MANITOBA

DEPARTMENT OF ENERGY AND MINES

MINERAL RESOURCES DIVISION

OPEN FILE REPORT OF82-1

CHROMITE RESERVES AND GEOLOGY OF THE BIRD RIVER SILL, MANITOBA
(Parts of NTS 52L/5, 6, 10 and 11)

Compiled by
B.B. Bannatyne and D.L. Trueman

1982

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Introduction

Chromite in the Archean rocks of the Bird River area of southeastern Manitoba was reported first in 1926 from the Wards claim. Subsequent investigations resulted in the discovery in 1942 of the major deposits of chromite in the Bird River Sill.

The chromite deposits of the Bird River area are of three types: those of stratiform nature within ultramafic cumulates of the Bird River Sill, those of lensoid nature in gabbroic rocks, and those described as injected into gabbros of the Bird River Sill. However, the latter two of these types of occurrences have not been investigated thoroughly, and in the following report deposits within the Bird River Sill are emphasized; the other types are summarized in the section concerning property descriptions.

Since their discovery, the chromite deposits of the Bird River area have been the subject of several studies directed toward possible production. However, their comparatively low grade and low Cr-Fe ratio have discouraged their development. As only intermittent production has been achieved from other deposits in Canada and the United States, almost all chromite ores and ferrochromium used in these two countries are imported. The chromite deposits in the Sill could be readily marketed, however, if problems related to their development can be solved. One over-riding aspect should be considered: chromite is of strategic importance and normal marketing or economics could be waived if current sources of supply are disrupted.

Location and Access

The Bird River area is centred approximately 130 km northeast of Winnipeg (Fig. 1) and is accessible from the town of Lac du Bonnet. The chromite deposits are within 0.5 to 16 km of either Provincial Road 314 or 315, although access to some deposits is difficult.

Previous Work

An account of the discovery of the deposits is given by de Wet (1942), and early papers on their geology are those by Brownell (1942) and Bateman (1942, 1943, 1945). Early studies of the regional geology are those by Colony (1920), Cooke (1922) and Wright (1932). Regional studies by the Manitoba Mines Branch were made by Springer (1948, 1949, 1950) and Davies (1952, 1955). Descriptions of the deposits and estimated tonnages of chromite were reported by Davies (1958), and summarized in Davies et al. (1962). Osborne (1949) completed a thesis on the Bird River Sill. The mineralogy of the chromite has been described by Brownell (1943), Bateman (1945) and Gait (1964).

In 1969, the Geological Services Branch of the Mineral Resources Division initiated a study of the ultramafic rocks of Manitoba, under Scoates (1971a), and early work included preliminary maps of the Bird River Sill (Trueman, 1970; Trueman and Macek, 1971) and a review of their mineral potential (Scoates, 1971b). Thesis studies of the Bird River Sill and of the Bird River - Winnipeg region were completed by Trueman (1971; 1980), and a study of the petrology of the Bird River Sill is being prepared for publication (Trueman, in prep.).

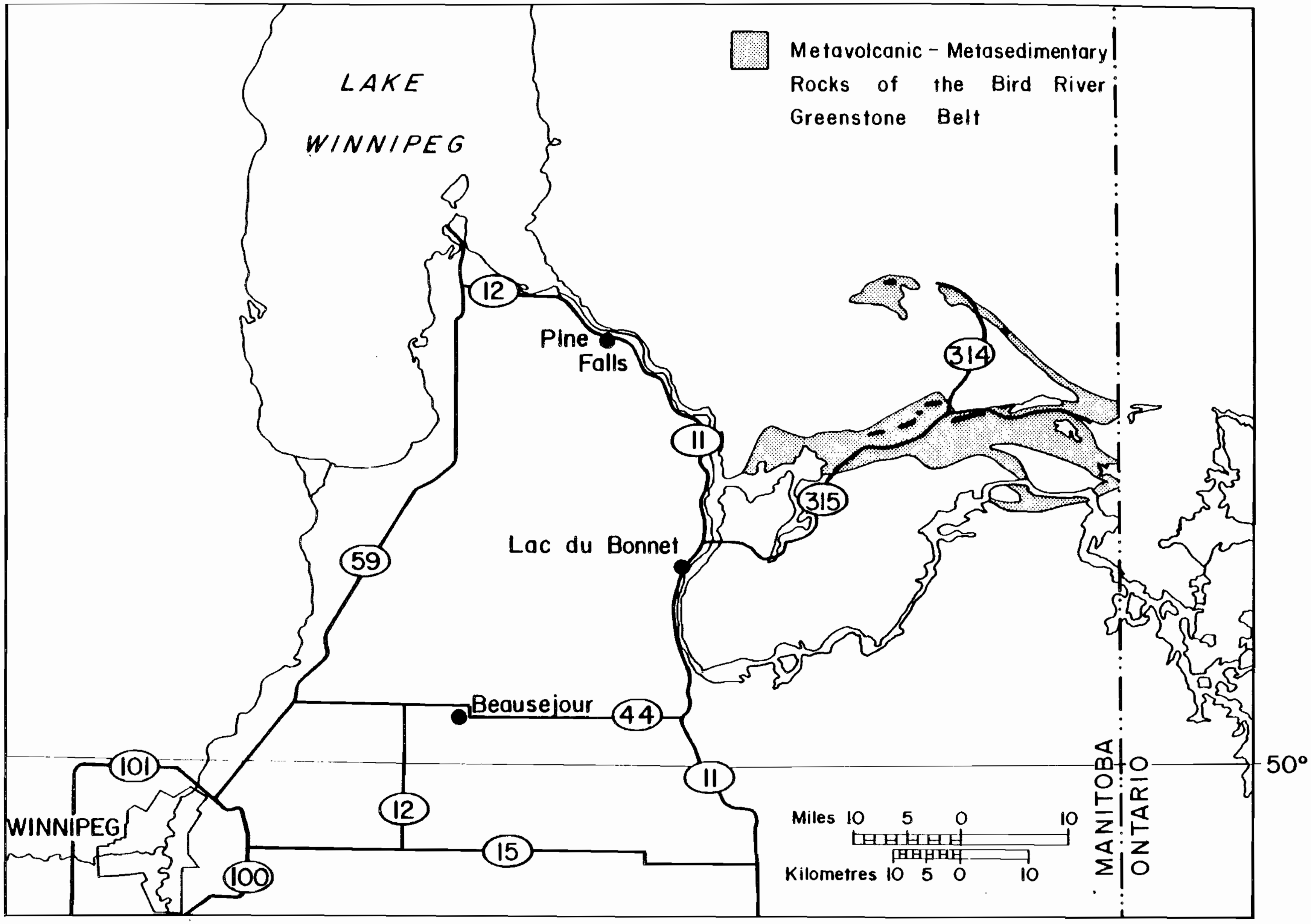


Figure 1. Index map, southeastern Manitoba (Bird River Sill shown in solid black)

Numerous studies on methods of processing the chromite to produce marketable products have been made, and are reviewed by Downes and Morgan (1951), and by Raicevic (1976, 1977).

Mineral Inventory cards for the chromite deposits were prepared in 1973 under supervision of J.D. Bamburak, and are appended to this report. Results of some exploration work are available in the Cancelled Assessment Files, Geoscience Data Section.

Acknowledgements

The Mineral Resources Division is indebted to the late Albert O. Zeemel, who was involved with the early exploration of the chromite deposits, for making available for this study results of exploration on the Chrome and Euclid Lake deposits.

The accompanying report was prepared in 1975 as an internal report to provide information on the quantity and grade of chromite deposits in the Bird River Sill. In response to requests for data on the chromite deposits, the original report has been prepared for release as an open file report.

P. Theyer critically read and made changes to earlier drafts of this report.

The Bird River Sill

The Bird River Sill is an intrusive layered complex with an average thickness of 1000 m, which crops out along both of the steeply (60° to 90°) dipping limbs of an eastward plunging anticline developed in an east-trending belt of volcanic and sedimentary strata. The sill is intruded along the contact between the Lamprey Falls and Bernic Lake Formations of the Rice Lake Group.

Subsequent granitic intrusion and associated folding and complex faulting have resulted in a segmented outcrop pattern of the sill, and movements along faults have resulted in offsets of up to 1525 m. The faulting has resulted in omission of parts or all of some sill units on some properties, and this, along with regional variations (probable approach to the sill edge) has resulted in variations in grade and thickness of chromite at the various reported occurrences.

The main occurrence of chromite in the sill is located in the Bird River - Bird Lake area; other occurrences of chromite are in isolated blocks of the sill at Euclid Lake and 8 km north of Maskwa Lake (Figs. 2, 5).

The sill is considered by Juhas (1967) and Trueman (1971) to have been intruded as a single pulse, and its layering to be due to fractional crystallization and gravitational differentiation. Intrusion and differentiation of the sill is interpreted by Juhas (1967) to predate appreciable deformation of the belt since magma layering is parallel to underlying volcanic-sedimentary strata. Trueman (1971) considered intrusion of the sill to be synvolcanic.

Trueman (1971; in prep.) has divided the sill, as exposed on the Chrome property, into the various units, in ascending stratigraphic sequence, of marginal group, layered ultramafic series, transitional serpentinized picrite, and layered gabbroic series.

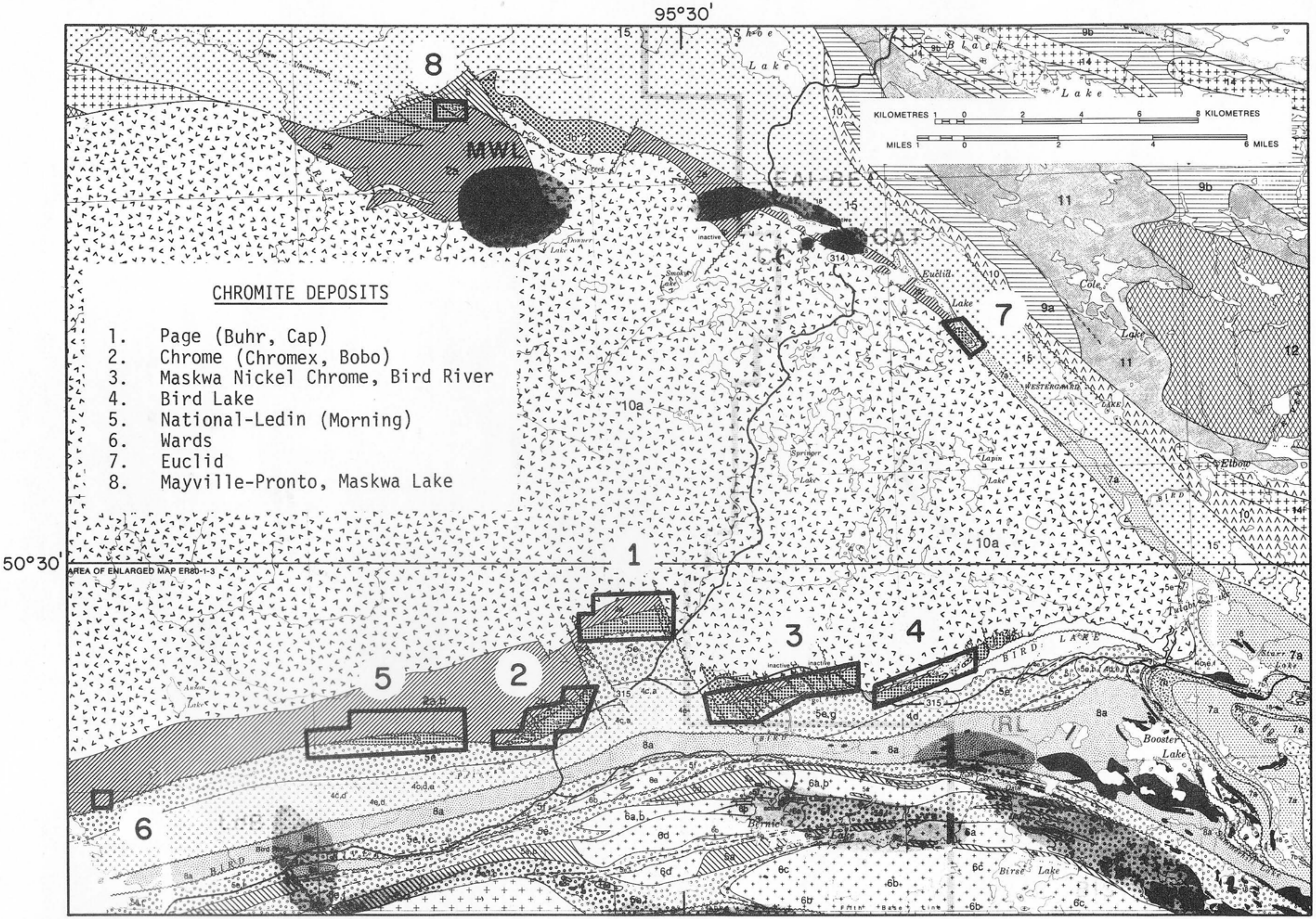


Figure 2. Geology of the Bird River-Cat Lake area; and location of chromite deposits (from Černý et al., 1981, Map ER80-1-1)

LEGEND

SYN-TO LATE TECTONIC INTRUSIVE AND METASOMATIC ROCKS

Pegmatitic granite, pegmatite

17 Lac du Bonnet granite

16 Monzogranite, microgranite, pegmatite

15 Inconnu granite

14 Black River suite

13 Granodiorite

EARLY TO SYN-TECTONIC INTRUSIVE AND METAMORPHIC ROCKS

12 Tonalite, schollen zone

11 Migmatite complex

10 / 10a / 10b Great Falls quartz diorite; 10a Maskwa Lake batholith; 10b Marijane Lake batholith

9 Paragneiss; 9a upper amphibolite facies; 9b lower amphibolite facies, in part equivalent to map unit 7

METAVOLCANIC, METASEDIMENTARY AND SYNVOLCANIC INTRUSIVE ROCKS

8 Booster Lake Formation; 8a greywacke mudstone; 8b conglomerate/metamorphosed equivalents

UNCONFORMITY

7a / 7b Flanders Lake Formation; 7a lithic arenite; 7b polymict conglomerate/metamorphosed equivalents

6 Composite synvolcanic intrusive rocks; 6a gabbro; 6b diorite; 6c quartz-feldspar porphyry; 6d granodiorite/metamorphosed equivalents

UNCONFORMITY

5a-5d / 5e-5i Bernic Lake Formation; 5a basalt; 5b andesite; 5c dacite; 5d rhyolite; 5e polymict conglomerate; 5f oligomict conglomerate; 5g cordierite-anthophyllite schist; 5h garnet-biotite schist; 5i quartz porphyry

UNCONFORMITY

4 Peterson Creek Formation; 4a rhyolite; 4b breccia; 4c lapillistone; 4d lapilli/tuff; 4e tuff; 4f volcanic sandstone/metamorphosed equivalents

3a Bird River sill; serpentinized dunite, peridotite, picrite and related anorthositic and gabbroic rocks/metamorphosed equivalents

3b Gabbro; synvolcanic stocks and sills, in part hypabyssal/metamorphosed equivalents

2 Lamprey Falls Formation; 2a pillow basalt; 2b porphyritic basalt; 2c amygdaloidal basalt; 2d megacrystic basalt; 2e hyaloclastite, aquagene breccia/metamorphosed equivalents

1 Eaglenest Lake Formation, volcanic wacke, pebbly wacke, volcanic sandstone/metamorphosed equivalents

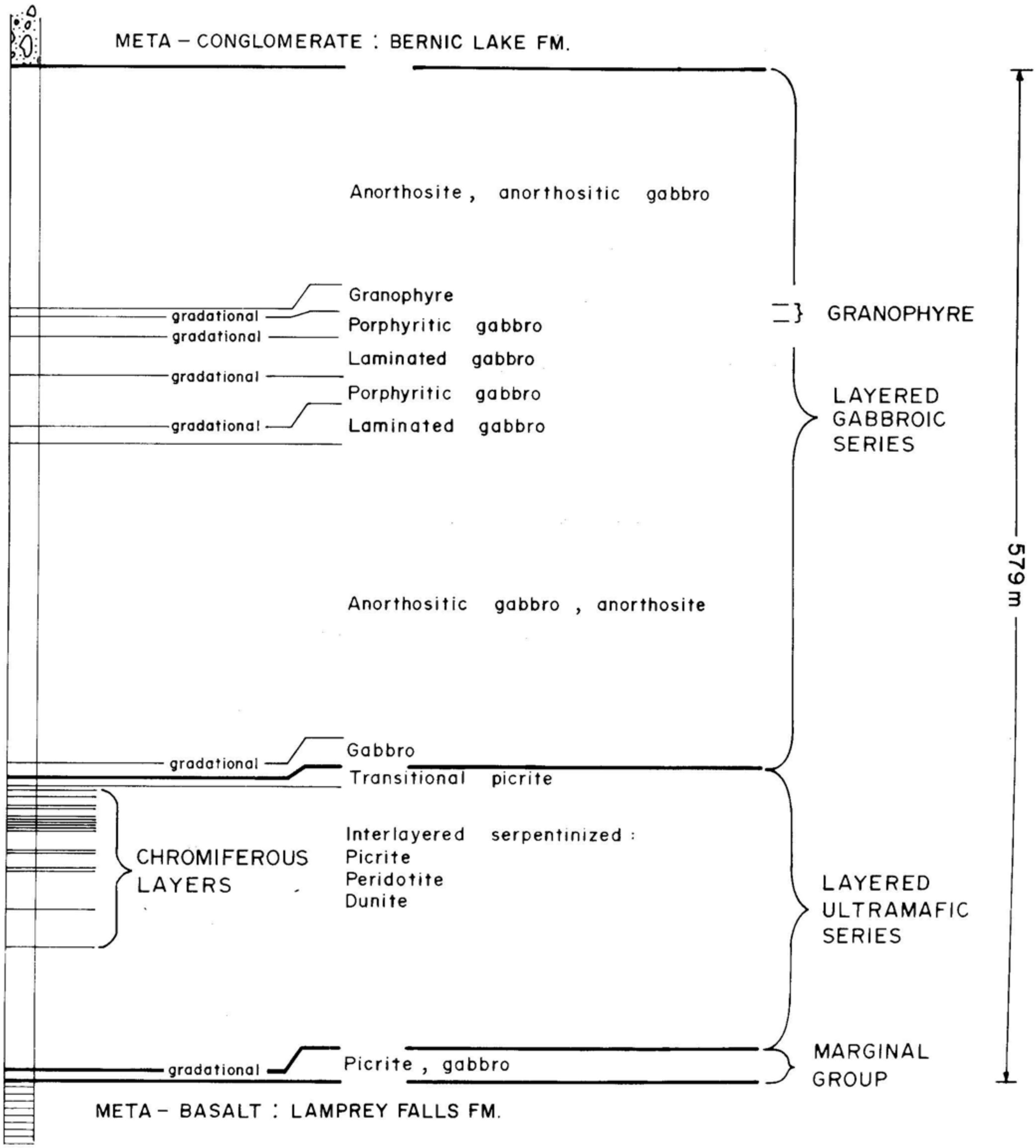


Figure 3. Composite section of the Bird River Sill from the Chrome property (from Trueman, 1980). See also Figure 4.

