RESEARCH COUNCIL OF ALBERTA
GEOLOGICAL DIVISION

Preliminary Report 58-4

Mineralization in the Andrew, Waugh and Johnson Lakes Area, Northeastern Alberta

by

J. D. GODFREY

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MINERALIZATION IN THE ANDREW, WAUGH AND JOHNSON LAKES AREA, NORTHEASTERN ALBERTA

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J. D. Godfrey

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MINERALIZATION IN THE ANDREW, WAUGH AND JOHNSON LAKES AREA, NORTHEASTERN ALBERTA

Introductory Statement

Interesting new deposits of molybdenite and radioactive minerals have been found near Andrew, Waugh and Johnson Lakes in the Precambrian Shield of northeastern Alberta. These occurrences were noted and examined during a geological survey carried out by field parties of the Research Council of Alberta during 1957 and 1958 (Godfrey, 1958a). A detailed and direct search for mineralization in the area mapped has not been carried out. Traverses spaced at one quarter of a mile intervals were made in the course of the geological mapping. On these traverses radioactivity was measured by a portable geiger counter. The level of radioactivity was assessed using the following relative scale: "significant" when radioactivity is in the range of 2.5 to 4 times background, "high" when radioactivity is 4 to 5 times background, and "very high" when radioactivity is 6 times background or greater.

Radioactivity varies over the different rock types. For example, the counts over granite, granite gneiss, pegmatite, and some metasedimentary rocks may be twice as high as those over some schists. Some of the minerals in the more recent discoveries were identified in the field and need confirmation. This area should be of interest to prospectors and mining exploration companies.

Grateful acknowledgment is made for the valuable assistance rendered in the field by senior assistants J. M. McLelland and E. W. Peikert, and by junior assistants D. Clements, B. E. Henson, E. Overbo, J. Steiner and G. Wysocki.

The location of the area under discussion is shown on figure 1 and the distribution of the mineral deposits is shown on Map 58-4 (in pocket).

The area is accessible by air on a scheduled passenger service operated by Canadian Pacific Air Lines Ltd. from Edmonton to Beaverlodge, Saskatchewan, or Fort Smith, Northwest Territories. Aircraft equipped with pontoons or skis are required to reach the interior; such aircraft may be chartered at either of these centres. From the railhead at Waterways, tugs and barges move heavy freight along the Athabasca River. Dock facilities are available near Uranium City and Fort Chipewyan on Lake Athabasca, and at Fort Fitzgerald on the Slave River. This service is operated by Northern Transportation Company Limited at McMurray.

General Geology

The rocks present in the area fall into three broad divisions: (a) granites and granite gneisses, (b) quartzite, biotite-sericite schists; conglomerate and slate, and (c) porphyroblastic schists grading into porphyritic grey granite. Granitic rocks in the area include hornblende, biotite, muscovite, ~~and~~ granites and granite gneisses; feldspar augen gneisses, amphibolite, and veinlets of epidote are commonly associated with these rocks. Some of the granites and granite gneisses grade into pegmatites. Division (b) contains pods, lenses and stringers of quartz and pegmatite. Basic volcanic rocks and amphibolites occur in some of the metasedimentary bands. Quartzite and biotite schists may grade through porphyroblastic feldspar schists to augen or porphyritic grey granite gneisses. Garnets are common in the quartzites and rare in granite gneisses.

