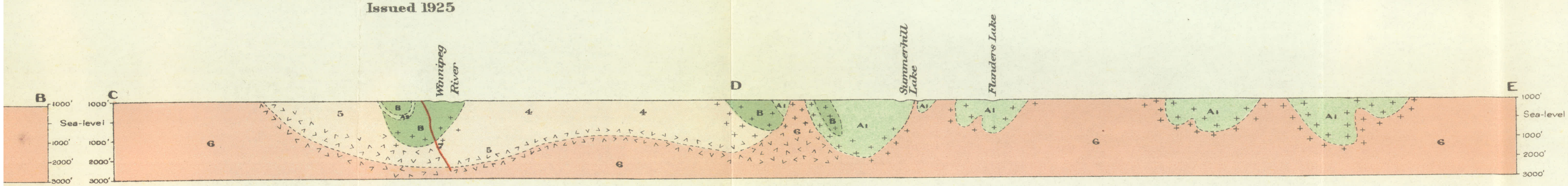
Canada
Department of Mines

HON. CHARLES STEWART, MINISTER; CHARLES CAMSELL, DEPUTY MINISTER.

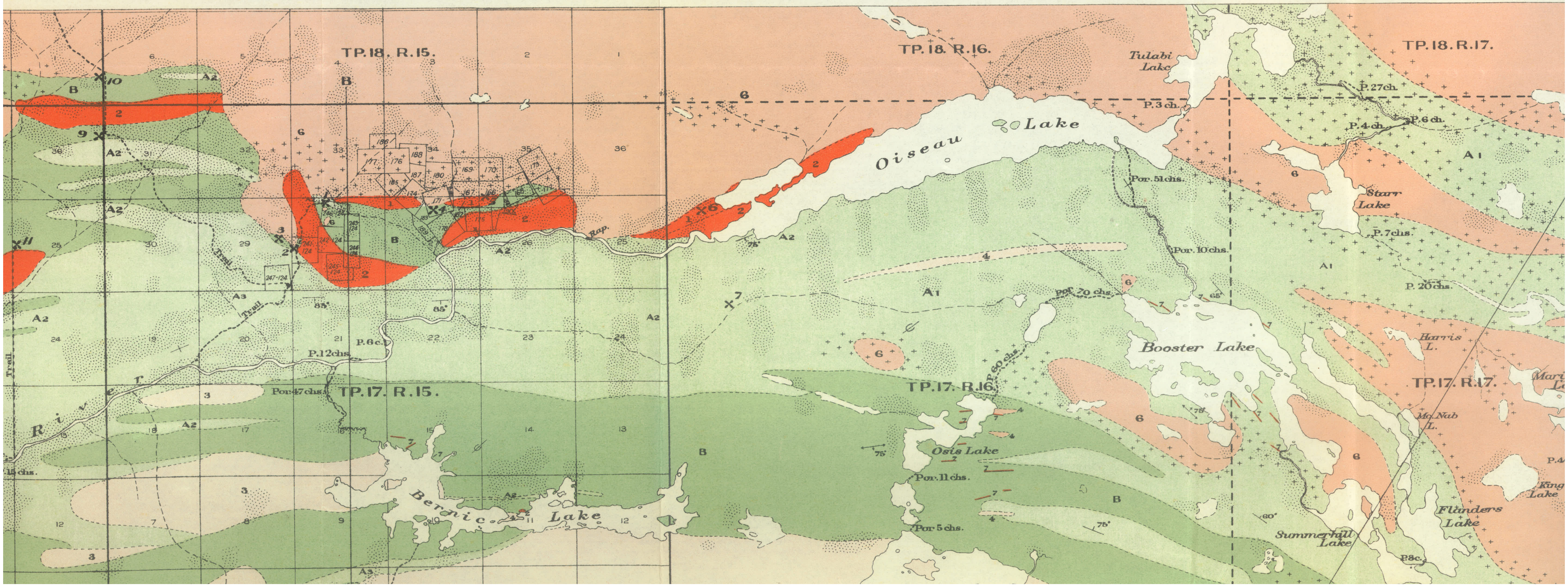
GEOLOGICAL SURVEY