Marginal Group

Rocks of the lower marginal group include layers of olivine pyroxene gabbro (Osborne, 1949), intersected by diamond drilling only, and "picrite" (Trueman, in prep.), a sporadically occurring layer up to 6 m thick of plagioclase olivine gabbro with a peculiar graphic texture on its surface and containing chlorite phenocrysts pseudomorphous after plagioclase.

Layered Ultramafic Series

Rocks included in this series are dunite and peridotite, both of which contain varying amounts of chromite.

Figure 3 is a simplified section through the layered ultramafic series of the Chrome property after Trueman (1971). It shows the relative location of rock units and chrome-rich layers. The layered ultramafic series, approximately 200 m wide, includes serpentinized peridotite and dunite. Serpentinized peridotite is the dominant rock type and is medium to coarse grained with pseudomorphs after olivine in its massive portions.

Serpentinized dunite is medium to coarse grained and may be massive or schistose. Pseudomorphs after olivine and disseminated, patchy or reticulating chromite are seen near the base of this rock series. Trueman (in prep.) describes two layers of serpentinized picrite which are similar to the previously described picrite layer of the marginal group, located below and above the "main upper" chromite horizon (Fig. 4).

Transitional serpentinized picrite forms the uppermost layer of the ultramafic series, and is characterized by the first appearance of cumulus plagioclase. This layer is approximately 10 m thick on the Chrome property where it is exposed for approximately 750 m along strike.

Layered Gabbroic Series

A series of gabbroic rocks stratigraphically overlying the ultramafic rocks forms the widest portion (approximately 380 m) of the sill at the Chrome property. Rock types included in this series are anorthositic gabbro, laminated and glomeroporphyritic gabbro, and anorthosite. The gabbroic members of the Bird River Sill reportedly do not contain chromite in noteworthy amounts.

Granophyre, composed of irregular quartz-feldspar intergrowths and minor actinolite, forms a narrow zone about 9 m thick, sandwiched by downward accumulation of the overlying anorthosite and upward accumulation of the other gabbros (Fig. 3). Trueman (in prep.) interprets the granophyre as the last product of crystallization of the sill magma. It has been reported also from the Bird Lake area (Fig. 5).

Detailed descriptions of all of these rocks may be found in Trueman (1971).

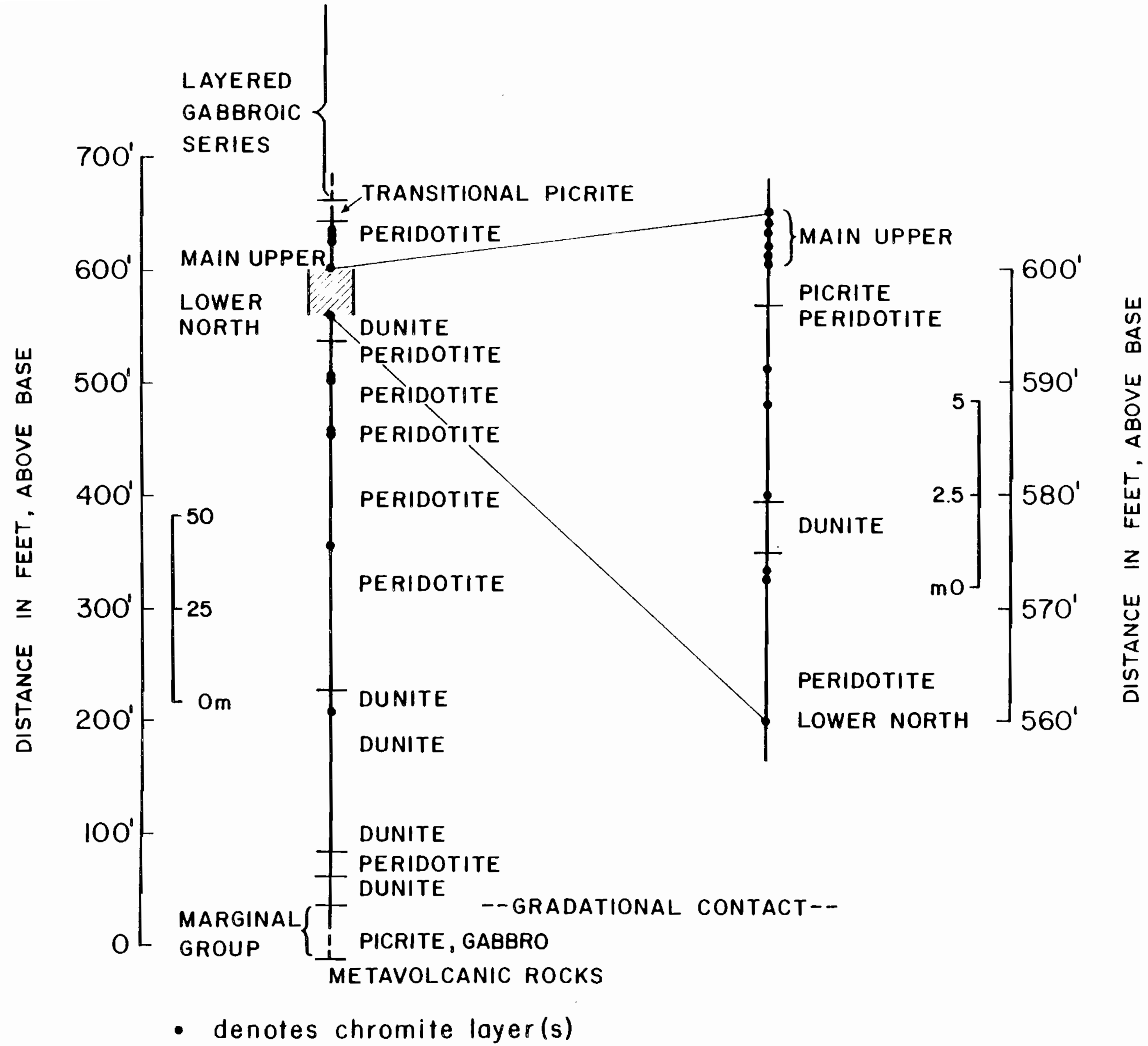


Figure 4. Section through the layered ultramafic series exposed on the Chrome property.

Chromite in the Bird River Sill

Chromite is found exclusively within the ultramafic portion of the Bird River Sill. An occurrence of chromite hosted by gabbro in the area of the Wards claim may not be an exception to this rule, since this gabbro is interpreted to be a separate intrusion (Trueman, in prep.).

Chromite enriched layers are differentiated into "chromitite", containing in excess of 85 per cent chromite, and "chromiferous layers", containing from 25 to 85 per cent chromite.

Chromitite occurs as black to dark grey layers with knife edge contacts with the silicate substrata (Fig. 7). Primary structures such as load casting (Fig. 8), bifurcation of layers (Fig. 9) and disruption of layers are present (Fig. 10). Chromiferous layers are delicately interbedded with silicate layers (Fig. 11). In the lowermost layers, chromite may form diffuse concentrations.

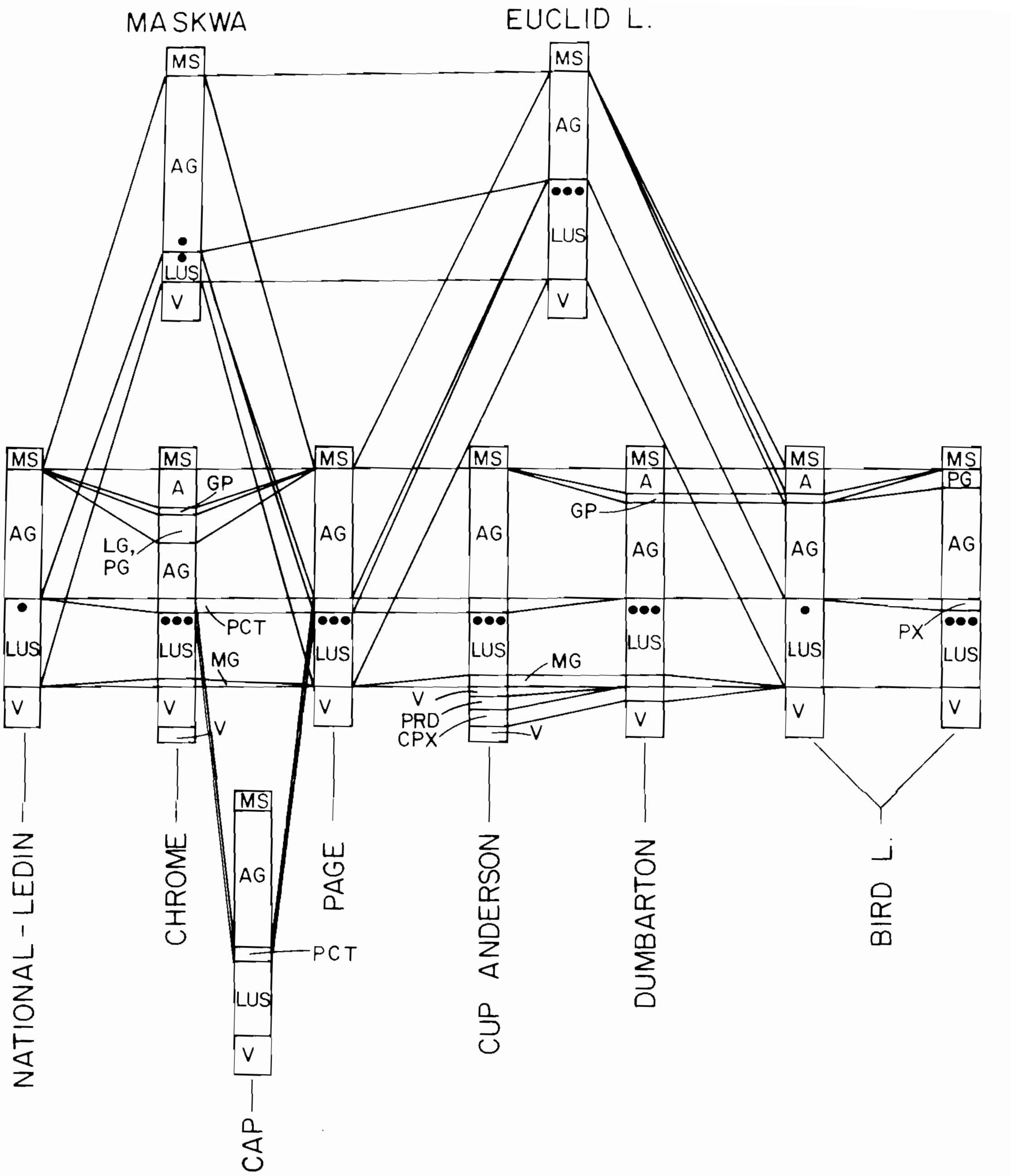
The chromite crystals are euhedral to subhedral, show slightly corroded margins and frequently may be cracked or broken; some of these crystals contain nucleii (Fig. 12). The chromite of the Bird River Sill is classed as "chromian spinel" by Gait (1964, based on Deer et al., 1962). Trueman (in prep.) indicates the mineral is mainly within the "aluminian chromite" field of Thayer (1964). The chromite shows small variations in chemical composition from one layer to another; aluminum content is high at 15 to 20 per cent, and Cr:Fe averages 1.1:1 (Gait, 1964). However, Bateman (1943) reported Cr:Fe of 1.2:1 to 1.5:1 for concentrates prepared from the "main chrome band" of the Page property, and reported chrome-iron ratios from various parts of the sill range from 0.26:1 to 1.59:1 (see section on: Review of Processes for Recovery of Chromium).

As noted, the chromite zone occurs in the upper part of the peridotite portions of the Sill. Suggested correlations between the various properties that represent separate fault blocks of the Bird River Sill are indicated in Figure 5, from Trueman (in prep.). Palinspastic reconstruction of the south limb of the sill, shown in Figure 6 (from Trueman, 1980), was achieved by restoration of lithologically and stratigraphically similar units which are thought to represent portions of a once continuous body.

Property Descriptions: Chromite in the Bird River Sill

The known occurrences of chromite in the Bird River Sill are discussed by property. Their locations are shown in Figure 2. Trueman and Macek (1971) mapped these occurrences, and part of their map is shown as Figure 26 in this report. A final version of that map was produced by Trueman and others for the regional geology maps in Černý et al. (1981, maps ER 80-1-1 and ER 80-1-3), portions of which are shown in Figures 2, 14 and 19.

The chromite zone occurs in the upper part of the peridotite portion of the sill, and correlations between the various properties have been made by Trueman, as shown in Figure 5. The chromite distribution differs in grade and thickness from property to property, as shown in Figure 13. An individual measured section is shown where possible, as well as a diagram indicating the average grade and thickness used in this section for tonnage calculations. As the same scales have been used for width and grade respectively, the wide variation present in each por-



KEY:

MS	META-CONGLOMERATE	●●●	MAIN CHROMITE HORIZON	
A	ANORTHOSITE, ANORTHOSITIC GABBRO	●	OTHER CHROMITE	
GP	GRANOPHYRE	LUS	LAYERED ULTRAMAFIC SERIES	
PG	PORPHYRITIC GABBRO	MG	MARGINAL GROUP	
LG	LAMINATED GABBRO	PRD	PERIDOTITE	FEEDER DYKE*
AG	ANORTHOSITIC GABBRO, ANORTHOSITE, GABBRO	CPX	CLINOPYROXENITE	
PCT	TRANSITIONAL SERPENTINIZED PICRITE	V	META-BASALT	
PX	PYROXENITE (DAVIES _et al_, 1962)			

*The northern segment of the sill in the Cup Anderson and Dumbarton areas (see Figs. 19 and 20) has been referred to by Trueman (1980) and others as a possible feeder dyke to the intrusion. Genetic inferences such as this have been avoided in this report.

Figure 5. Correlation of exposed lithologic units of the Bird River Sill and adjacent rocks. Locations of sections are shown in Figure 2. Not to scale. (Trueman, in prep.)

tion of the sill is evident. However, the overall chromite content does not differ that much when both factors are considered. The main difference is in the quantity of ore that would have to be mined at each site to provide the same amount of product.

Mineral Inventory cards on the Page, Chrome, Petra Chromite (Bird Lake) National-Ledin, Wards, Euclid and Mayville claims are included in Appendix 2. The history of ownership and of exploration is listed on those cards.

a) Page claims (Manitoba Chromium Limited c/o Hudson Bay Exploration and Development Co. Ltd.

The regional geology in the area of the Page claims and to the west is shown in Figure 14, from Černý et al. (1981). Trueman (1970) indicates the chromite zone in the Bird River Sill extends a length of 3050 m in the area of the Page, Buhr and Cap claims (Fig. 15). Segments of the eastern part are offset by faulting. In addition, on the western end a section of peridotite some 460 m long has been offset to the south by faulting. The main part of the chromite zone is in fault contact with metavolcanic rocks to the west, and with quartz diorite-granodiorite to the east.

At least 28 drill holes were drilled in 1942 to determine chromite reserves on the property; the sill was drilled to a depth of 75 to 90 m, over a length of 700 m. An additional 5 holes in 1954 and 6 holes in 1967 were drilled on the Page Group, but these were for base metal deposits, not chromite.

The map by Trueman (1970) suggests the chromite zone is more or less continuous across two major blocks (Fig. 15). However, closely spaced faulting divides the chromite zone into segments from 7.6 to 61 m in length. Each of those segments may be displaced by step-faulting, by rotational faulting, or by dip-slip movements. A detailed map showing the effect of closely spaced faults is shown in Figure 16.

The main chromite zone is 1.52 to 2.13 m wide (average 1.86 m), and dips southward from 55^{o} to almost vertical (average 70^{o}). The zone is displaced by numerous steep faults. Bateman (1943) placed the average grade at 25.5% Cr_2O_3.

The north (or lower) chromite band is 0.3 to 1.22 m wide (average 0.64 m) and is located 6 to 9 m north of the main band, and dips concordantly with it. It grades 23% Cr_2O_3 (Bateman, 1943). It is not included in ore reserve calculations in this report.

Locally a 0.4 m wide band of low-grade chromite is present about 1.5 m north of the north band, and in some sections a zone of chromite in stringers occurs over a width of 3 m, but not of sufficient concentration to constitute ore (analyses have not been reported).