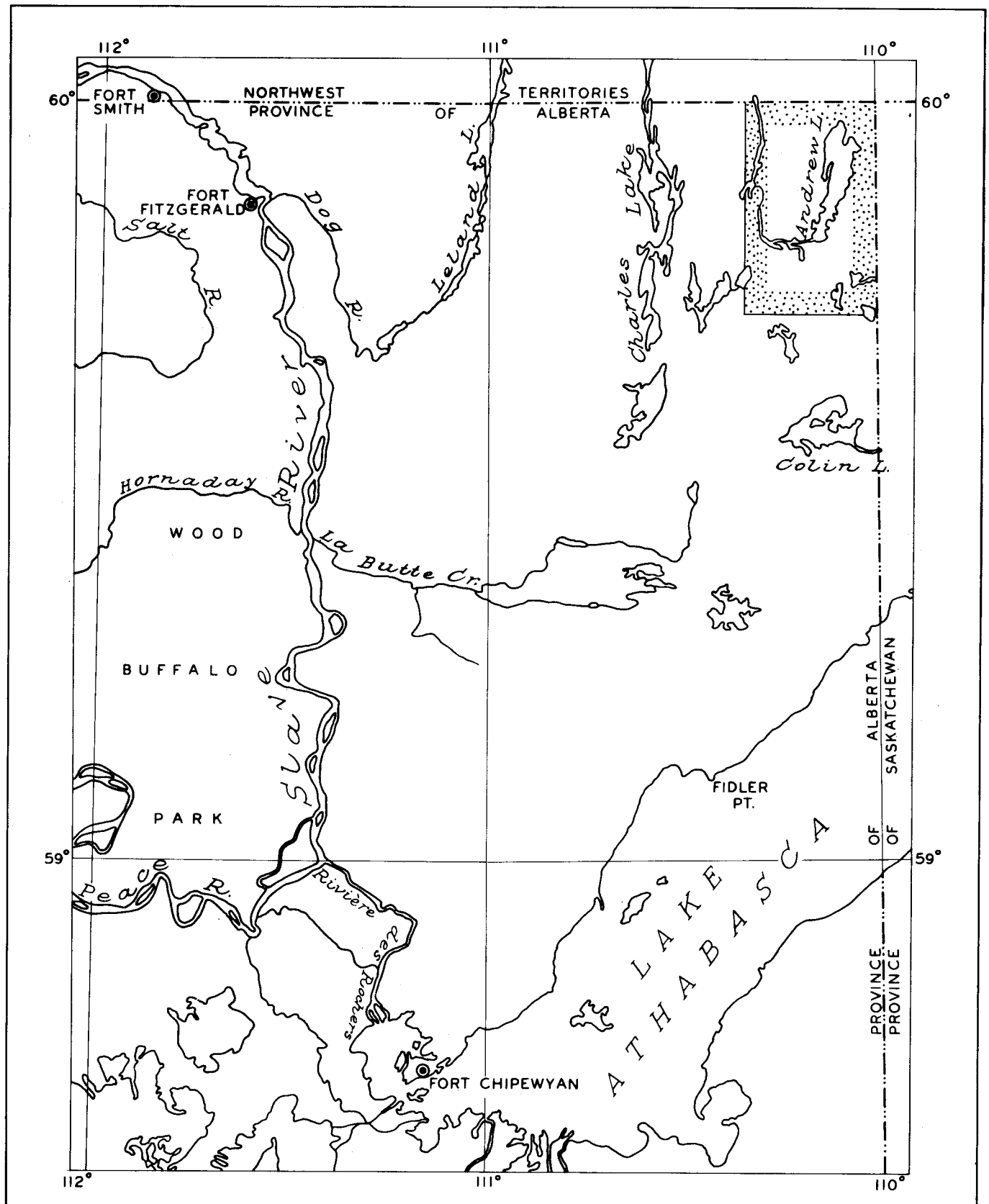

FIGURE 1

GENERAL LOCATION OF MAP AREA

The bands of granitic and metamorphic rocks of this area have a distinct northerly trend. They are cut by many major faults. Two separate trends have been recognized, one trending north and the other northwesterly. Escarpments which have been recognized on aerial photographs[1] (Godfrey, 1958b) are believed to indicate the principal faults.

Description of Deposits

Brief descriptions of the mineralization and geology of each of the locations indicated on Map 58-4 are given below. Field evaluation of the mineralization has been summarized in the accompanying table.

Location 1, Map 58-4 - Southwest of the arm of Andrew Lake

A very high level of radioactivity was found on an outcrop of sheared metasedimentary rocks located 2,000 feet southwest of the southwest corner of the arm of Andrew Lake.

The outcrop measures 200 by 75 feet and consists of quartzite, biotite schist, feldspathic quartzite, porphyroblastic feldspar schist and pegmatite. Both molybdenite and the radioactive mineralization seem to be concentrated in a biotite schist band although small zones of significant radioactivity and flakes of molybdenite were noted elsewhere on the outcrop. The band of biotite schist, six inches wide, which strikes north 17 degees east, contains molybdenite and yellow stains

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[1] Aerial photographs covering this area may be obtained either from the Technical Division, Department of Lands and Forests, Government of Alberta, Edmonton, or from the National Air Photographic Library, Department of Mines and Technical Surveys, Ottawa.

Table Giving Significance of Mineralization at Locations Shown on Map 58-4

Mineral Indications	Location Numbers
Radioactivity	
Very high	1
High	2 3 4 6 7
Significant	2 3 4 8 9
Molybdenite	
Important	1
Minor	2 10 11 12 13 14
Minor Mineralization	
Arsenopyrite	4 5 16
Smaltite	5
Pyrrhotite	5 15 16
Galena	15 17
Chalcopyrite	17

which resemble carnotite. This band can be followed for 110 feet before it is covered by glacial drift. The radioactive zone and surrounding rocks follow the same trend and dip either vertically or 85 to 90 degrees west. The mineralized biotite schist is iron stained and contains thin lenses and pods of quartzite and veins of quartz. Pyrite is found in all rocks and particularly in the metasedimentary rocks.

Location 2, Map 58-4 - Spider* Lake

A zone containing highly radioactive bands with molybdenite has been followed for over half a mile along the strike of the metasedimentary rocks at Spider Lake. Geiger counter readings taken at intervals along the direction of the strike indicate that this radioactive zone may extend at least two miles (fig. 2). Similar radioactive occurrences with molybdenite associated with pegmatites have been described from several localities in northern Saskatchewan (Mawdsley, 1957a, 1957b).