W. H. COLLINS, DIRECTOR.

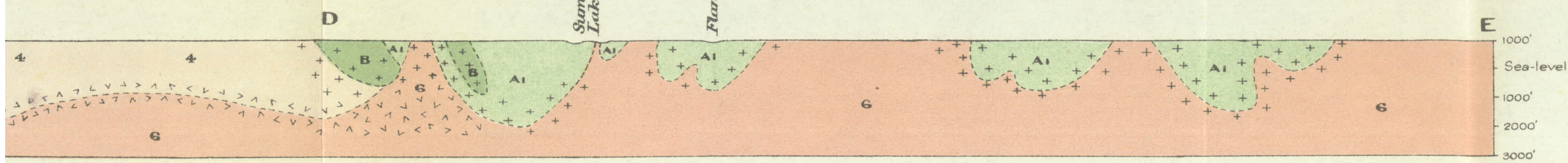
Issued 1925



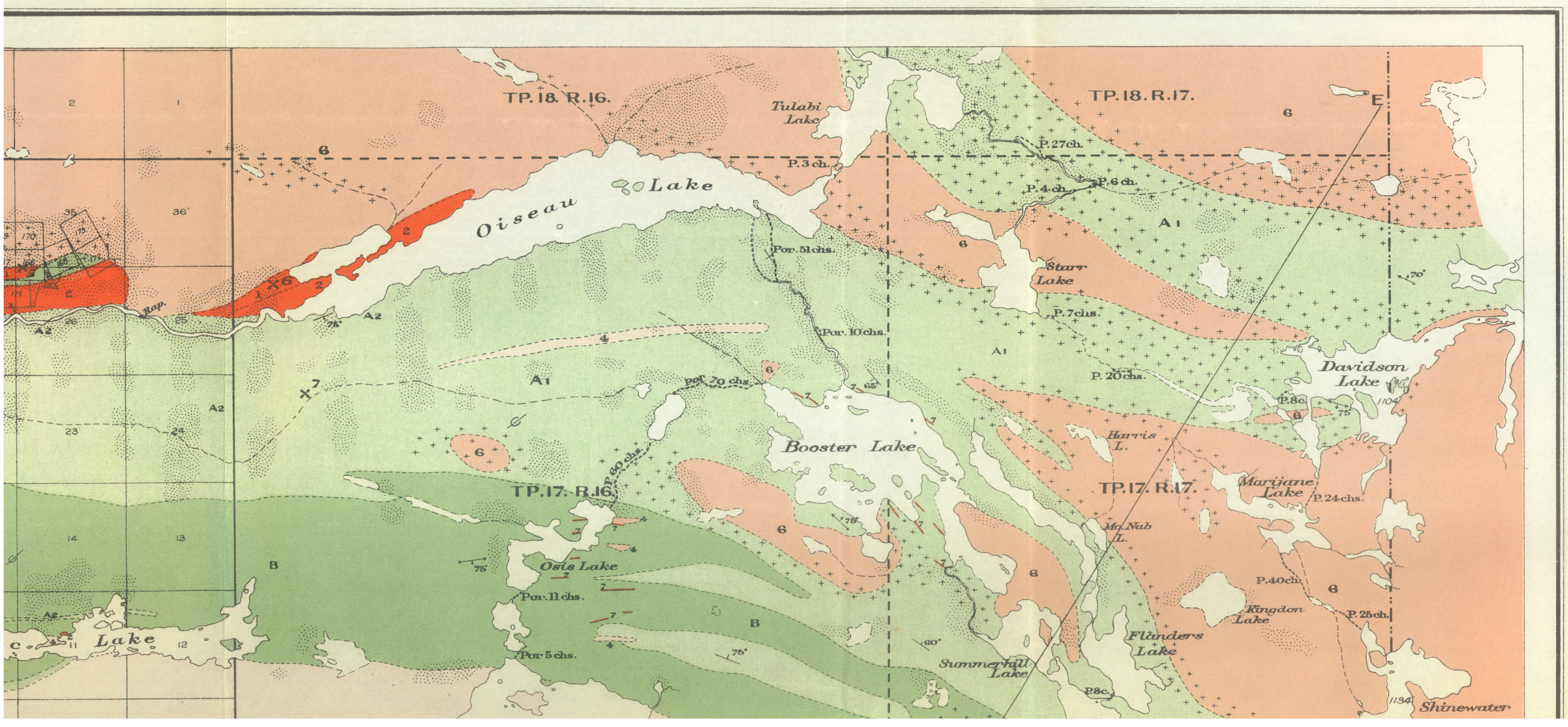
Diagrammatic structural sections along lines A B and C D E.



Deputy Minister.