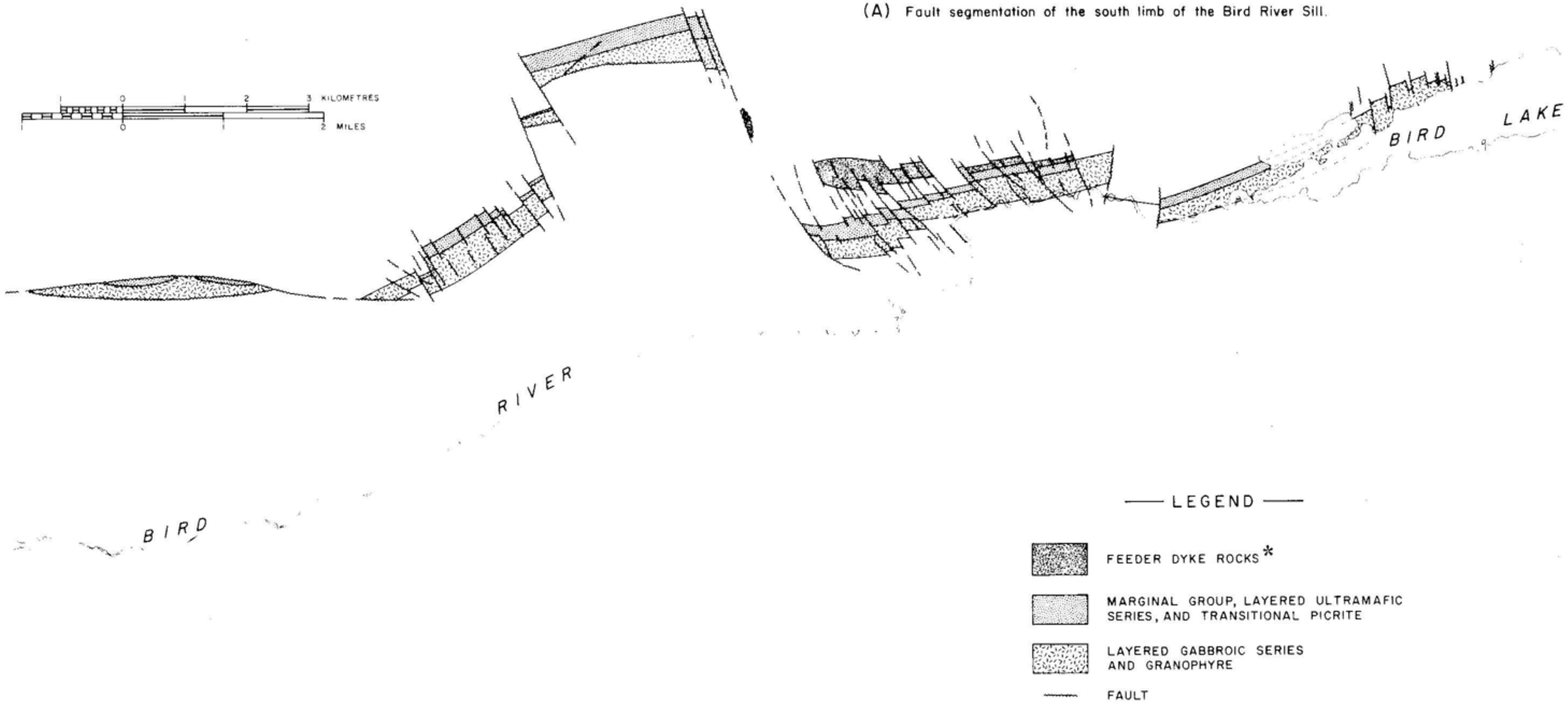
For the main chromite zone, the figures used for tonnage calculations are from Bateman (1943):

Average width: 1.86 m (true thickness)
Average grade: 25.2% Cr_2O_3
Cubic m per tonne: 0.2907 (S.G. 3.44)

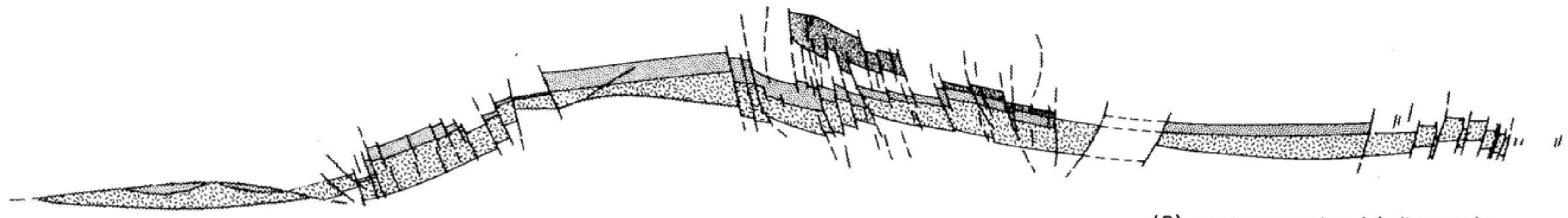
Drill logs and assay results for the chromite zone on this group of claims are not available.

It is reported that the drilling was planned to test the ore to a depth of 90 m. The measured reserves are considered to extend to the 99 m level. Bateman (1943) reduced the calcu-

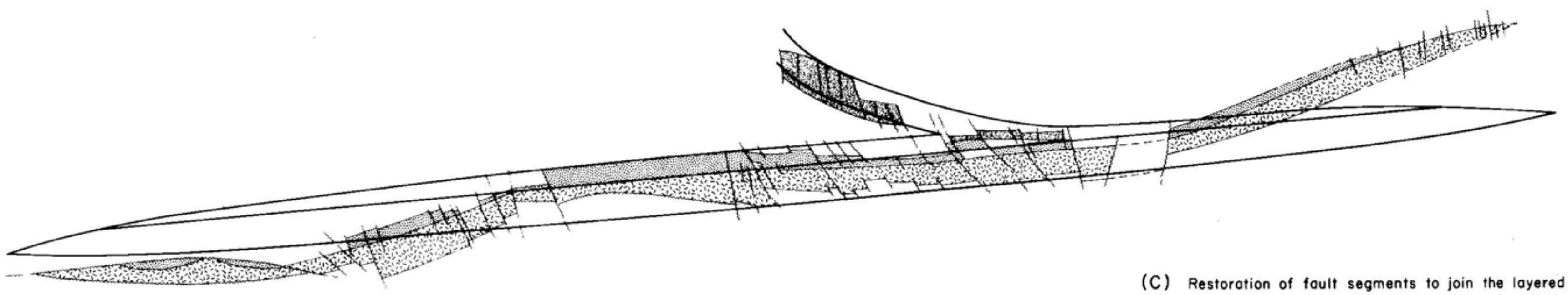
(A) Fault segmentation of the south limb of the Bird River Sill.



*The northern segment of the sill in the Cup Anderson and Dumbarton areas (see Figs. 19 and 20) has been referred to by Trueman (1980) and others as a possible feeder dyke to the intrusion. Genetic inferences such as this have been avoided in this report.



(B) Partial restoration of fault segments.



(C) Restoration of fault segments to join the layered ultramafic series–gabbroic series contact.
Positioning of feeder group rocks is based on partial restoration of the basal contact with host rocks.
The heavy outline represents idealized restoration of the Bird River Sill by addition of fault omitted rocks and restoration of the principal chromite layers to a horizontal position.

Figure 6. Palinspastic reconstruction of the Bird River Sill (from Trueman, 1980, Fig. 53)

Figure 7. Black-grey chromitite layers and lighter silicate layers in the Bird River Sill, Chrome property.

Figure 8. Graded bedding and seriate load casting in the Bird River Sill.

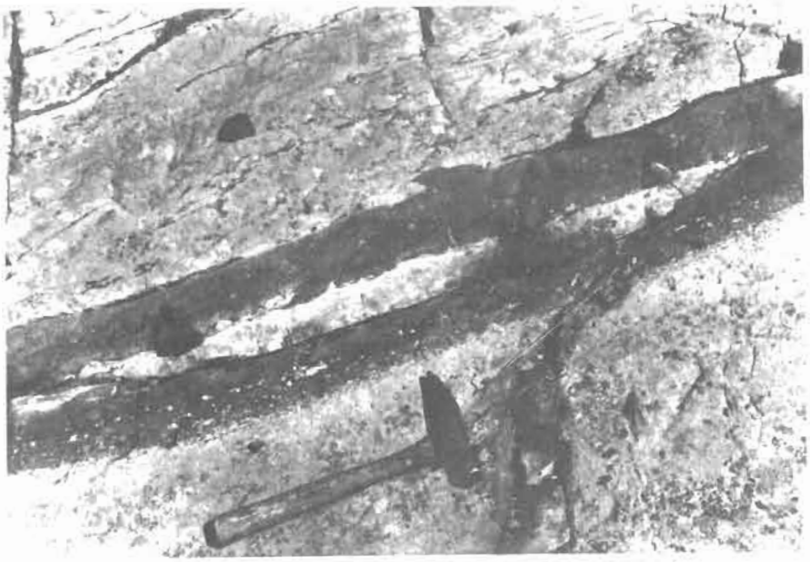


Figure 9. Bifurcated chromitite layers in the Bird River Sill, Chrome property.

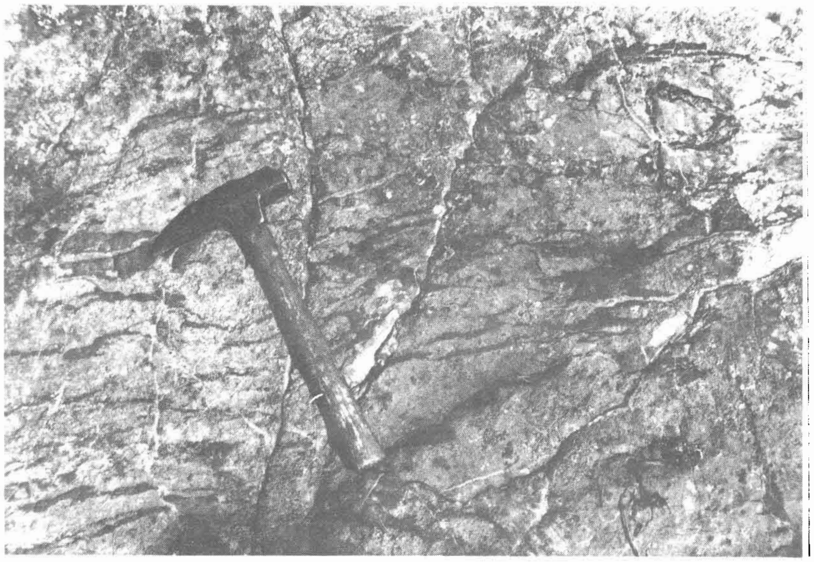


Figure 10. Disrupted chromitite layers in the Bird River Sill.

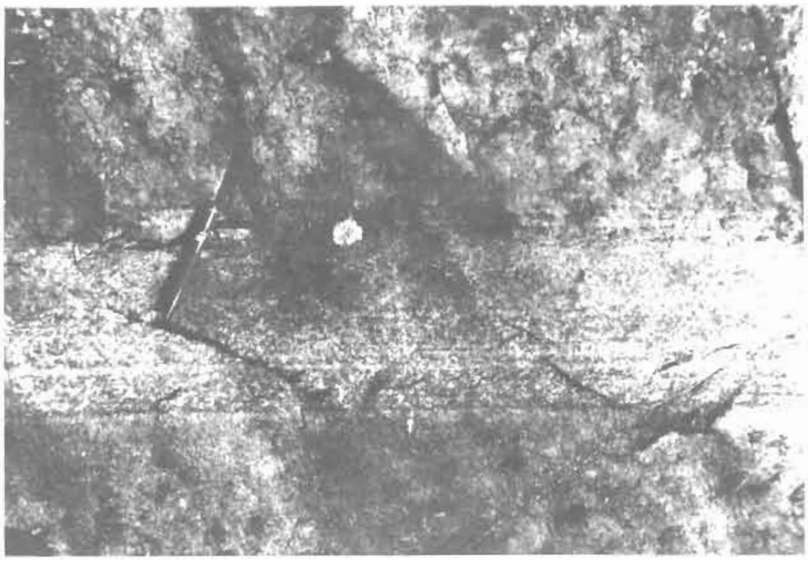


Figure 11. Chromiferous dunite in the Bird River Sill.

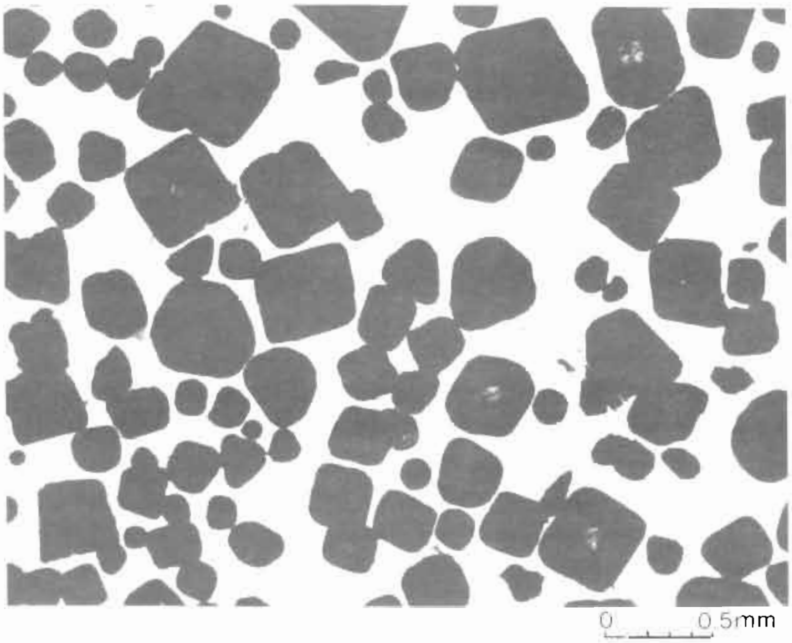


Figure 12. Cumulus chromite grains in serpentinite; note silicate nucleus in some chromite grains.

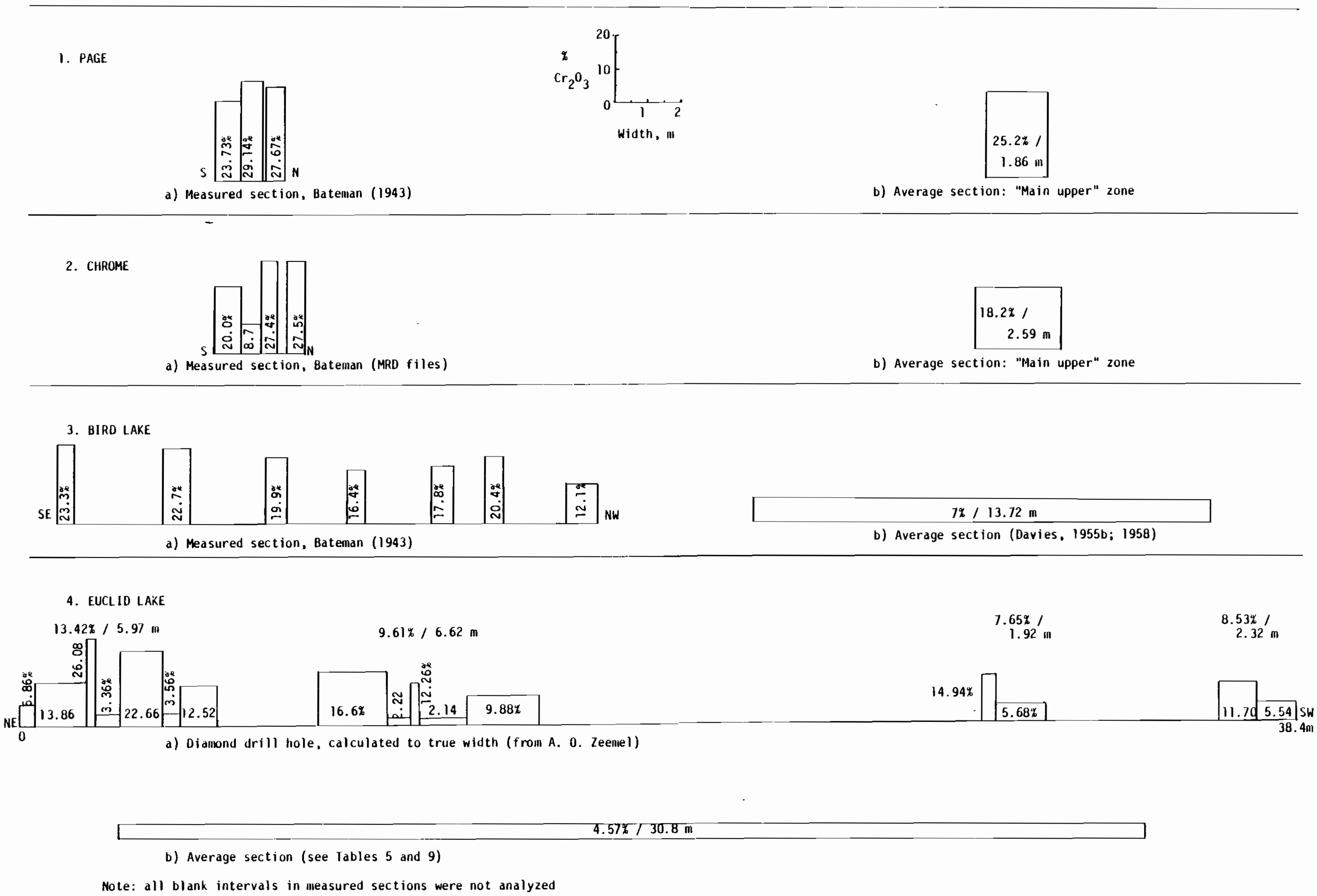


Figure 13. Measured sections of the chromite zone from each of the major deposits, and comparison of their average grade of Cr_2O_3

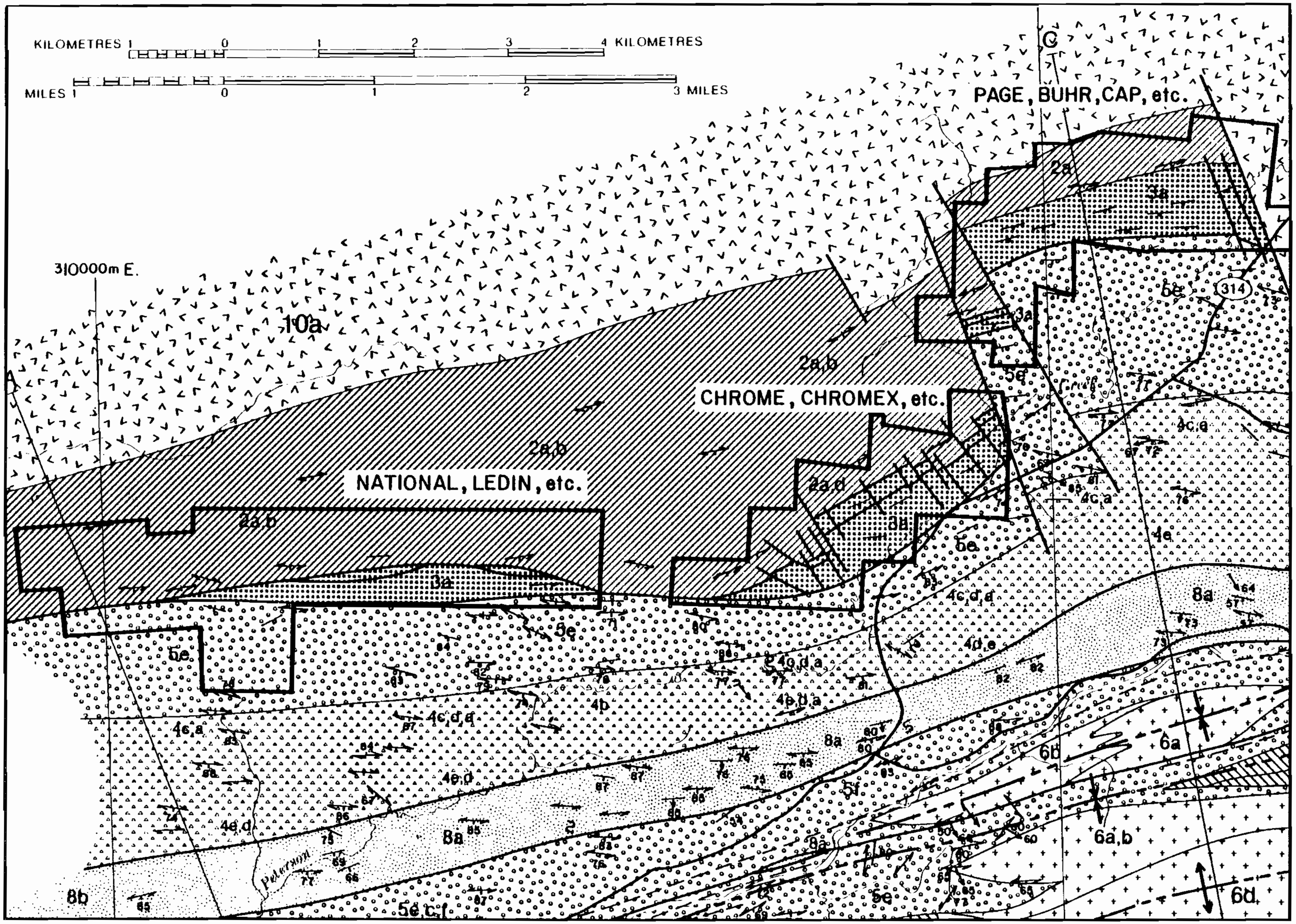


Figure 14. Bird River Sill (unit 3a) from National-Ledin to the Chrome and Page claims; from Map ER 80-1-3, Černý et al (1981); see Figure 2 for legend.

lated values for tonnage in the exposed section by 18 per cent on the Page Group, because of gaps in the main chromite zone, resulting from faulting, that reduce the cumulative length of the zone. Applying that figure to tonnage calculations, the in-place tonnage on the Page Group is listed in Table 1.