Three grab samples taken from the highly radioactive zone have been assayed by G. S. Eldridge and Co. Ltd., Vancouver and gave the following results:

Sample Number	U_3O_8%	Mo%
JG-58-44-1A	1.03	0.69
JG-58-44-1B	3.93	1.03
JG-58-44-1C	3.29	1.40

* Names marked with an asterisk in this report are used for convenience and have not been authorized by the Canadian Board on Geographical Names.

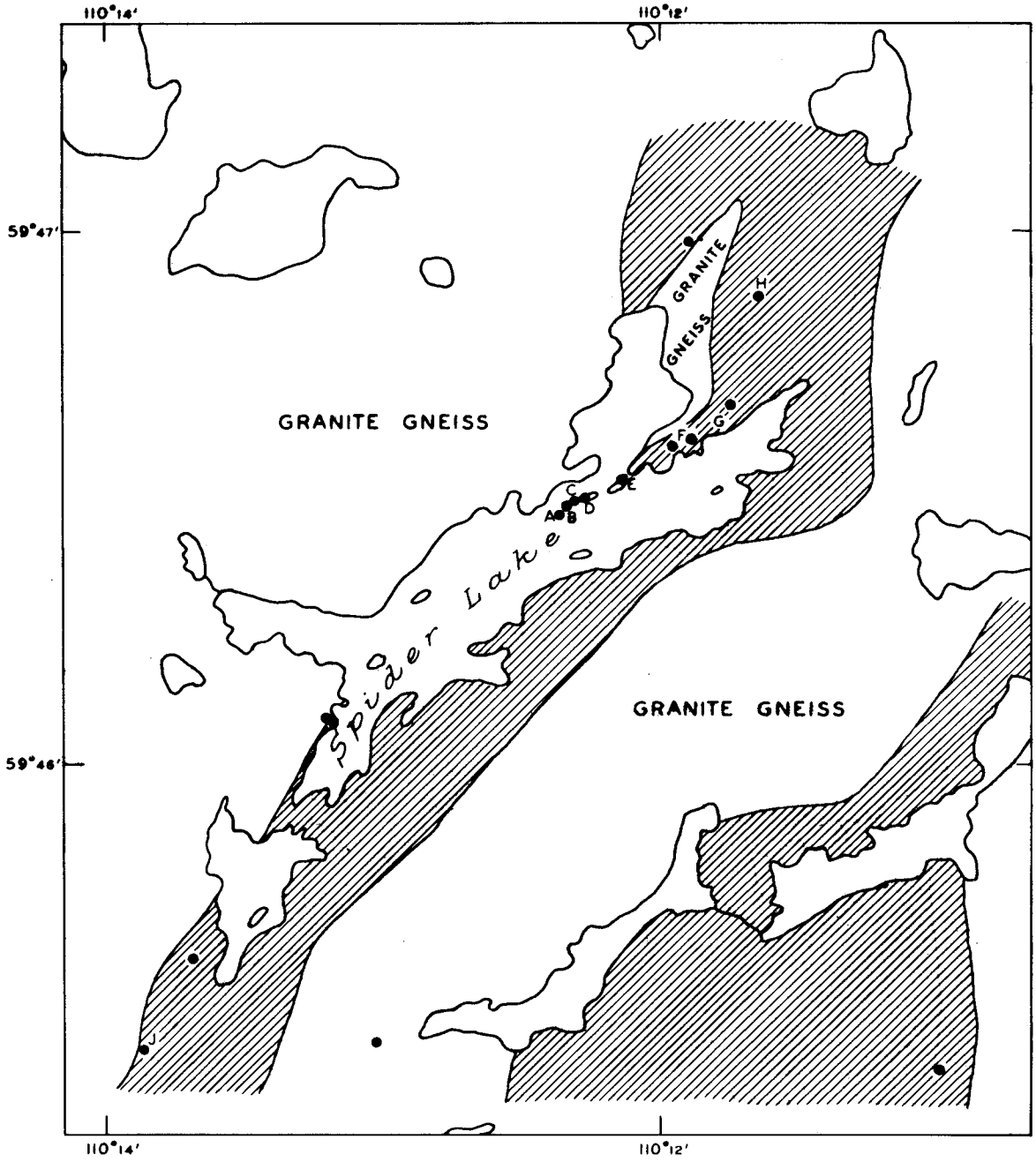

FIGURE 2

SPIDER LAKE

Scale in Miles

0 1/4 1/2 3/4 1

LEGEND

Metasedimentary band...

Radioactivity.....

Semi-quantitative spectrographic analysis on two of the samples gave the following results (reported in per cent as oxides of the elements involved):

JG-58-44-1A		JG-58-44-1C	
Na	6.0	Na	0.25
Mg	7.5	Mg	10.0
Al	20.0	Al	15.0
K	8.0	K	10.0
Ca	2.5	Ca	0.25
Ti	4.0	Ti	5.0
V	0.15	V	0.1
Cr	0.25	Cr	0.1
Mn	0.2	Mn	0.3
Fe	20.0	Fe	20.0
Co	0.01	Co	0.01
Ni	0.01	Ni	0.01
Cu	0.04	Cu	0.03
Sr	0.01	Zr	0.15
Zr	0.1	Mo	2.0
Mo	1.0	Y	0.15
Ag	0.0008	Yb	0.03
Y	0.05	Ba	0.2
Yb	0.02	U	2.5
Ba	0.35	Pb	0.75
U	1.0		
Pb	0.5		

Si + non-detectables: Balance in both samples.