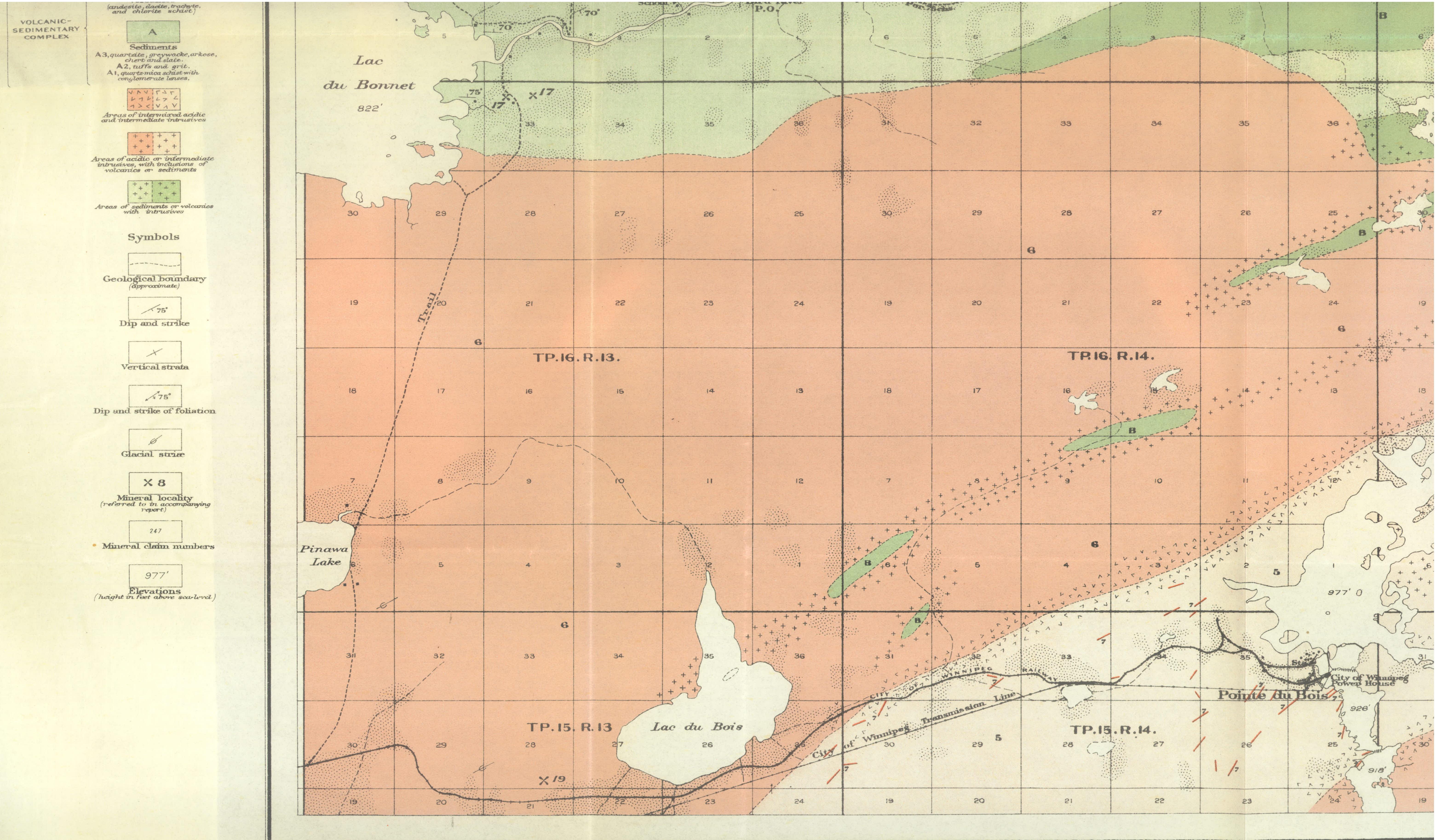


s AB and CDE.