Total reserves (measured + indicated) are 1 583 186 tonnes in situ, undiluted, grading 25.5% Cr_2O_3. This is equivalent to 398 963 tonnes Cr_2O_3 or 272 990 tonnes contained Cr. Total inferred tonnage is 4 025 610 tonnes in situ, or 1 014 450 tonnes Cr_2O_3 or 694 140 tonnes contained Cr.

Table 1

Calculated tonnage of chromite, Page Deposit

	Length		Depth	Tonnes (in situ)	Tonnes Cr_2O_3	Tonnes Cr
Measured (drill-indicated)	762 m	x	99 m	395 797	99 741	68 248
Indicated	2286	x	99	1 187 389	299 222	204 742
Reserves: measured and indicated				1 583 186	398 963	272 990
Inferred:						
a) untested	3048	x	206	3 294 306	830 165	568 040
b) western faulted zone	457	x	305	731 304	184 288	126 100
Total inferred:				4 025 610	1 014 450	694 140

Notes: 1. Average grade: 25.2% Cr_2O_3; average width 1.86 m; S.G.: 0.2907 m^3 per tonne.

2. Adjustment for 18% reduction in length due to faulting has been included in tonnage figures.

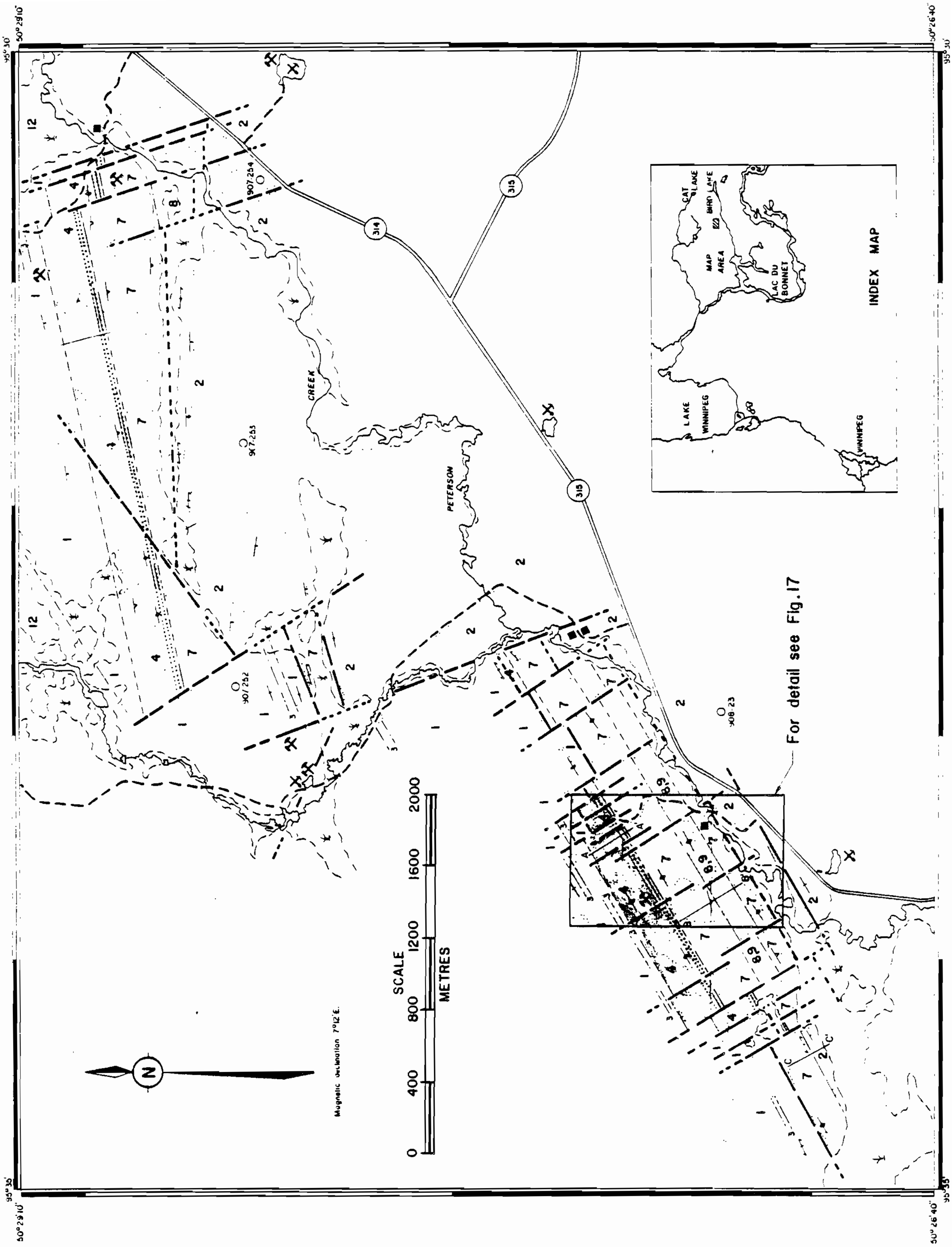
3. Extrapolation beyond the 305 m depth is not considered justified because of the possible occurrence of low-angle transverse faulting.

b) Chrome claims (Albert O. Zeemel estate)

The main chromite zone across the Chrome property consists of offset blocks of variable length. From Trueman's map 1970-A-1, (this report, Fig. 17) the lengths of the major blocks range from 35 to 480 m.

To the east, 700 m of gabbro is indicated (Fig. 15) and then 300 m of peridotite without the main chromite band. A diagram by Bateman (1943) reproduced as Figure 18, shows the nature of the faulting in detail.

Detailed drill results, are not available. Davies (1952) reported the deepest hole, to 198 m, indicated similar grade and thickness as on surface.



For detail see Fig.17
INDEX MAP
CAT LAKE
BIRD LAKE
MAP AREA
LAC DU BONNET
LAKE WINNIPEG
WINNIPEG
PETERSON
CREEK
SCALE
METRES
0
400
800
1200
1600
2000
N
Magnetic declination 7°12'E.
314
315
907-254
907-253
907-252
908-23
50°29'10"
95°30'
95°35'
50°26'40"

GEOLOGY OF THE CHROME AND PAGE PROPERTIES:

BIRD RIVER SILL

PRELIMINARY MAP 1970 A-1

UNIT NUMBER	LAYER NUMBER	DESCRIPTIVE NOTES
1		METAVOLCANIC ROCKS: Metavolcanic rocks consist of pillowed lavas interlayered with porphyritic andesite flow rocks. Pillowed lavas are dark grey, fine to medium grained, and massive to moderately foliated. Porphyritic andesite is greenish weathering, weakly foliated, and characterized by numerous plagioclase phenocrysts.
2		METASEDIMENTARY ROCKS: Metamorphosed greywacke, dark grey, fine grained, and weakly foliated, is interbedded locally with conglomeratic lenses and forms the major portion of the metasediments. Polymict conglomerate, consisting of amphibolite and quartzo-feldspathic clasts in an argillaceous matrix, outcrops east of the central faulted block of the Bird River Sill. Crystal tuff, consisting of large plagioclase crystals randomly oriented in a tuffaceous matrix, outcrops at the southwest corner of the map-area near P.T.H. 315. Sporadically distributed granitic boulders in the tuff indicate a water lain origin, and a mixed provenance for this unit.
		.... INTRUSIVE CONTACT ....
3		GABBRO: Gabbro occurs as narrow, concordant intrusives in the metavolcanics of unit 1. The gabbro is typically grey to black, medium to coarse grained, and massive. These bodies may represent a once contiguous body offset by faulting.
		.... INTRUSIVE CONTACT ....
4	(1)	SERPENTINIZED PERIDOTITE: Serpentinized peridotite, buff to greenisn weathering, coarse grained, and massive, forms the basal unit of the Bird River Sill. Towards the base, the unit is characterized by large tremolite knots. Interstitial chromite increases in abundance towards the top of the unit and imparts a patchwork appearance to the rock. Prominent greyish green serpentine ovoids, pseudomorphic after olivine, are well displayed on the weathered surface.
5		CHROMITE, CHROMIFEROUS PERIDOTITE: Chromite, (>90% chromite), and chromiferous peridotite, (<90% chromite), form sharply defined black, fine grained, massive layers along an approximate strike distance of 15,000 feet. The layers range from less than 1/2 inch to 18 inches in thickness, and where closely spaced give rise to zones of chromite-rich peridotite up to 10 feet thick.
6	(2)	PYROXENITE: Rusty weathering, coarse grained moderately foliated pyroxenite forms a 30-foot layer above the serpentinized peridotite of unit 4. The pyroxenite grades into the anorthositic gabbro of unit 7 with increasing plagioclase content.
7	(3, 9)	ANORTHOSITIC GABBRO: Anorthositic gabbro comprises two layers with an estimated cumulative thickness of 1,400 feet. The anorthositic gabbro is greyish white, very coarse grained, and massive. Anorthosite phases occur locally in this unit. Hornblende, which is interstitial, forms large bladed aggregates. Zones of ovoid plagioclase aggregates give rise to orbicular gabbro in layer 3.
8	(4, 6)	HORNBLENDE GABBRO: Hornblende gabbro, dark grey to black, coarse grained, and massive, forms two layers with a cumulative thickness of 150 feet. It is in contact with the anorthositic gabbro (layer 3), and is interlayered with porphyritic gabbro (layers 5 and 7). Anorthositic phases occur locally in this unit.
9	(5, 7)	PORPHYRITIC GABBRO: Dark grey, coarse grained, massive porphyritic gabbro forms two layers of a cumulative thickness of 170 feet. It is characterized by large knots of hornblende which stand out in relief on the weathered surface. These knots comprise up to 30 percent of the rock and commonly display greyish selvages of plagioclase.
10	(8)	QUARTZ GABBRO, GRANOPHYRE-BEARING GABBRO: Quartz gabbro forms a narrow 30-foot layer above the porphyritic gabbro of layer 7. The rock weathers dark grey, is coarse grained, and massive. Interstitial quartz, in places, makes up 10 percent of the rock. Granophyric intergrowths occur near the top of the layer, but nowhere exceed 5 percent of the rock.
11	(10)	GRANOPHYRIC GABBRO: Granophyric gabbro forms a narrow, 10 to 15-foot thick layer above the anorthositic gabbro of layer 9 near the southwest portion of the map-area, and is considered to be the topmost layer of the Bird River Sill. The rock weathers grey, is fine to medium grained, massive and siliceous in appearance. Minor shearing occurs at the upper contact where the granophyric gabbro is in contact with conglomeratic greywacke of unit 2.
		.... INTRUSIVE CONTACT ....
12		QUARTZ DIORITE; GRANODIORITE: A large heterogeneous quartz diorite-granodiorite pluton intrudes the Rice Lake Series. The rock weathers grey to pink, is coarse grained, and massive, being characterized by large ellipsoidal quartz grains. Several small dykes of quartz diorite-granodiorite composition intrude the metavolcanics of the Rice Lake Series, and the rocks of the Bird River Sill.

SYMBOLS

Geological boundary (defined, approximate, assumed, gradational	Swamp, muskeg
Igneous layer (inclined, vertical)	Trench
Bedding (inclined, vertical, tops shown by arrow)	Gravel pit
Foliation (inclined, vertical)	315 Road
Fault (defined, approximate, assumed)	Trail
1, (1) Unit number, Layer number	Bridge

Figure 15. Geology of the Chrome and Page properties (from Trueman, 1970).

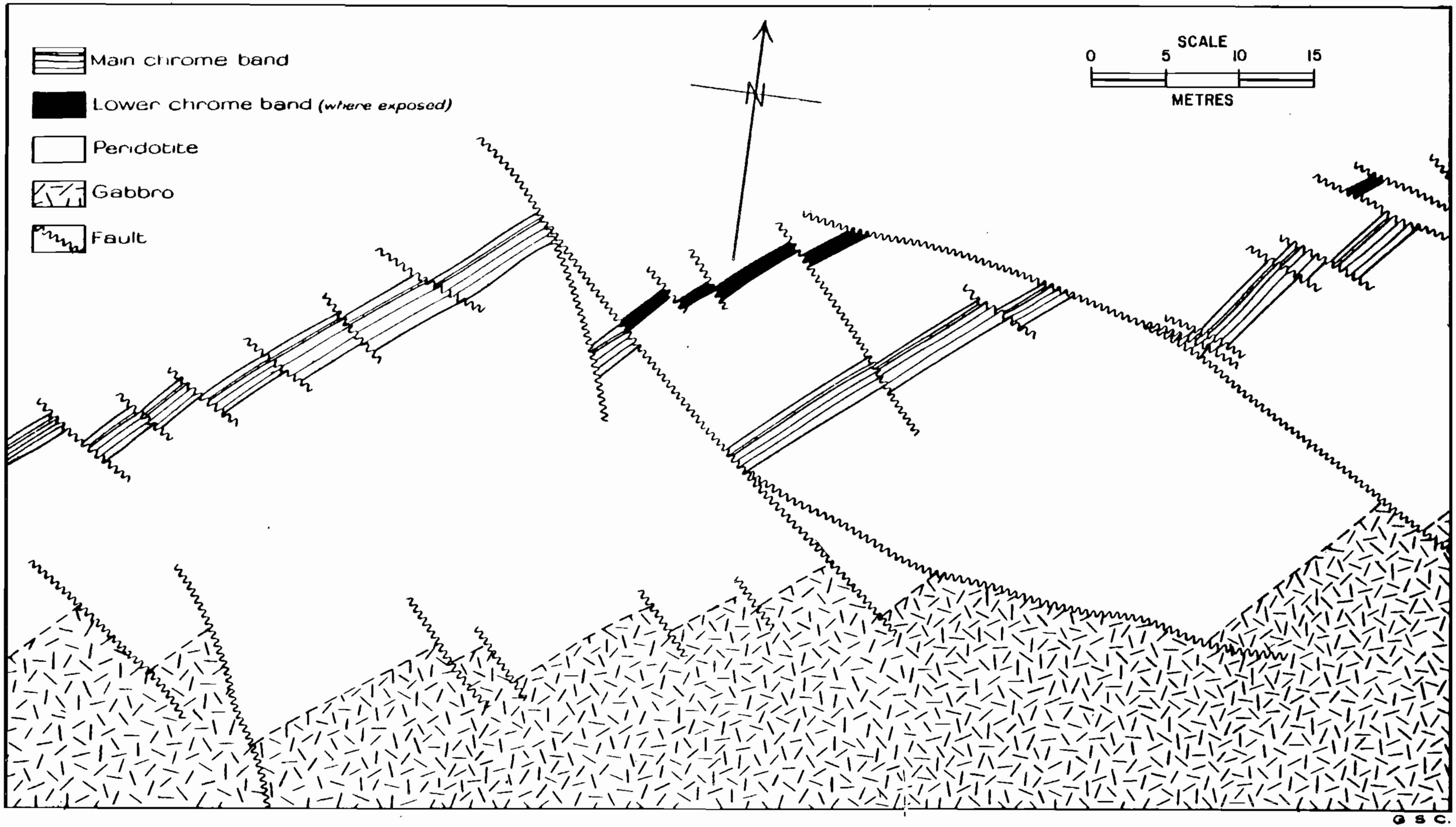


Figure 16. Plan of part of chromite zone on Page property (from Bateman, 1943).