A high level of radioactivity and yellow stains similar to carnotite were found in pink feldspar pegmatites within quartzites and biotite schist. In some cases similar looking yellow stains are nonradioactive; these stains are thought to be derived from the weathering of disseminated flakes of molybdenite. The radioactive zone was noted along the peninsula at the northern end of Spider Lake and continues through the string of islands to the southwest. It reappears

three-quarters of a mile south at the southwest corner of Spider Lake and has been noted at several points for another three-quarters of a mile farther south. The zone of radioactivity is situated near the western edge of the metasedimentary band and may be more extensive than shown. Each station of examination is located on figure 2 and described below.

Station A. Significant radioactivity is present over a 1- to 2-foot wide zone showing slight yellow stains. The rock is a sheared, contorted, finely banded, garnetiferous, feldspathic quartzite. This rock has a general strike of north 65 degrees east with large local variations.

Station B. A very high level of radioactivity, considerable yellow stain, and molybdenite make this the best "mineral showing" at Spider Lake. One zone having a high level of radioactivity was recorded in a pegmatite 6 feet wide and 38 feet long. Other less important radioactive zones were noted within the adjacent sheared, contorted, garnetiferous quartzite, feldspathic quartzite, and biotite schist. Small flakes of molybdenite are scattered throughout the outcrop. The metasedimentary rocks generally strike north 55 degrees east and are steeply dipping.

Station C. Radioactivity equivalent to over three times background was measured in yellow-stained pegmatites within the quartzite and schist. These rocks are vertical and strike north 55 degrees east.

Station D. Two radioactive, yellow-stained zones one to three feet in width were noted at this location. One extends for 65 feet and the other for 20 feet. They are composed of sheared pegmatite, and are separated by 15 feet of garnetiferous feldspar quartzite and biotite schist which strike north 80 degrees east and dip

vertically. The radioactivity and yellow stain appear to be concentrated in quartz-rich areas within the pegmatites.

Station E. Several yellow-stained radioactive zones are concentrated in pegmatites within garnetiferous quartzites and biotite schists. These rocks strike north 70 to 75 degrees east and dip 86 degrees east.

Station F. A high level of radioactivity comes from three yellow-stained pegmatites which contain minor amounts of molybdenite, pyrite, and fluorite. The individual pegmatites vary from 3 inches to 3 feet in width and can be traced for distances up to 200 feet parallel to the strike of the foliation in the country rocks. The foliation strikes 68 degrees and dips 78 degrees to the northwest. Similar smaller pegmatites were observed but these do not have yellow stains or a high level of radioactivity. The pegmatites have been displaced a few feet by two sets of fractures, one trending north 50 degrees west and the other north 28 degrees east. In one of the pegmatites small disseminated flakes of molybdenite are associated with iron stains and a very high level of radioactivity. The country rocks are dominantly feldspathic biotite schists which may contain up to 15 per cent of pink garnet with minor amounts of quartzite and feldspathic quartzite.

Station G. Yellow staining and a high level of radioactivity were found associated with coarse-grained quartz-rich zones within a sheared pegmatite. The host rock consists of sheared and contorted quartzites, and biotite quartzites containing feldspathic lenses. In general these rocks strike north 10 degrees east and dip 85 degrees west. Radioactivity was found in a zone 200 feet long and 6 to 10 feet wide. Flakes of molybdenite are found in the radioactive zones.

Station H. A high level of radioactivity was found in a sheared pegmatite within contorted feldspathic quartzite. The radioactive band is 10 feet wide and was traced for 100 feet. The rocks are vertical and have a general strike of north 10 degrees east. The quartzites on either side of the radioactive zone also show significant radioactivity.

Station J. Considerable yellow stain and high radioactivity were found associated with sheared, quartz-rich white petmatites between iron-stained quartzites and contorted granite gneiss. The rocks are vertical and generally strike north 40 degrees east. The radioactive zone is about 50 feet wide and about 150 feet long. The yellow stain appeared to be concentrated on quartz-rich bands in the pegmatites.

Location 3, Map 58-4 - Cherry* Lake

A significant level of radioactivity and yellow stains were found at several places near Cherry Lake (fig. 3). A brief description of these occurrences is given below.

Station A. A pegmatite which occurs within locally sheared iron-stained granite contains a significantly radioactive yellow-stained zone. This zone averages 400 to 500 feet in width and extends for three-quarters of a mile due north from the north end of the lake. The yellow stains are believed to be due to the weathering of flakes of molybdenite.

Station B. Yellow stains are found in quartz veins within pegmatites, along northwesterly trending fractures and scattered throughout biotite granite. Radioactivity -- 1.5 to 3 times background -- was noted at this location.