List of surveyed mineral claims

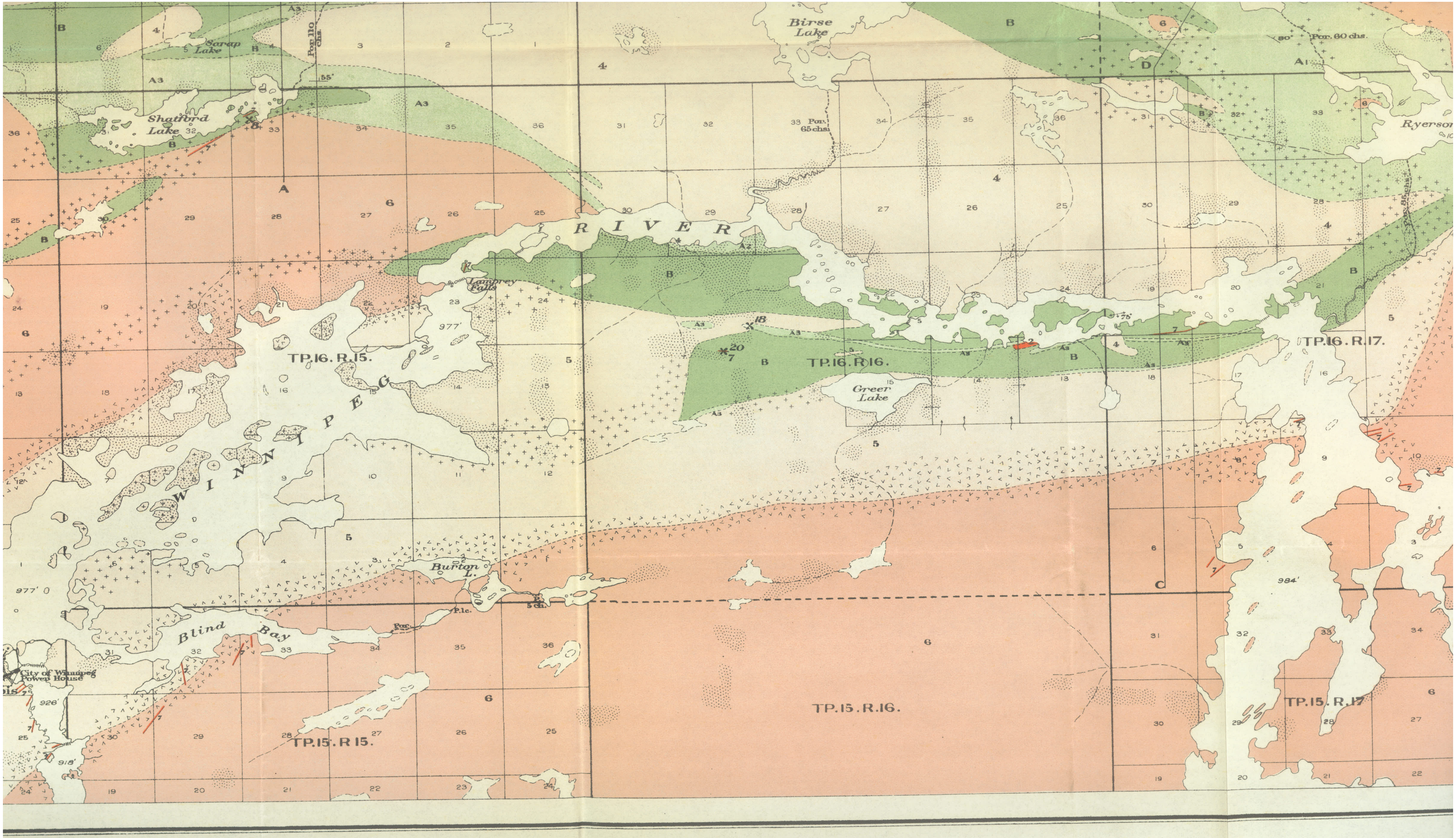
No. of Claim	Name
166 - 124	Chence



C.O. Senécal, Geographer and Chief Draughtsman.
A. Joanes, Draughtsman.

OISEAU

To accompany report by J.F. Wright, in Summary Report, Part B, 1926.



OISEAU RIVER AREA, SOUTHEAST MANITOBA.