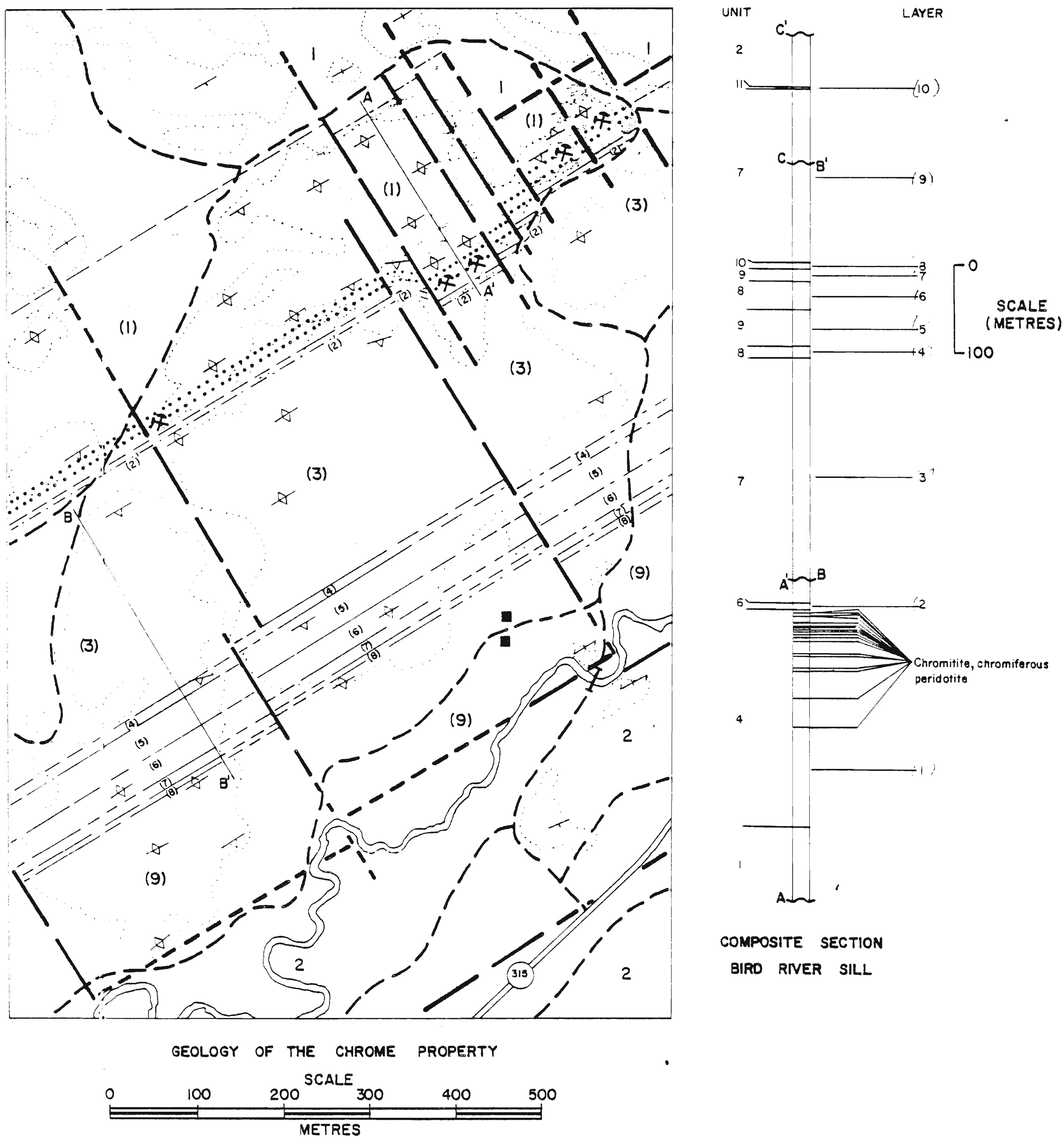


Figure 17. Geology of the Chrome property, Bird River Sill (from Trueman, 1970: Preliminary Map 1970A-1). See Figure 15 for Legend.

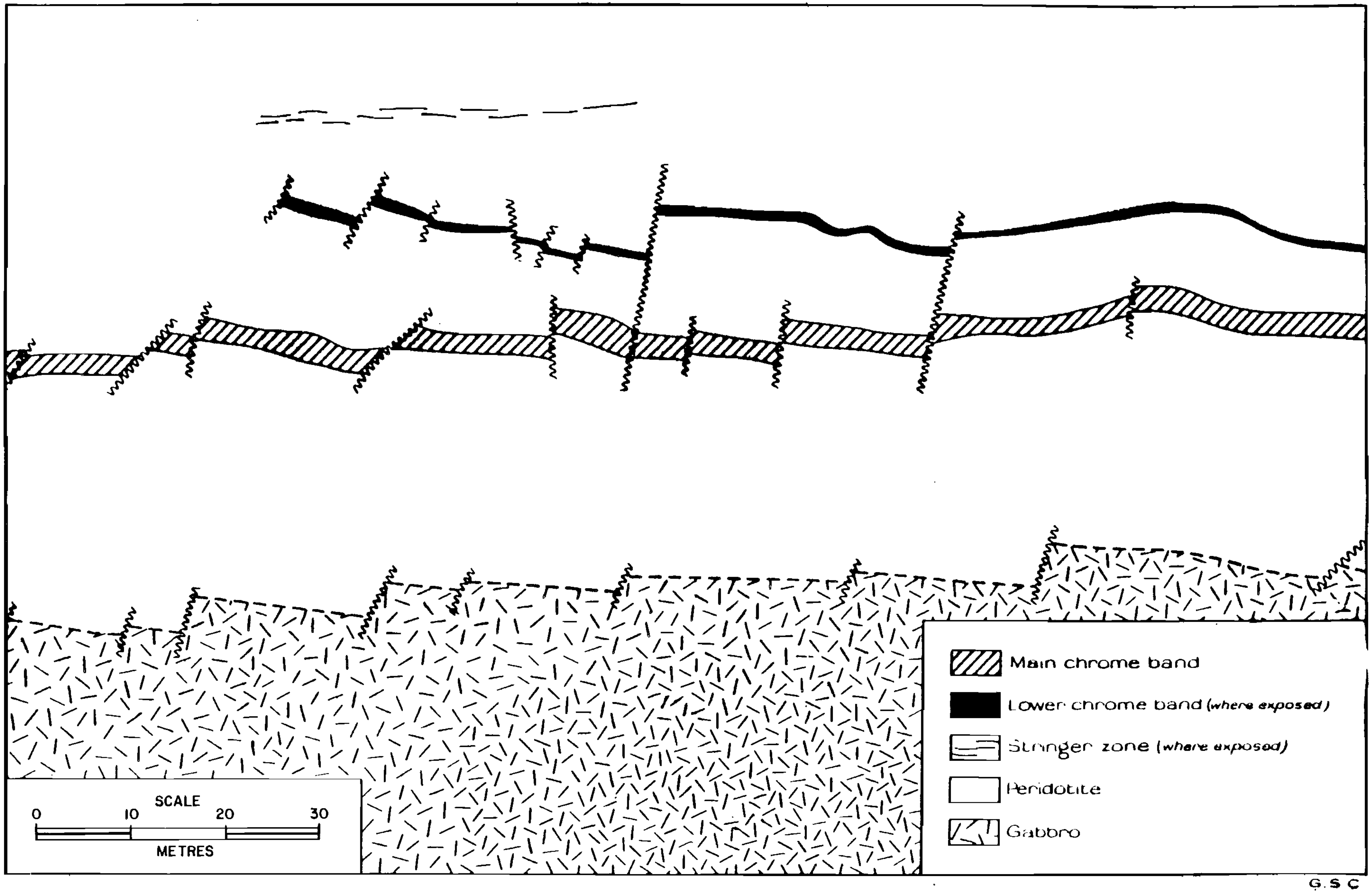


Figure 18. Plan of part of chromite zone on Chrome property (from Bateman, 1943).

The figures used in tonnage calculations are those proposed by Bateman (1943):

Average width: 2.59 m (true thickness)

Average grade: 18.2% Cr_2O_3

Cubic m per tonne: 0.2969 (S.G. 3.368)

Bateman (1942) also indicated offset of the chromite zones by faulting produced gaps in the ore zone, for which he recommended a 12 per cent reduction in length. This figure is used in the calculations listed in Table 2. Bateman reported the western section of the exposed main chromite band dips 78.7°N. A 90 m section to the east dips 77°S., and the eastern part dips 82.5°N. Extensive faulting has produced individual segments 3 to 15 m long, with major displacements as shown by Trueman (Fig. 17).

Table 2

Calculated tonnage of chromite, Chrome Deposit

	Length x	Depth (-12%)	Tonnes	Tonnes Cr_2O_3	Tonnes Cr
Measured	640 m	198 m	972 786	179 260	122 655
Indicated	725	198	1 101 984	200 561	137 234
Reserves: measured and indicated			2 074 770	379 821	259 893
Inferred	1 365	107	1 121 625	204 136	129 680

Although Davies (1952, 1958) thought that it was probable that the ore continued to greater depth than 305 m, extrapolations beyond the 305 m depth should not be inferred until drill results justify doing so, because of the possibility of removal or dislocation of the ore zone by low-angle transverse faulting. Trueman's suggestion (1971) that dip-slip faulting has occurred introduces the possibility that each block may show variations in grade with depth. This possibility also suggests that extrapolations to great depths are not justified with presently available data, even though the stratiform nature of the deposit likely ensures continuity well below the drilled depth, considering the length of the exposure.

The north band is 0.3 to 1.2 m wide (average 0.64 m) and is 9 to 12 m north of the main band. Because of faulting, its dip is not always the same as that of the main band. Average grade is 23% Cr_2O_3; it has not been considered in the reserve calculations.

c) Bobo claims

Two holes were drilled on the Bobo claims, since cancelled. Brownell (1942) stated:

"Diamond drilling did reveal only thin layers of chrome, too thin to be of commercial value, on the Bobo claims where the gabbro-peridotite sill is only 400 - 500 feet thick" (122 - 152 m).

Brownell (1942) noted that in the area of the Chrome claims, the thicker portion of the sill (about 600 m) extends only to the west boundary of the Chrome 8 fractional claim.

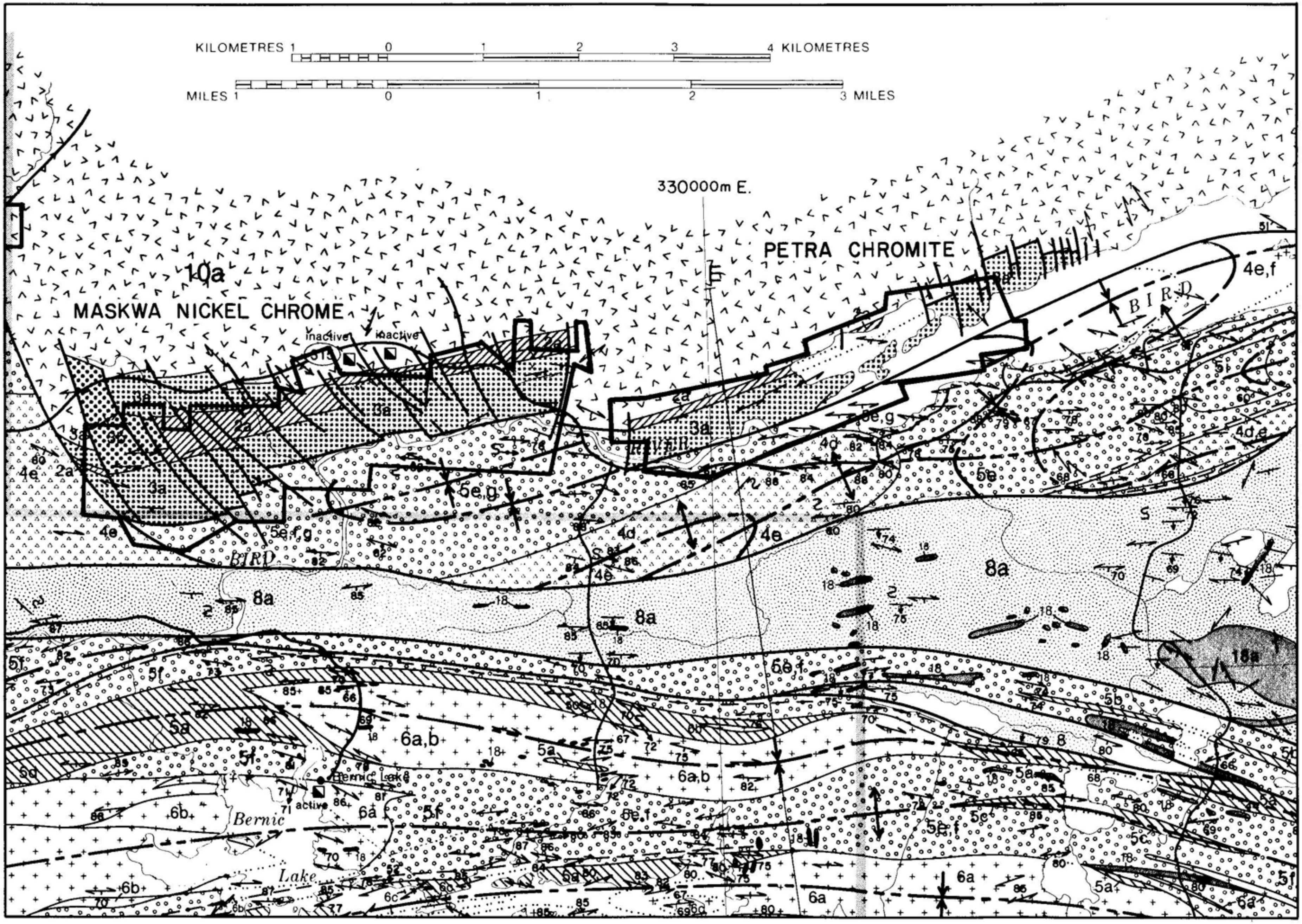


Figure 19. Geology of the Maskwa-Chrome to Bird Lake area; from Černý et al. (1981, Map ER80-1-3); for legend see Figure 2.

"The southwest end, however, narrows down on the Chrome #9 fraction to a width of only 400 to 500 feet and maintains this narrow width of the westward into the Bobo #3 claim. Its continuation across the Bobo group is obscured by overburden, but as the sill outcrops in line again on the Pack #11 claim to the west of the Bobo group, it is reasonable to assume that the sill is continuous and that it maintains this narrow width as far as the west boundary of the Bobo #7."

Data on the precise grade and thickness of the thin chromite zone on the Bobo claims are not available.

d) Maskwa Nickel Chrome Mines Limited, Bird River (Queen 3 to Wilfred D. claims)

Davies (1955, p. 39) reported:

"The section of the Bird River Sill between the Wilfred D. and Queen 3 claims is held by Maskwa Nickel Chrome Mines, Limited. In 1952 this company did 2,356 feet of diamond drilling along the gabbro-peridotite contact. The drilling indicated that the chromite along this entire section is erratic in distribution. Most intersections, although of fairly high-grade chromite, were narrow."

The area is shown in Figures 19, 20 and 21. An aeromagnetic anomaly is present (Appendix 1, Fig. 32). Tonnage calculations cannot be made because of insufficient data. The length of the chromite zone from the Wilfred D. to the Queen 3 claims is about 3200 m. Extensive faulting and large displacements of the sill in that area are indicated in Figure 19. A portion of the earlier map of Davies (1955b) is reproduced as Figure 20.

The chromite zone is not known to outcrop there. Figures for grade and tonnage have never been reported by the company. A map by Karop-Møller and Brummer (1971), reproduced as Figure 21, indicates the chromite zone may be limited to a western section about 825 m long, extending across the Tatu and most of Queen 3 claims, and an eastern section about 575 m long between the Wilfred D. and Colossus 13 claims. Presence of chromite on the intervening 1800 m of the sill is not indicated. As the mineral inventory card for the Maskwa Nickel Chrome Mines Limited holdings in the Bird River area does not mention chromite, it has not been included in Appendix 2.

e) Petra Chromite Mines Limited (Wolf, Point, Fisher, and Bloom claims) Bird Lake

East of the Maskwa Nickel Chrome lease, the chromite zone of the Bird River Sill has not been reported in outcrop, and appears to be "faulted out" of the section for about 1 km. The sill is present farther east, displaced to the south by faulting, in the area north of Bird River and along and under the northwestern part of Bird Lake (Fig. 19). The chromite zone has been intersected in drill holes and its general location is shown in Figure 22, from Davies (1955b).

Bateman (1943) reported a "generalized cross section" of 6 narrow (0.49 to 0.98 m) chromite zones with an aggregate thickness of 4.72 m within a total width of 16.3 m. The grade of the bands ranges between 12.1% Cr_2O_3/0.98 m to 23.3% Cr_2O_3/0.55 m. Excluding any values in the intermediate peridotite, this gives an average grade of 5.4% Cr_2O_3/ 16.3 m. Values for the intervening chromiferous peridotite layers were not reported by Bateman, but Davies (1958) indicated that the values are less than 10% Cr_2O_3 and that the grade of the whole zone from a "typical drill hole", including the lower grade values, is about 7% Cr_2O_3 over 15.24 m (Fig. 23, from Davies, 1958). Bateman (1943) reported the zone was 1646 m long, as indicated by drilling, and

LEGEND

9	Diabase
7	Granite, quartz diorite, granodiorite
6	Hornblende gabbro
5	Peridotite, pyroxene, hornblendite
1-4	Rice Lake Group

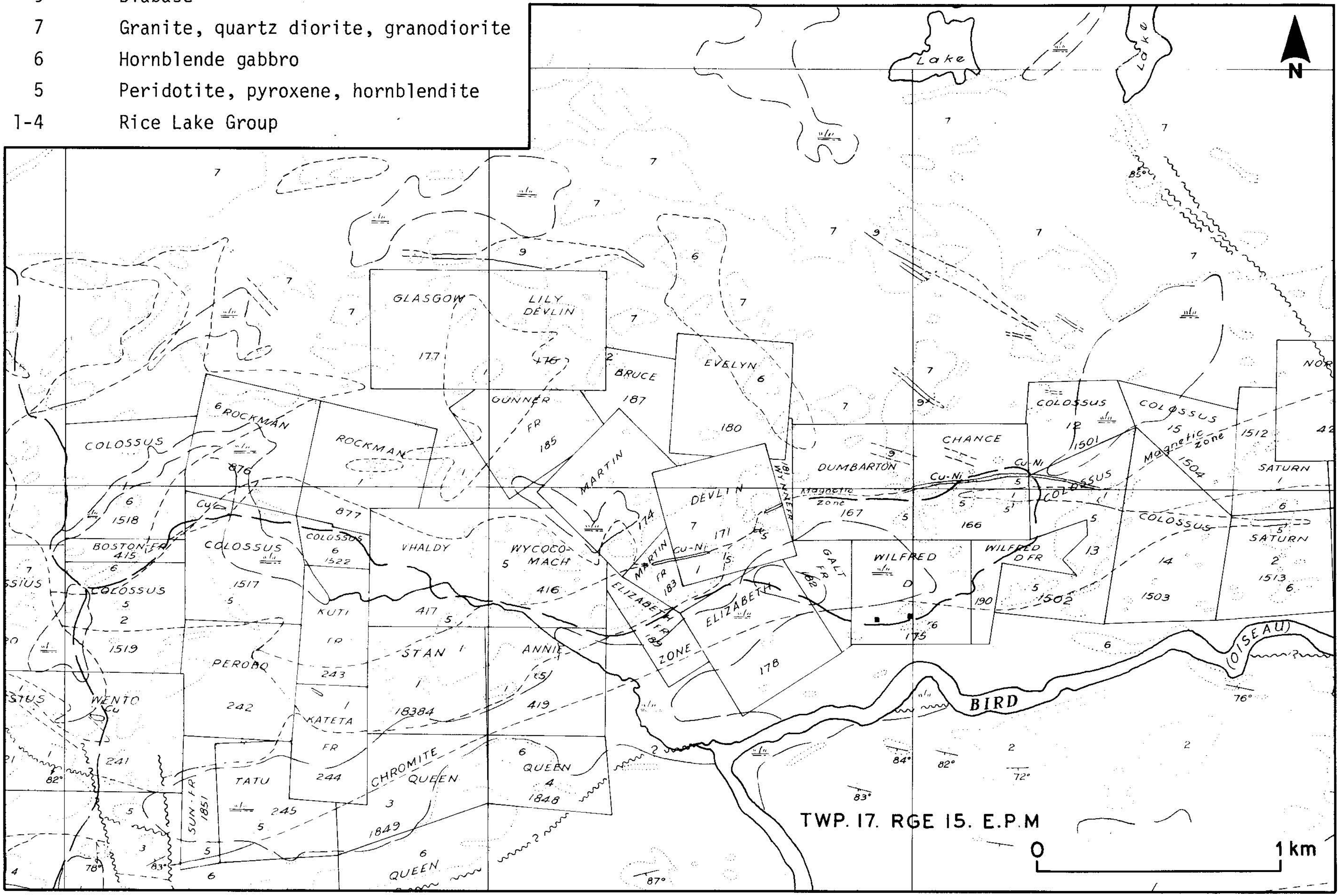


Figure 20. Geology of the Queen 3 to Wilfred D. claims (Davies, 1955b).