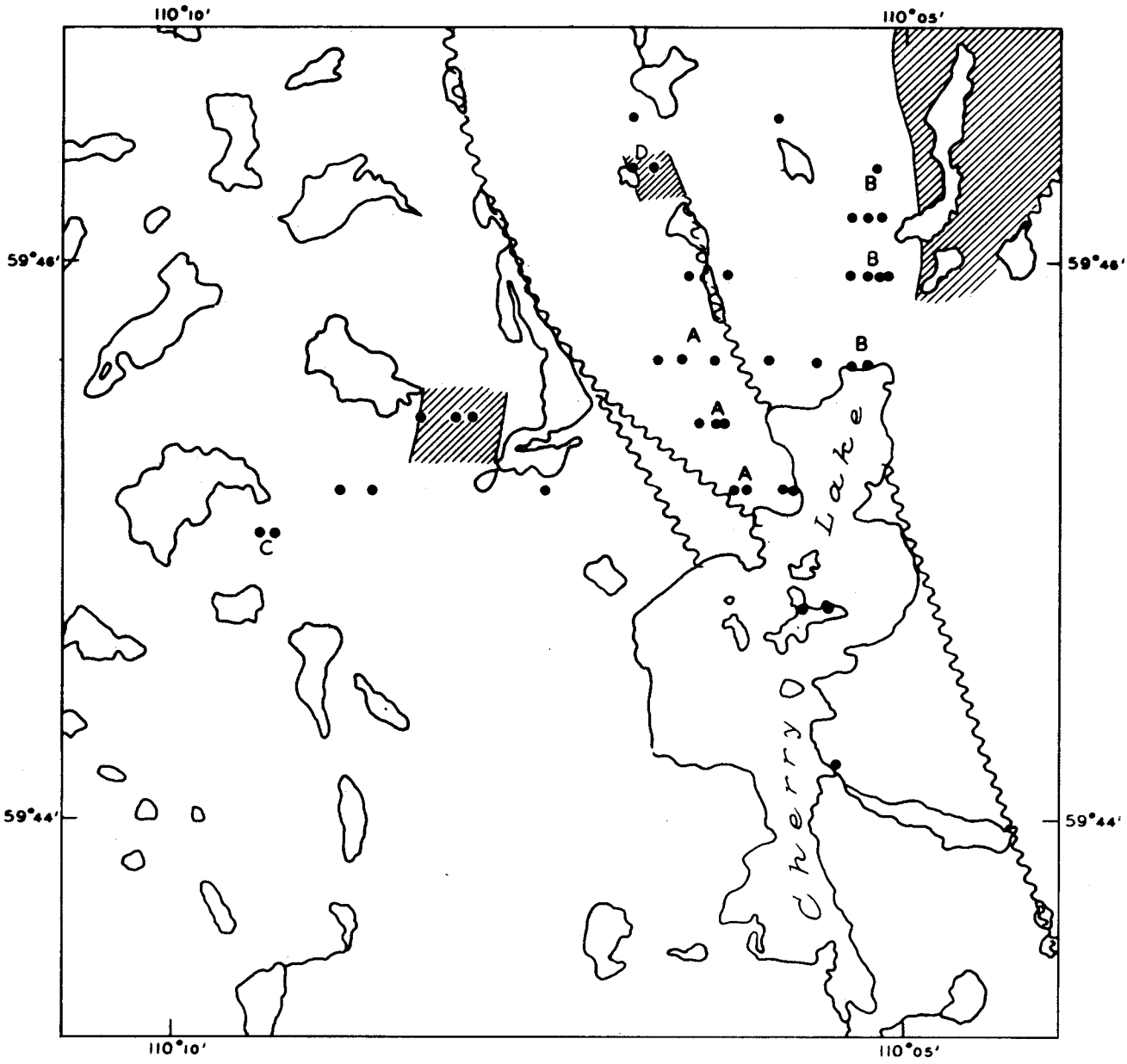

FIGURE 3

CHERRY LAKE

Scale in Miles

½ ¼ 0 ½ 1 1½

LEGEND

Radioactivity . . . . . ●

Fault . . . . . ~

Metasedimentary band . . . . ▨

Station C. A significant level of radioactivity is associated with biotite-rich granite gneiss and sheared quartz-rich pegmatite along a northeasterly trending fault scarp.

Station D. Along a northwesterly trending fault entering the north end of the lake a very high level (7 to 8 times background) of radioactivity was measured within feldspathic garnetiferous quartzites. Yellow stains are concentrated on "granitic" phases of the metasedimentary rocks. Radioactivity was traced for at least 150 feet along the strike and for 400 feet east across the strike into a vertical northwesterly trending fault scarp. The foliation in the quartzites is vertical and strikes north 35 degrees west.

Location 4, Map 58-4 - Bonny Fault

High radioactivity at a number of spots is found along the Bonny fault (fig. 4). This fault strikes north 27 degrees west and dips 80 degrees southwest. The main fault and several of its branches can be clearly seen on aerial photographs of the area. The Bonny fault has been traced on the ground for 8 miles northwest from Andrew Lake and continues as a well-defined topographic feature beyond the Alberta-Northwest Territories boundary. Southeast of Andrew Lake the fault can be traced for a number of miles as a series of branches.