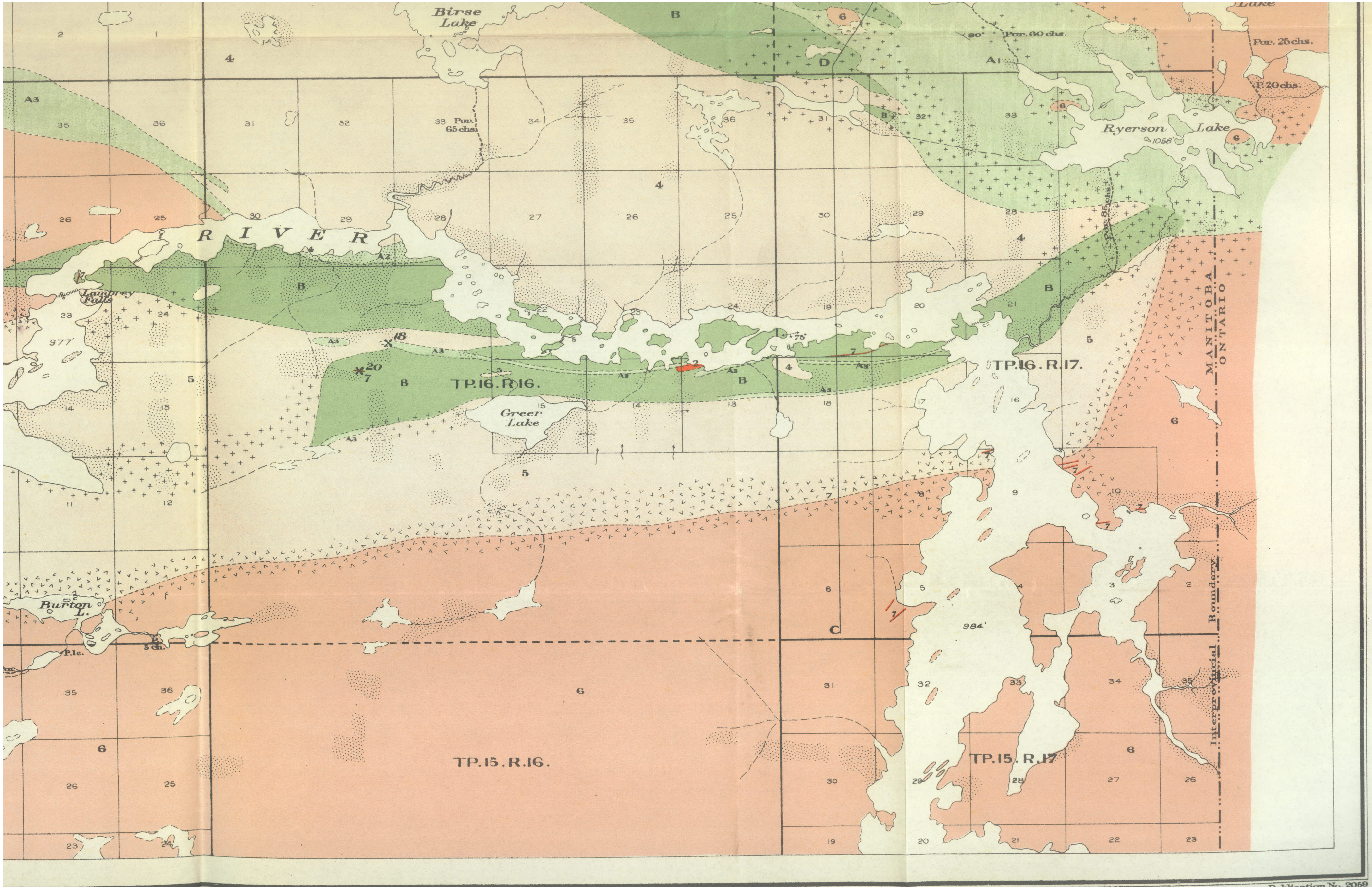
Scale of Miles

1 3/4 1/2 1/4 0 1 2 3

Sources of Information

Geology by J. F. Wright, *1923-24.*

Base map prepared from published surveys of the Topographical Surveys Branch *and* Dominion Water Power Branch, Department of the Interior; *and from surveys by* J. F. Wright 1924.



168	"	Copper Plate
169	"	Bella
170	"	Burn
171	"	Devlin
172	"	Copper King
173	"	Copper King No.2
174	"	Martin
175	"	Wilfred D.
176	"	Lily Devlin
177	"	Glasgow
178	"	Elizabeth
180	"	Evelyn
181	"	Wynne
182	"	Galt Fr.
183	"	Martin Fr.
184	"	Dumfries
185	"	Gunner Fr.
186	"	Kelvin Fr.
187	"	Bruce
188	"	Kooteney Fr.
189	"	Elizabeth Fr.
190	"	Wilfred D. Fr.
241	"	Wento
242	"	Peroba
243	"	Kutie
244	"	Keteta Fr.
245	"	Tatu
246	"	Cup Anderson
247	"	Camp

EAST MANITOBA.

Sources of Information

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