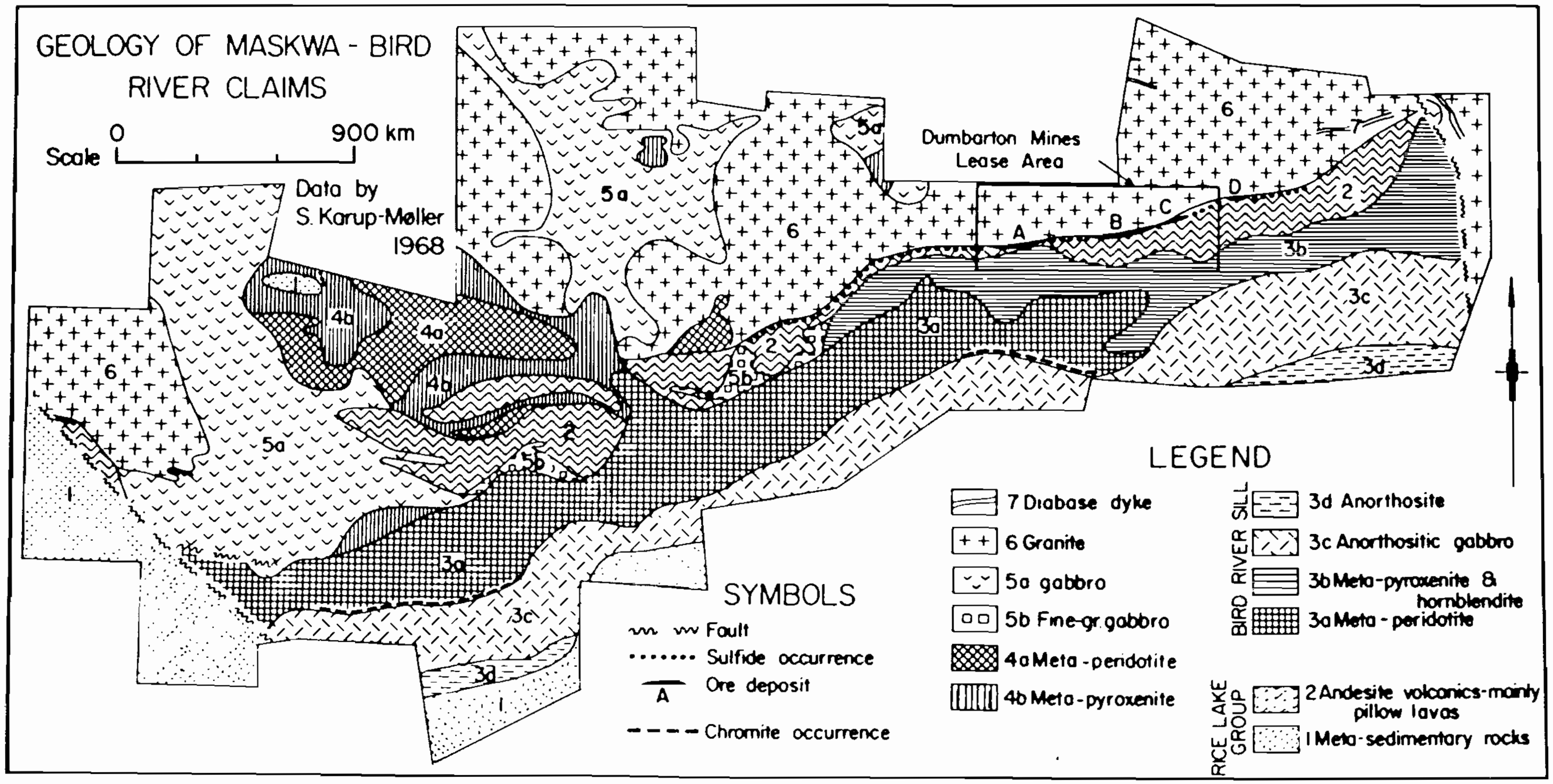


Figure 21. Geology of the Maskwa-Bird River claims, from Karop-Møller and Brummer (1971, p. 145).

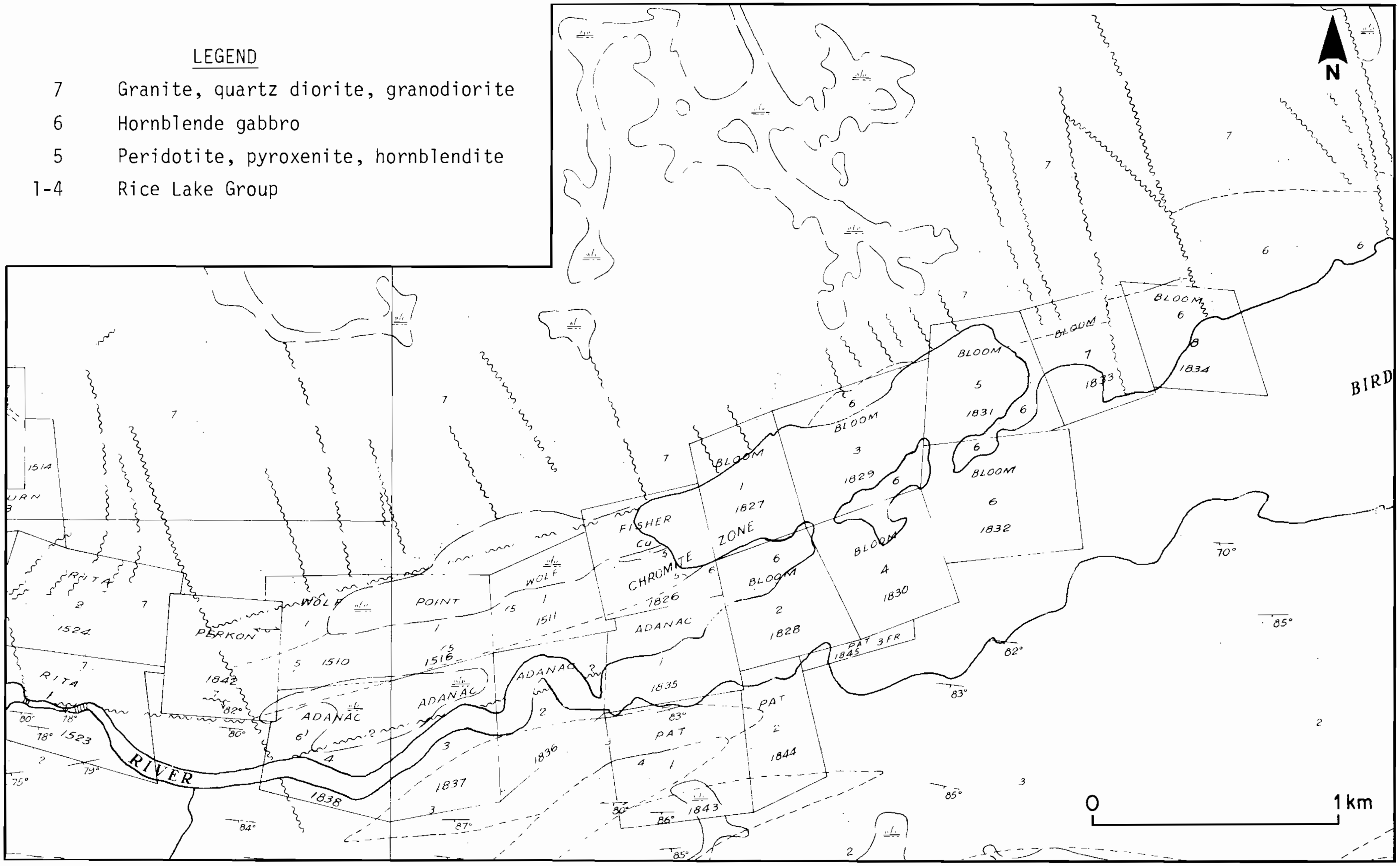


Figure 22. Geology of the Petra Chromite Mine Limited claims, Bird Lake (Davies, 1955b).

that the probable over-all length was 2500 m.

Davies (1955b, 1958) reported, that "based on information supplied by the companies", the chromite zone on this property is 2134 m long, an average of 13.72 m wide, and grades an average 7% Cr_2O_3. He reported the volume to 61 m depth, the approximate average depth to which the deposit was drilled, as being 2 721 550 tonnes. However, by calculation, the indicated volume, if 2134 m x 13.72 m x 61 m, should be about 5 830 000 tonnes (assuming a specific gravity of 3.265). The difference may lie in allowances for overburden thickness, non-recoverable material underlying part of Bird Lake, and reduction because of faulting, but these are assumptions.

Davies (1958, p. 38) noted, "Drilling has indicated that the chromite zone occurs in several segments separated by transverse faults probably striking north-northwest and having displacements of a few tens of feet up to 300 or 400 feet. The Bird Lake deposits differ from those in the area to the west . . . At Bird Lake the chromite occurs in more or less regularly spaced bands across the entire width of the deposit. Ten or more such bands, up to two feet wide, and grading up to 25 per cent chromic oxide occur within the chromite zone." A section of the chromite zone as reported by Bateman (1943) is shown in Figure 13.

A problem exists in making tonnage estimates for this property, because of some discrepancies, noted above. For purposes of this report, the arbitrary parameters listed in Table 3 are used.

Table 3

Calculated tonnage of chromite at Bird Lake (Petra Chromite Limited)

S.G. 3.265 (0.3060 m^3 per tonne)

Measured: 1646 x 13.72 x 61 m, 7% Cr_2O_3
1 377 570 m^3 or 4 497 453 tonnes of ore containing 314 822 tonnes Cr_2O_3
or 215 417 tonnes Cr

Indicated: 488 x 13.72 x 61 m, 7% Cr_2O_3
408 417 m^3 or 1 333 389 tonnes of ore containing 93 337 tonnes Cr_2O_3
or 63 866 tonnes Cr

Inferred: 2134 x 13.72 x 122 m, 7% Cr_2O_3
(from depth of 61 to 183 m) 3 571 975 m^3 or
11 661 686 of ore containing 816 318 tonnes of ore
or 558 566 tonnes Cr

These figures are not as reliable as those reported for the Page, Chrome and Euclid Lake deposits. No allowance has been made for displacements by faulting, for overburden thickness, or for the presence of Bird Lake. These factors could reduce the measured and indicated tonnages by 25 to 50 per cent.

The deposit appears to have potential for large tonnage at depth, but because of the faulting out of the Bird River Sill to both the east and west, and because the extent of faulting on the property is not well known (available data are shown in Fig. 19), extrapolation of

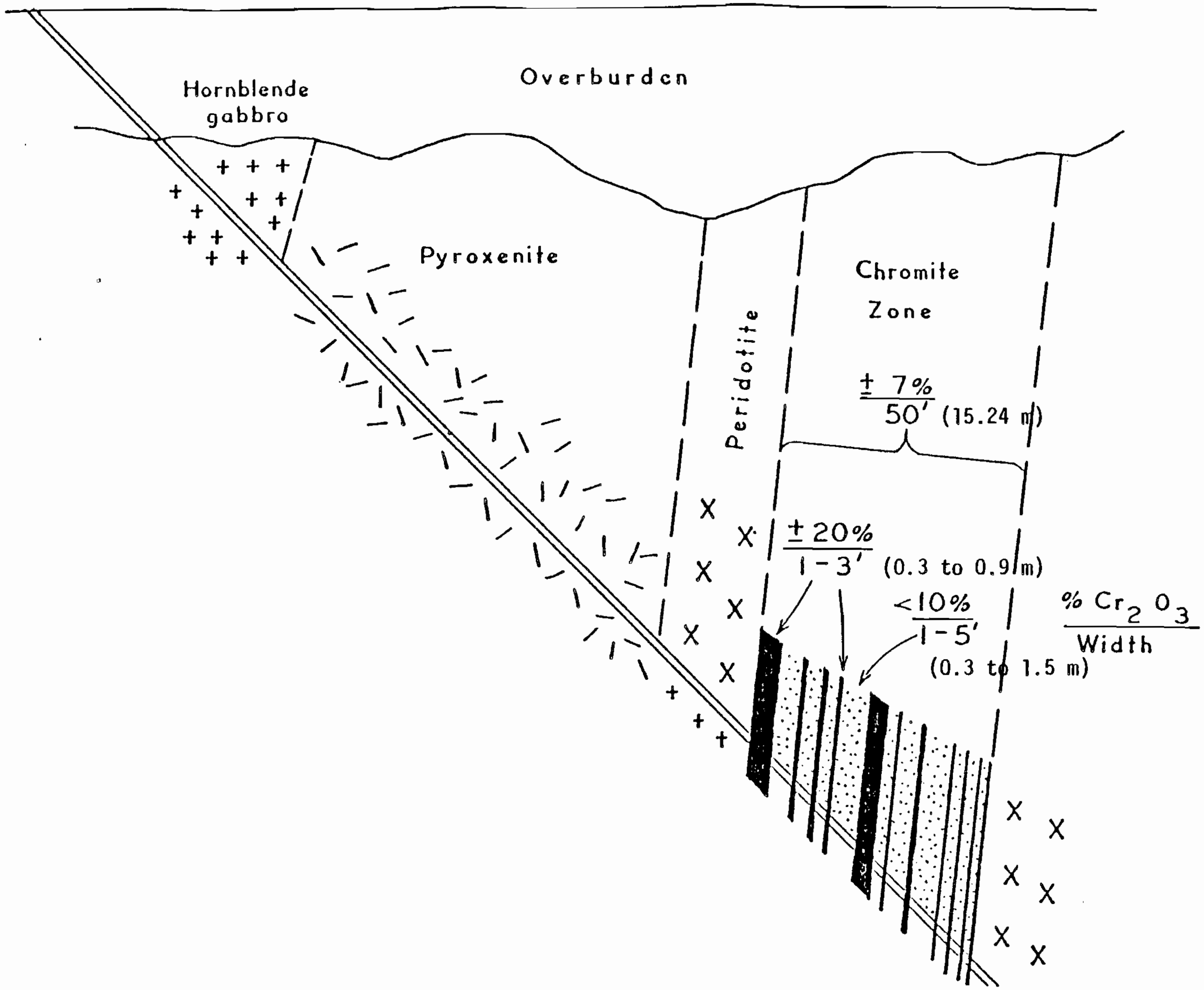


Figure 23. Typical drill hole intersection - Bird Lake deposit, from Davies (1958, Fig. 4).

tonnages to greater depth is not justified until drilling to deeper levels confirms the presence of ore.

f) National-Ledin claims

A westward extension of the Bird River Sill outcrops on the National-Ledin claims, some 4.8 km west of the Chrome claims (Figs. 2 and 14). Davies (1952) reported that peridotite was observed to outcrop in only one place.

In 1950 - 1951, Howe Bay Mining Co. Ltd. completed 7 drill holes on the group, the results of which are summarized in Table 4.

The chromite intersected in the drilling does not appear to be of mineable widths. Bands of dense chromite ore range from 2.54 cm to 43.2 cm (core length), except for one reported band of 114.5 cm (core length). No chemical analyses were reported, nor is the chrome-iron ratio known. The peridotite portion of the sill is about 91 m thick, about one-half its thickness on the Chrome property. Thus on geological grounds, it is expected that the chromite content, which tends to show a relation to the thickness of the peridotite, would be lower.

The aeromagnetic map of the area (Fig. 31) shows little trace of an anomaly on the National and Ledin groups. An anomaly is located immediately southeast of the property, but is of local extent only.