On the west shore of Andrew Lake this fault is a brecciated zone, 500 feet in width, filled with quartz and hematite. The breccia is bounded by parallel shears. In general, these features characterize the fault over at least 7 miles northwest from Andrew Lake. The discontinuity of metasedimentary

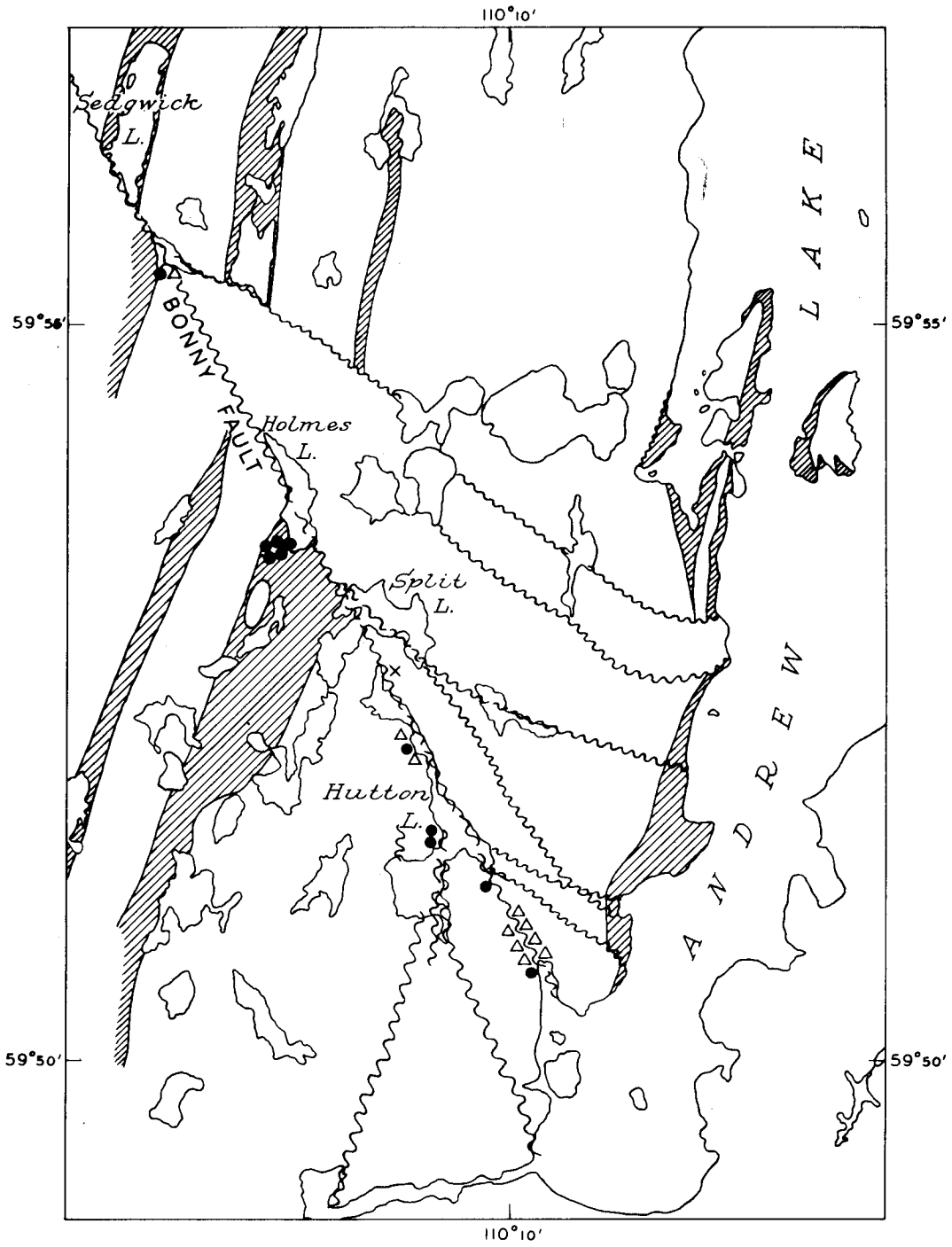

FIGURE 4

BONNY FAULT, WEST OF ANDREW LAKE.

Scale in Miles

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

LEGEND

Fault

Metasedimentary band

Radioactivity ●

Hematized breccia △

Arsenopyrite ×

rocks on either side of the fault, in addition to the structural features, suggests a large horizontal displacement, possibly measurable in miles.

Radioactivity has been noted at intervals along the fault zone, as indicated in figure 4. Significant radioactivity was found in the marginal shears and locally in the hematized breccia.

The country rock consists mainly of granite gneiss with amphibolite and migmatite bands. Shear zones containing chlorite and red feldspar are developed within the granite gneiss. Small veinlets of light-green epidote cut all these rocks. A small outcrop of metasedimentary rocks with a significant level of radioactivity occurs on the south side of the fault and close to the shore of Andrew Lake.

Location 5, Map 58-4 - Lindgren Lake

A band of feldspathic quartzite and biotite schist about 30 feet wide is exposed on the southwest shore of Lindgren Lake. A gossan measuring 3 by 20 feet within these rocks contains massive arsenopyrite, pyrite, and smaller amounts of pyrrhotite, smaltite, and probably one other white arsenide similar to smaltite. The quartzite and schist strike north 23 degrees east and dip vertically. One grab sample from this location containing about 25 per cent sulfides, analysed by Mr. C. E. Noble, Provincial Analyst, University of Alberta, Edmonton, assayed 0.39 per cent nickel and 0.30 ounces silver per ton. Half a mile to the south and on strike with the above-mentioned gossan there is a similar occurrence of arsenopyrite and pyrite. Here the rock is a garnetiferous feldspathic quartzite with pegmatitic pods.

ERRATA:

Page 7, Location 2, paragraph beginning "Three grab samples . . . " and table - to be inserted at end of Location 1 text. Also,

Page 8, paragraph beginning "Semi-quantitative spectrographic . . ." to end of table - to be included at end of Location 1 text.

One mile farther south and on the western margin of the same rocks a 3-foot wide gossan contains arsenopyrite and pyrite. At this locality the feldspathic quartzite strikes north 32 degrees east, and dips steeply west.

Minor amounts of smaltite were found in a 30-foot band of amphibolite and biotite schist 2,000 feet north from the main mineralization, on Lindgren Lake. These rocks strike north 3 degrees west.

Location 6, Map 58-4 - Sonja* Island, Andrew Lake

High radioactivity was recorded in a few places in unaltered porphyritic granite and pegmatite which are surrounded by metasedimentary rocks.

Location 7, Map 58-4 - West of Sonja Island, Andrew Lake

A high level of radioactivity was found at the fault scarp which marks the contact between metasedimentary rocks to the east, and biotite pegmatite and granite gneiss to the west. The granite gneiss near the fault is biotite-rich and the metasedimentary rocks are composed of amphibolites, biotite quartzites, dark sugary quartzites, and biotite schists -- all are feldspathic. Shearing trends north 65 degrees east although the trend of the scarp is north 25 degrees east.

Location 8, Map 58-4 - South of Ney Lake

A significant level of radioactivity was found in a sheared band of coarsely crystalline hematite-bearing biotite schist 2 to 4 feet wide, occurring within a red, coarse-grained porphyritic granite with pegmatites and aplites.

Location 9, Map 58-4 - West of Spider Lake

At intervals between 600 and 900 feet, and at 1,200 feet, east of the most northern small lake marked on the map, significant levels of radio-

active counts were recorded. In the westerly occurrence radioactivity was noted in fractures within sheared granitic gneiss and porphyritic granite. The foliation strikes from north to north 15 degrees east, and the dip is vertical. The easterly radioactivity is associated with a stained band of feldspathic quartzite and biotite chlorite schist 10 feet wide within granite gneiss.

Location 10, Map 58-4 - Sederholm Lake

One thousand five hundred feet east of the north end of Sederholm Lake flakes of molybdenite were found in a quartz vein and quartz-rich pegmatite within quartzites. The area of mineralization extends for 10 feet in all directions and is then concealed by overburden.

Locations 11, 12 and 13, Map 58-4 - Arm of Andrew Lake
Location 14, Map 58-4 - South shore of Hieroglyphic* Lake

Isolated flakes of molybdenite were noted in quartzite or gneiss at these four places. These rocks strike generally north and dip steeply to the west.

Location 15, Map 58-4 - West of Waugh Lake

Specks of galena and pyrrhotite occur in sheared and folded quartzites which are found 1,300 feet due west of the wide bay on the west shore of Waugh Lake. The foliation of the rocks strikes north 20 degrees west and dips vertically.

Location 16, Map 58-4 - East of Waugh Lake

At a number of points within one mile of the east side of Waugh Lake small amounts of pyrrhotite (?), pyrite and arsenopyrite are found in quartzite.

Location 17, Map 58-4 - North of Johnson Lake

Fifteen hundred feet due north of the point of the largest headland on the north shore of Johnson Lake specks of galena and chalcopyrite occur in quartzose layers in a quartz-rich biotite phyllite.

Miscellaneous

Graphite, frequently mistaken for molybdenite, is commonly found in most of the metasedimentary bands observed to date. It is most abundant in biotite schists, but is also present in quartzite and quartz veins. A satisfactory field test for distinguishing between the two minerals is the streak on a glazed surface of white pottery. Molybdenite produces an olive-green color and graphite a black or dark-grey color.

Pyrite has been noted in every rock type found in the area, though it is most common in amphibolite, hornblende granite, granite gneiss, and in the metasedimentary rocks.

Hematite occurs both as a coating on the surface of minerals and in a massive form. It has been found in quartzites, schists, granite gneisses, and in fault zones.