Table 4

Drilling Results from National-Ledin Chromite Deposit

Claim	Drill Hole	Angle	Chromite Occurrence
Ledin #1	1	50°	Nil, no peridotite
National #27	2	50°	Nil; no peridotite
National #38 extending into Ledin #3	3	45°	Peridotite: 227' to 432' (69.2 to 131.7 m) Intervals of disseminated chromite 3" at 288'6" (7.6 cm at 87.9 m); 2' at 298' (61 cm at 90.8 m); 8'8" at 305'4" (264 cm at 93 m).
Ledin #3	4	40°	Peridotite: 104' - 191'6" (31.7 to 58.4 m) Chromite: 191'6" to 195'3" (58.37 to 59.51 m) Peridotite to 275' (bottom of hole)(83.8 m)
Ledin #3	5	40°	Dense and disseminated chromite in peridotite at intervals 47' 8" to 128'1" (14.5 to 39.0 m); including Dense chromite: 2" at 51'10" (5.1 cm at 15.8 m) 2.5" at 52' 4½" (6.3 cm at 15.96 m); 1'5" at 121'1" (3.8 cm at 36.9 m) Peridotite: 3' to 220' (0.91 m to 67 m) (total length of hole).
Ledin #3	6	40°	Peridotite 14' to 122' (total length) (4.27 to 47.24 m) Disseminated Chromite: 5" at 26' 10" (12.7 cm at 8.18 m) Dense Chromite: 3" at 71'11" (7.6 cm at 21.9 m); 1'11" at 89.4" (58.4 cm at 27.23 m).
Ledin #3	7	40°	Peridotite: 60' to 453' (18.3 to 138 m) Dense and disseminated chromite at intervals. Dense Chromite: 1" at 70' (2.54 cm at 21.3 m); 6" at 130' (15.2 cm at 39.6 m); 2½" at 165'11" (6.3 cm at 50.57 m); 1'4" at 173'10" (40.6 cm at 53 m); 4" at 176.5" (10.2 cm at 53.77 m)

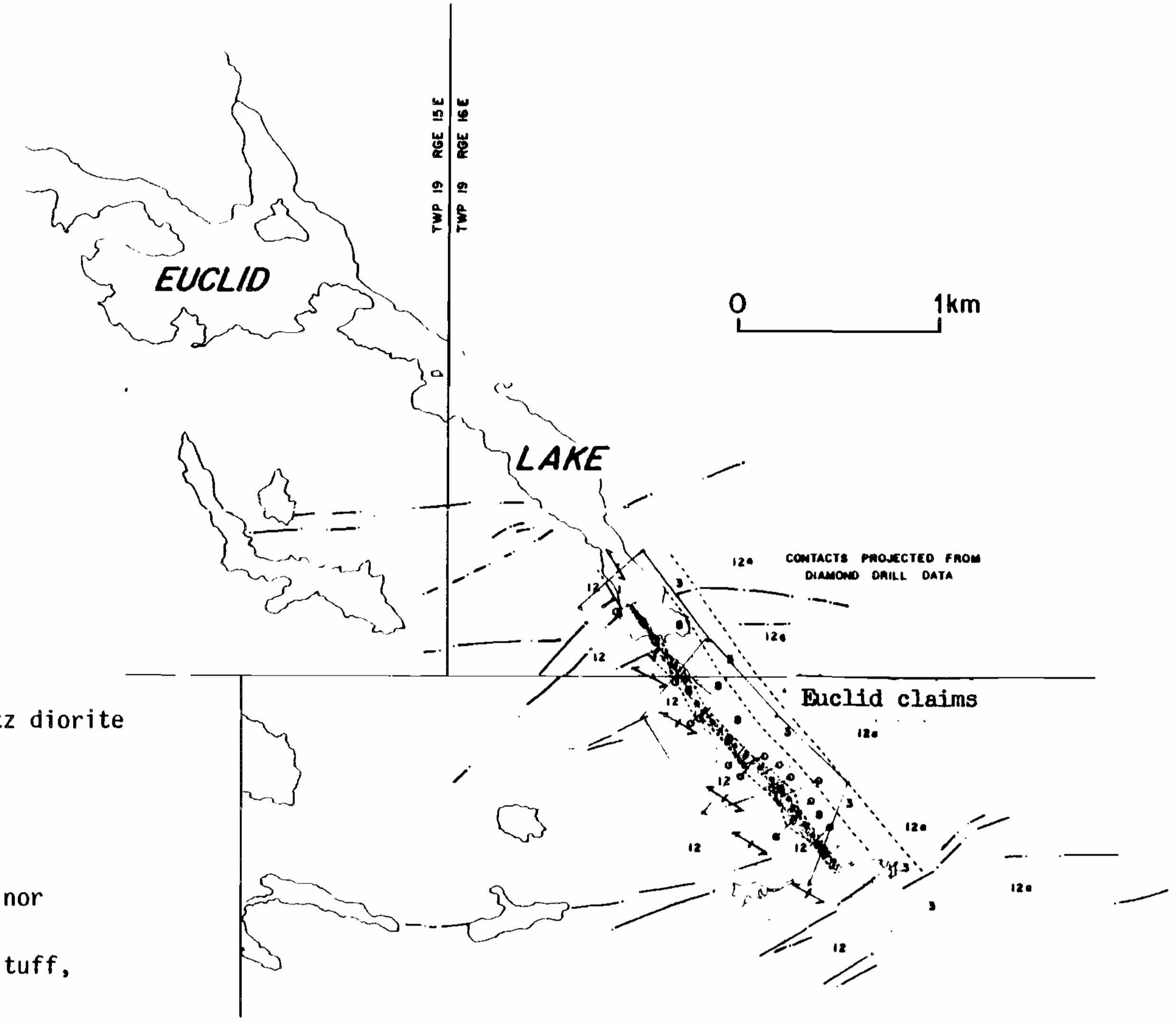
SYMBOLS

----- Geological contact, assumed

— · — Air photo lineament

—∘ Diamond drill hole

Foliation, inclined, vertical



LEGEND

12 Granite, granodiorite, quartz diorite
12a quartz monzonite

BIRD RIVER SILL
- 8 Anorthositic gabbro, gabbro, anorthosite
- · · Chromite-bearing layer
- 6 Serpentinized peridotite, minor pyroxenite

3 Rice Lake Group: greywacke, tuff, minor chert

Figure 24. Bird River Sill (units 6 and 8) south of Euclid Lake (Trueman and Macek, 1971).

g) Wards claim

Bateman (1943, p. 178) described an "occurrence of chromite in the gabbro on Wards claim, at the western extremity of the south limb of the sill (Fig. 2). At this locality there are 19 irregular patches and one intermittent lens of dense ore containing about 22.5 per cent chromic oxide; but the occurrences are not sufficiently large or closely spaced to constitute ore bodies."

On the mineral inventory card (Appendix 2), it is noted:

> "The Wards claim and its adjoining Trimpas and Cuba mineral claims were grouped and on this group Mr. Lapin put down several trenches and test pits (in 1943). Additional pits and trenches were put down and some diamond drilling was performed on the . . . group in the period 1943 to 1950."

No drill results or assays are on file with the Mineral Resources Division.

The current (1977) owner of the claim is listed as Macroy Mining and Exploration Limited.

Davies (1952) refers to "small lenses of chromite in gabbro" on the Wards claim, and implies that the deposit is not of economic interest. A small magnetic anomaly is located near the southwest corner of the claim, as shown on the aeromagnetic map of the area (Fig. 30).

Recent work by Trueman (in prep.) indicates that chromite-bearing gabbro on the Wards claim is a rock unit separate from, and not a part of, the Bird River Sill.

h) Euclid Lake deposit (Albert O. Zeemel estate)

The known extent of the Bird River Sill south of Euclid Lake is shown in Figure 24. The sill is exposed in several small outcrops occurring over a length of 100 m extending northwestward from the centre of the Euclid claim (Fig. 25).

Springer (1950) reported on the outcrop of chromite at Euclid Lake:

> "The gabbro-peridotite contact lies beneath a small stream flowing into the lake. On the south side of the stream chromite-bearing peridotite abuts against granite which has destroyed the lower part of the sill. Disseminated and dense chromite may be seen in the few feet of peridotite exposed. Gunnar Gold Mines Limited reported that drilling beneath the stream to the gabbro contact intersected a wider chromite zone. It is possible that the sill extends for some distance southeast of Euclid Lake, but it cannot be very wide as rocks of the Rice Lake group outcrop on both sides of the covered valley."

The results of 21 drill holes were made available in 1975 by courtesy of Albert Zeemel for this study. The drill hole locations are shown in Figure 25.

Several thin layers of dense or disseminated chromite are separated by layers of low grade chromiferous peridotite. The drilling outlined the main area of chromite occurrence over a length of 373 m. Because of some uncertainty in the correlation between the drill holes, and because of faulting in the area, tonnage calculations have been made for separate blocks, as listed in Table 5.

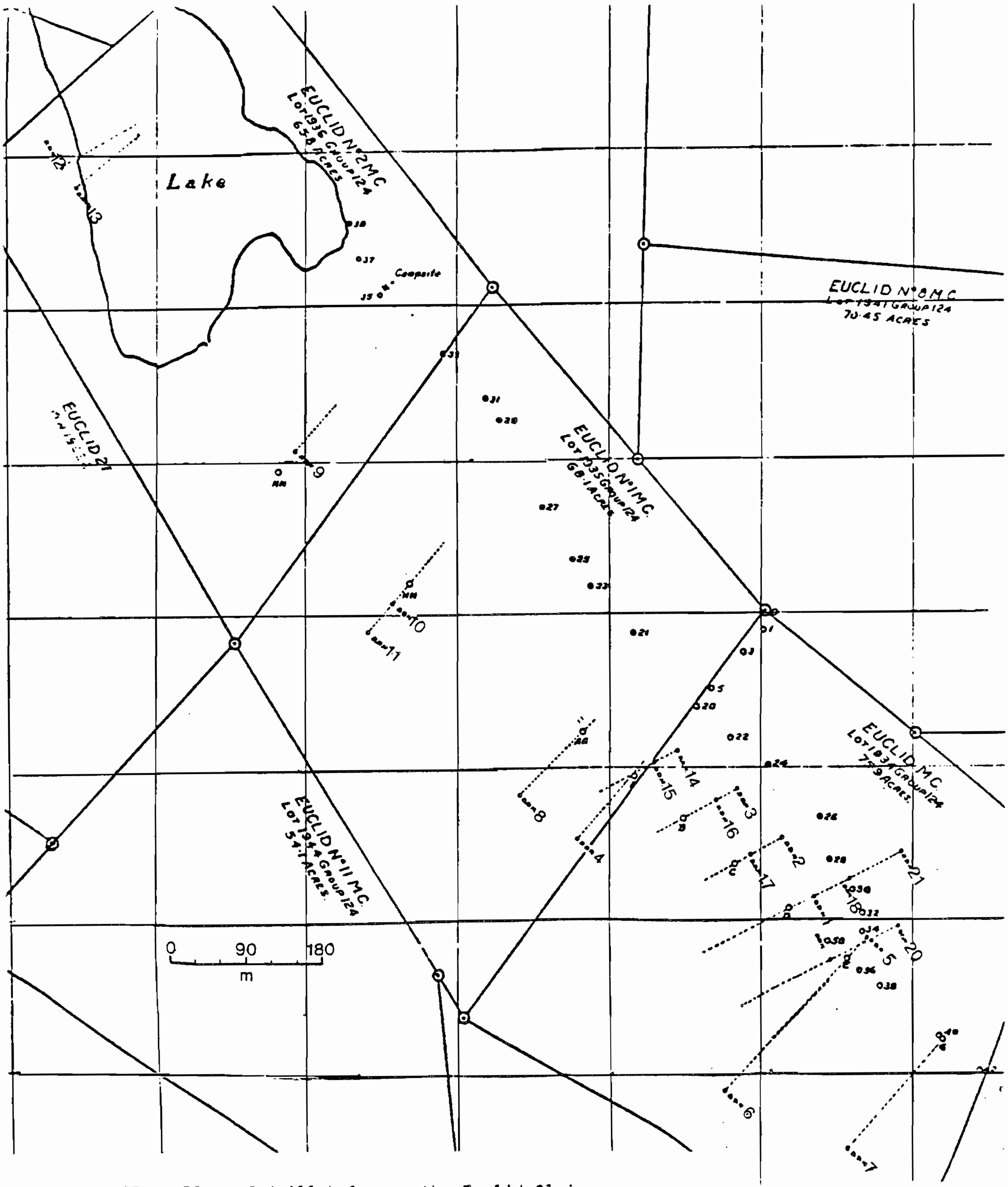


Figure 25. Plan of drill holes on the Euclid Claims.

Table 5

Tonnage calculations from drill results, Euclid Lake deposit

Maximum Depth Tested	No. of Drill Holes	Av.% Cr_2O_3/ True Thickness	Block Length	Tonnes to 122 m
130 m	2	5.30/26.2 m	30.5 m	315 090
213	2	4.43/48.8	53.3	1 025 620
259	3	5.03/31.7	76.2	952 475
99	2	3.78/38.7	76.2	1 162 800
61	2	5.18/26.6	76.2	799 240
91	3	3.46/11.9	61.0	286 230
			373.4 m	4 541 455 tonnes

Notes: 1. Average grade: 4.57% Cr_2O_3/30.844 m (average width)

2. Tonnage factor: 0.3094 m^3 per tonne (S.G. 3.23)

Measured reserves are considered to extend to a depth of 122 m for 4 541 400 tonnes grading 3.57% Cr_2O_3 (207 542 tonnes Cr_2O_3 or 142 010 tonnes Cr). A similar amount of ore is indicated between the 122 m and 244 m levels. Total reserves (measured + indicated) are 9 082 800 tonnes grading 4.57% Cr_2O_3, containing 415 084 tonnes Cr_2O_3 or 284 020 tonnes Cr (in situ, undiluted).

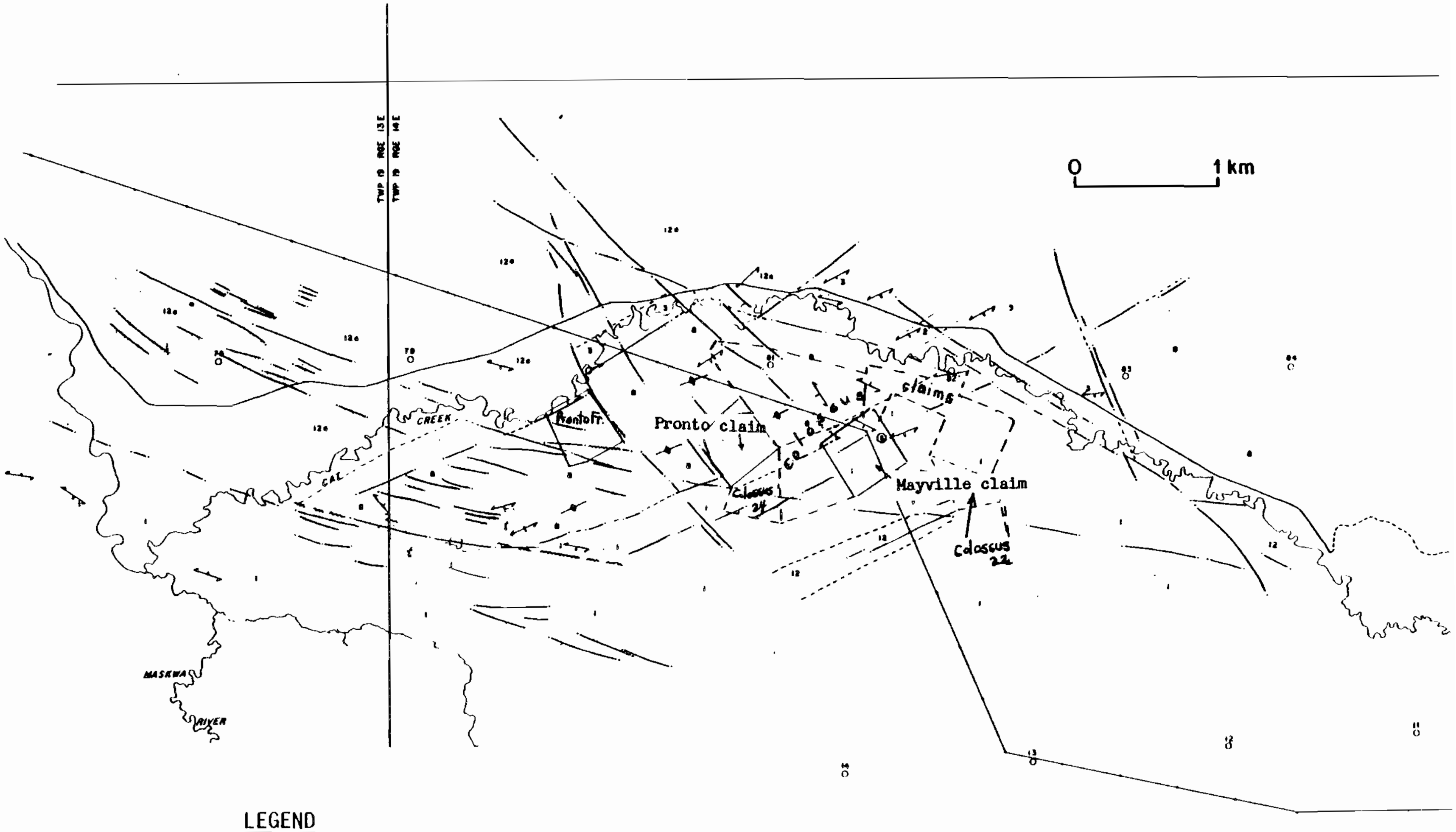
Because of the similarity of results within each section, inferred reserves are considered to extend from 244 to 366 m, containing an additional 4 541 000 tonnes grading 4.57% Cr_2O_3. As this depth equals the known length of the deposit, it is not considered advisable to extrapolate the results any farther, without some evidence of extension of the deposit to greater depth.

In several drill holes, a "western zone" of chromite was indicated separated by 8 to 30 m of barren rock from the main zone. The results are summarized in Table 6.

Table 6

Western zone, Euclid Lake Deposit

No. of Drill Holes	Av.% Cr_2O_3/True Thickness	Length	Tonnes to 122 m
2	12.13/1.37	61 m	32 950
3	10.96/1.98	76.2	59 490
2	4.85/5.03	61	120 985
2	8.25/2.59	38.1	38 910
Total: Average grade	8.15% Cr_2O_3	236.3 m	252 335 tonnes



LEGEND

	12	Granite, granodiorite, quartz diorite 12a quartz monzonite
	8	Bird River Sill: anorthositic gabbro, gabbro, anorthosite
RICE LAKE GROUP	3	Greywacke, tuff
	2	Conglomerate
	1	Basalt, andesite, minor tuff, intravolcanic gabbro sills.

SYMBOLS

- Geological boundary, gradational, assumed
- Airphoto lineament
- Fault
- Foliation, inclined
- Igneous layering, trend
- Area of Exposure
- Air photo centre
- Sulphide occurrence

Figure 26. Bird River Sill (unit 8) in the Cat Creek area north of Maskwa Lake (Trueman and Macek, 1971).