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Mawdsley, J. B. (1957a): The geology of the Charlebois Lake area, northern Saskatchewan; Saskatchewan Dept. Mineral Res., Geol. Div., Rept. 24, map with marginal notes.

_____ (1957b): The geology of the Middle Foster Lake area, northern Saskatchewan; Saskatchewan Dept. Mineral Res., Geol. Div., Rept. 26, 49 p.

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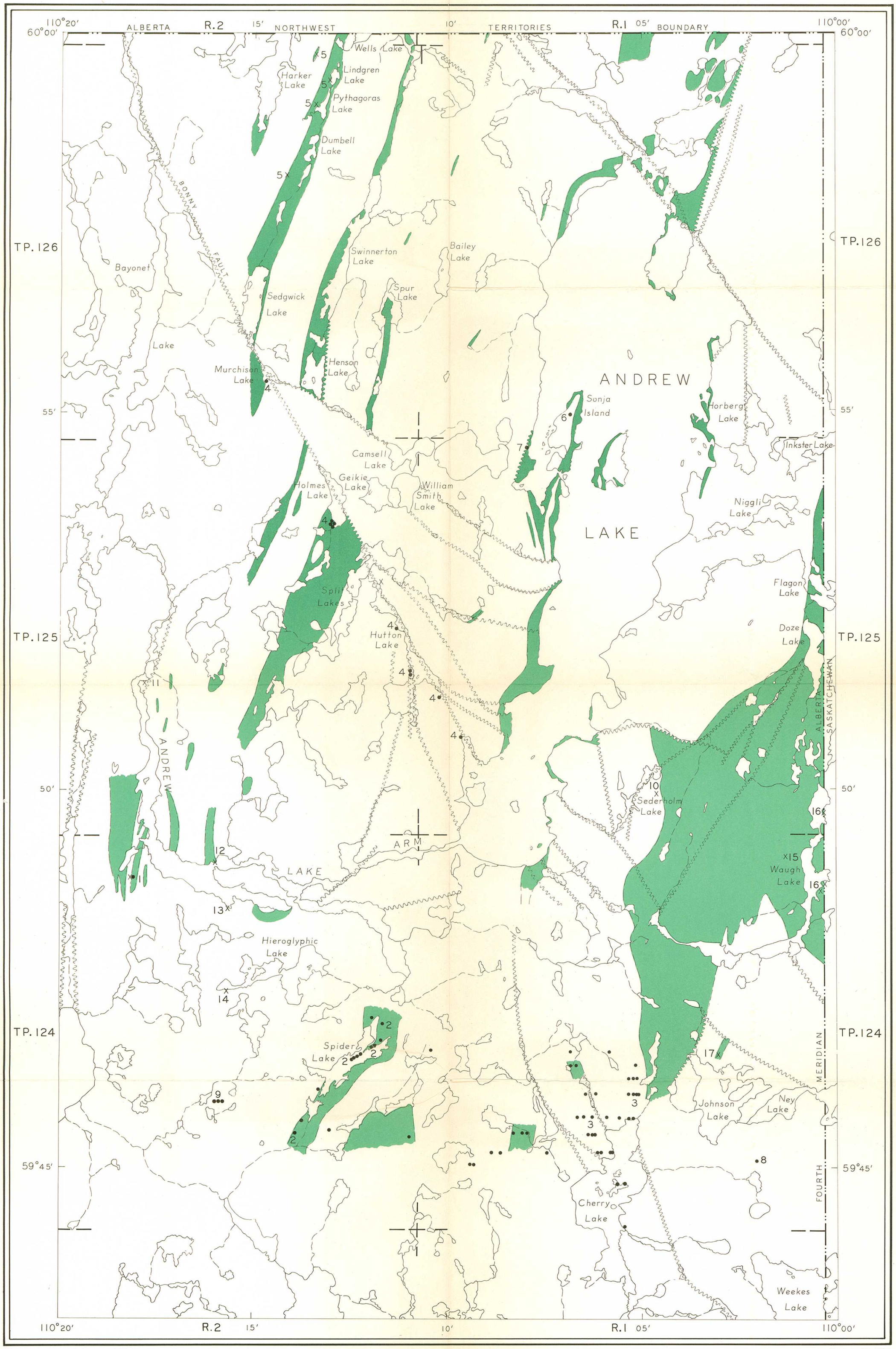

Map to accompany preliminary report 58-4

Published in 1958.

MAP 58-4

ECONOMIC MINERALS IN THE ANDREW, WAUGH AND JOHNSON LAKE AREA, NORTHEASTERN ALBERTA

WEST OF FOURTH MERIDIAN

Scale 1 Inch to 1 Mile

0 1 2 3 4

LEGEND

- Metasedimentary band
- Geological boundaries (approximate)
- Mineralization locality ..... X 14
- Radioactivity ..... ●
- Fault (known, assumed) ..... ~~~

Geology by J.D. Godfrey, 1958.

REFERENCE

Cartography taken from Department of Lands and Forests, Alberta, Aerial Survey Sheet No. 74 M. 16 and 9. – 1951.

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