Reserves (measured plus indicated) for this western zone may be considered to extend to 122 m in depth, and consist of 252 335 tonnes containing 20 565 tonnes Cr_2O_3 or 14 070 tonnes contained Cr (in situ, undiluted). An equivalent amount may be considered as inferred tonnage, present from 122 m to 244 m below surface. However, these quantities have not been included in the summary figures listed in Table 9.

i) Mayville and Pronto claims, north of Maskwa Lake

Bateman (1943) reported the occurrence of chromite in old drill core stored on the Mayville claim (but chromite was not located in outcrop because of heavy overburden), and he quoted results supplied by G.M. Brownell from an incomplete section exposed on the Pronto claim. Four zones of chromite are present. The zones total 2.2 m in a total section of 4.95 m with an average grade of 7.51% Cr_2O_3:

20.34% Cr_2O_3	64 cm
13.20	36.5 cm
not analyzed	274.3 cm
17.22	85.3 cm
13.50	35.5 cm

The location of the claims is shown in Figure 26, and also on the aeromagnetic map of the area (Fig. 34).

The occurrence of chromite in the Bird River Sill in the Maskwa Lake area is described by Springer (1950):

"Chromite is sporadic in occurrence on the north limb of the sill, in sharp contrast to the more extensive outcrops along Oiseau [Bird] River. Only small deposits can be located, and they are always in close proximity to gabbro. In some localities the chromite-bearing peridotite is considered to have been squeezed into the gabbro at a time when the gabbro was only partly consolidated.

"The gabbro-peridotite contact is exposed at the northeast junction of the Pronto and Colossus 24 mining claims. The relations are somewhat obscure as chromiferous peridotite and gabbro alternate for a distance of more than 200 feet [61 m] south of the uniform gabbro. Both dense and disseminated chromite are present.

"A band of peridotite, 150 feet [45.7 m] long and 12 feet wide [3.65 m] that contains dense chromite and small blebs of massive chromite is located in gabbro on Colossus 22 claim. The gabbro is sheared for a few inches on either side of the band. This gives the impression that post-intrusive movement has shifted the upper part of the peridotite into the gabbro.

"Diamond drill cores from the Mayville property which are lying open to the weather and in a state of disarray show sections of peridotite that contain chromite crystals."

A wide area underlain by gabbro of the Bird River Sill (unit 8) is shown in Figure 26.

The history of the Mayville claim, which does not include any reference to the chromite, is given in Appendix 2.

The geology of the area from north of Maskwa Lake to Euclid Lake has been completed only on a reconnaissance basis. The full extent of the Bird River Sill in this complexly faulted area has yet to be determined.

j) Other Occurrences

Trueman and Macek (1971) indicate chromite occurs to the east of the National-Ledin group, in the area of the "Morning" claims (Fig. 14). This zone corresponds with an aeromagnetic anomaly (Fig. 31). Assessment work (magnetic and electromagnetic surveys) also shows this magnetic anomaly but data on thickness and grade are not available, and it is not known if the deposit has been drilled.

In the area along the fault zone between the Chrome and Page claims, slices of probable Bird River Sill material are probably present (Figs. 14, 27). Lac du Bonnet Chromium Limited held mining claims in that area. In a report on the cancelled assessment work files (File 92317) the occurrence of chromite bands over a length of at least 180 m is noted. Sufficient data for tonnage calculations are not available.

Chromite has not been reported in the area east and northeast from the Petra Chromite Mines deposit to the Euclid Lake deposit. An anomaly on aeromagnetic maps south of the eastern end of Bird Lake is attributed to pyrrhotite and magnetite (Trueman, personal communication) and sill material is not known in that area.

An outcrop of ultramafic rock occurs near the southwest end of Donner Lake, 8 km west of Cat Lake.

Chromite has been reported on the Mayville and Pronto claims, as described above, and the map by Trueman and Macek, 1971 (Fig. 26) shows the gabbroic portion of the Bird River Sill (their unit 8) outcropping over a wide area on both sides of Cat Creek. Parts of the area have been complexly faulted.

In summary, the geology of the area northwest and west from Euclid Lake to the area north of Maskwa Lake is not fully known, and further work would be required to determine the extent of chromite deposits in that area, and the relationship of the various mafic and ultramafic occurrences.

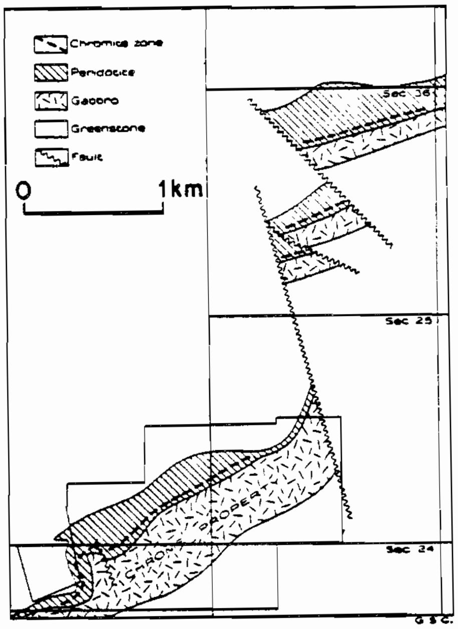


Figure 27. Plan of Chrome property and adjacent area, showing geological relationship of chromite zone to Bird River Sill (Geology modified after G. M. Brownell); from Bateman (1943).

Review of Processes for Recovery of Chromium

Bird River chromite has a low chrome-iron ratio. Available information indicates that ore from the Page property has Cr:Fe of 1.24:1 to 1.59:1; from the Chrome property, 1.13:1, and from the Euclid Lake property, 0.74:1 to 1.35:1 for ore grading between 14% and 28% Cr_2O_3, and between 0.26:1 and 0.59:1 for ore grading between 3% and 12% Cr_2O_3. Most of the processes discussed by Downes and Morgan (1951) have as their goal either improvement in the chrome-iron ratio to 3:1, or separation of Cr, which is then used to sweeten material with low Cr:Fe.

Three processes are discussed in detail by Downes and Morgan (1951), with details of tests carried out by the Mines Branch at Ottawa and by others, together with cost estimates. The processes are summarized:

1) Reduction of carbon or methane and leaching with sulphuric acid:

a) roasting of chromite concentrates at 1200°C with carbon or 1000-1100°C with methane;

b) leaching with hot 10% H_2SO_4; removes iron;

c) yields Cr:Fe of 3:1 or 10:1 or higher;

d) recovery of Cr is about 90%.

2) Oxidation to chromate and reduction of chromate with carbon:

a) roasting with soda ash to give sodium chromate;

b) reduction of sodium chromate crystals to 90% chromic oxide (Cr_2O_3);

c) recovery of Cr is about 90%.

3) Leaching in sulphuric acid under pressure:

a) leaching with H_2SO_4 at elevated temperatures and pressures;

b) Cr recovery is about 95%.

Three other processes are described briefly by Downes and Morgan (1951).

4) Leaching in sulphuric acid, and precipitation of chromium trioxide (Cr_2O_3) by evaporation.

5) Decomposition of chromite by fusion with lime, silica, and coke (Udy process). Gives product with 50 to 60% Cr_2O_3 with Cr:Fe of 20:1 in one trial; recovery variable from 30 to 77 per cent. Further work required.

6) Electrolytic chromium.

Raicevic (1976, 1977) has published reviews of various processing techniques that have been applied in investigations of the recovery of potentially useable chrome products from the Bird River chromite. In addition to the processes described above, Ontario Research Foundation has worked out methods of preparation of metallic carbides (i.e. chromium carbide), involving one-step solid-state reduction and carburization of chromite concentrates and also of high-grade chromic oxides; another process entailed the reduction of sodium chromate by carbon. More recent work has resulted in production of a"dirty" chromite concentrate that may be suitable for direct use in steel-making (H.G. Brandstatter, public communication). Also, CANMET at Ottawa has developed a process for preparation of sponge ferrochromium in which chromite is reduced in a methane-hydrogen mixture. More details on the recovery of chromium are given by Raicevic (1977) and in the references listed therein.

Mining: tonnage requirements and life expectancy

In order to determine the expected life of the known reserves, the tonnages required from the various deposits to produce a basic unit of 10 000 tonnes of contained elemental Cr have been calculated (Table 7), on the basis of 90% recovery in milling (concentration), and a further 80% recovery in processing (reduction and carburization). Requirements for annual production of 25 000 and 50 000 tonnes of contained Cr also are listed in Table 7.

The data in Table 7 can be used to calculate expected years of production. As an example, the life expectancy for the Page deposit is shown in Table 8. Various combinations of recovery rates in milling and processing have been used.

Table 7

Tonnage requirements for various grades of Cr_2O_3 (all figures in tonnes/year)

Grade % Cr_2O_3	Tonnes from Reserves	Contained Cr_2O_3	90% Recovery in Milling Tons Cr_2O_3	80% Recovery in Processing Tons Cr_2O_3	Amount of Contained Cr	Tonnes Mined*	Tonnes Concent. 40% Cr_2O_3
25.2	80 543					96 651	
18.2	111 521	20 297	18 267	14 614	10 000	133 825	45 668
7.0	289 971					347 965	
4.57	444 135					a) 488 550	
						b) 532 960	
25.2	201 357					241 627	
18.2	278 802	50 742	45 667	36 536	25 000	334 562	114 170
7.0	724 885					869 862	
4.57	1 110 328					a) 1 221 361	
						b) 1 322 393	
25.2	402 714					483 254	
18.2	557 604	101 484	91 335	73 068	50 000	669 124	228 339
						1 739 724	
7.0	1 449 771					a) 2 442 722	
4.57	2 220 650					b) 2 664 788	

*Tons mined = amount from reserves + 20% dilution (considered barren); for 4.57% Cr_2O_3: a) open pit, 10% dilution; b) mining, 20% dilution.

Table 8

Page Deposit: potential years of production

Page Deposit: Reserves: 1 583 186 tonnes @ 25.2% Cr_2O_3

Inferred: 4 025 610 tonnes @ 25.2% Cr_2O_3

Assume product of 25 000 tonnes contained Cr, annually

Milling	Processing	Tonnes from Reserves	Tonnes Mined	Year for 100% Extraction of:		Years
				Reserves	Inferred	
90%	90%	178 987	214 784	8.85	22.49	31.34
90	80	201 357	241 627	7.86	20.00	27.86
80	90	201 357	241 627	7.86	20.00	27.86
80	80	226 325	271 590	7.00	17.79	24.79
75	80	241 642	284 971	6.55	16.66	23.21

Tonnes mined per tonne of contained Cr: 8.59, 9.66, 9.66, 10.86 and 11.60 respectively.

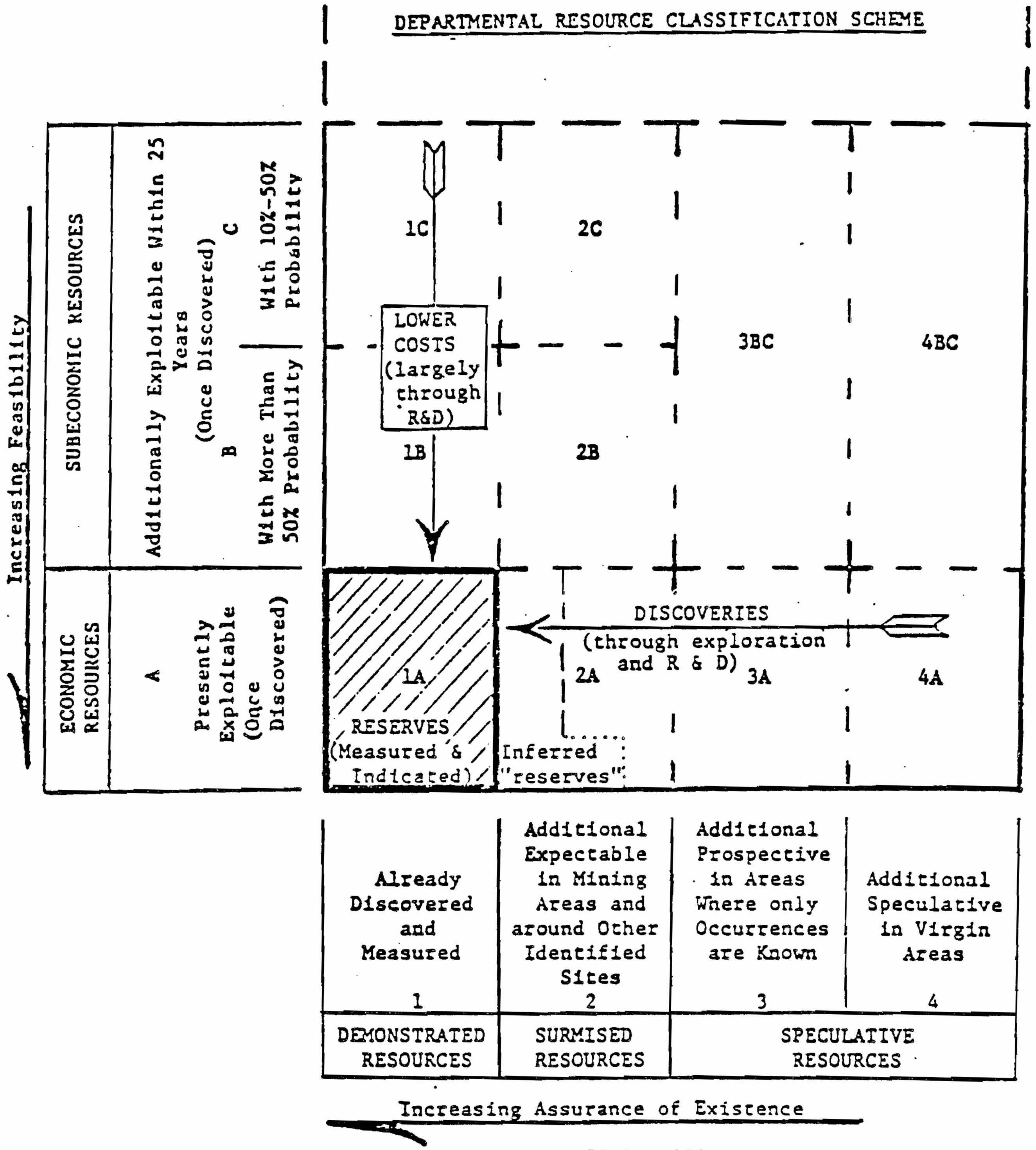
From Table 8, the mining of all the reserves from the Page deposit at a rate required to produce 25 000 tonnes contained Cr annually, would require between 6 and 9 years, and the inferred tonnage, if proven, developed and extracted, would require an additional 16 to 22 years, dependent upon milling and processing recoveries. This would entail extraction of all material over the known length of 2505 m to a depth of 305 m.

For comparison, production from estimated resources of the other chromite properties have been calculated, based on a milling recovery of 80 per cent and a processing recovery of 90 per cent, allowing 20 per cent dilution during mining. For the Page property, an estimated 9.66 tonnes of rock would be required for each tonne of Cr in the product.

For the Chrome property, over a total length of 1365.5 m, to a depth of 305 m, annual production of 25 000 tonnes contained Cr would require extraction of 278 802 tonnes per year from reserves (334,562 tonnes of rock mined, allowing 20 per cent dilution). For each tonne of contained Cr in the product, 13.38 tonnes of rock would have to be mined. Reserves of 2 074 770 tonnes would last 7.5 years, and the inferred 1 121 625 tonnes would last an additional 4 years.

The Bird Lake (Petra Chromite) deposit would require extraction of 724 885 tonnes from reserves (869 862 tonnes of rock mined, allowing 20 per cent dilution). For each tonne of contained Cr in the product; 34.8 tonnes of rock would have to be mined. Reserves of 5 830 842 tonnes would last 8 years, and inferred tonnage of 11 661 686 would last an additional 16 years. The above figures assume complete removal of material over a length of 2134 m, to a depth of 183 m. An allowance for overburden thickness or reduction in length because of faulting has not been made.

The Euclid Lake deposit would require annual extraction of 1 110 328 tonnes from reserves (1 332 393 tonnes of rock mined). For each tonne of contained Cr in the product, 53.3 tonnes of rock would have to be mined if underground mining methods were used, allowing 20 per cent dilution. If open-pit methods were used, and 10 per cent dilution allowed, the quantity mined would be reduced to 38.85 tonnes. Reserves of 9 082 800 tonnes would last 8.2 years, and the inferred 4 541 400 tonnes would last an additional 4.1 years. This assumes complete extrac-



RESERVES (measured & indicated) = 1A (i.e. demonstrated economic resources)
RESOURCES = RESERVES + all other numbered areas
RESOURCE BASE = RESOURCES + indefinite area beyond top of diagram

Note: It has been found impossible in practice to make distinctions between 3B and 3C, and between 4B and 4C.

Figure 28. Resource classification scheme, from Zwartendyk (1975).

tion over a length of 374 m, to a depth of 366 m. An allowance for reduction in length because of offsets by faulting has not been made.

The above calculations on the life expectancy of each deposit suggests that maximum recoveries in concentration and processing would be essential in prolonging the life of the reserves. Also, the importance of confirming ore reserves is demonstrated, particularly if applying the dictum of the Department of Energy and Mines and Resources in excluding inferred tonnage figures from detailed estimates. That dictum has been bent somewhat in the above calculations because of the stratiform nature of the chromite deposits, and because drilling at the Euclid property has indicated continuity to a depth of 305 m, thus providing some firmer ground for expecting a similar continuation in depth of the Page, Chrome, and Bird Lake deposits.

Tonnage and Grade Calculations for Chromite

Some qualifications are necessary in regard to tonnage and grade figures developed during this study.

1. The reserve category, as defined by Zwartendyk (1975), consists only of "known deposits of mineral-bearing rock that can be mined with existing technology and under present economic conditions."
2. Original drilling results for the Chrome, Page, Maskwa Nickel Chrome (Queen 3-Annie-Wilfred D.) and Bird Lake deposits are not available, and the present report has of necessity relied on summaries by geologists who have seen some of the earlier core and drill logs (e.g. Bateman, 1943, and Davies, 1955, 1958).
3. The terminology in reference to quantities of ore must be defined. The recommendations of Zwartendyk (1975) have been followed. These include the categories outlined in Figure 28.
   a) "Measured ("proved") ore reserves: Tonnage for which adequate sampling is available for calculating grade, size, shape and mineral content is well established. This category is sometimes referred to as "drill-indicated" ore reserves. The tonnage is calculated with an error of $\pm$ 20 per cent. The error in grade is estimated at $\pm$ 1.0 per cent Cr_2O_3 for the Page and Chrome deposits, and $\pm$ 0.5% Cr_2O_3 for the other deposits. The tonnages are calculated as being in situ. Not all the ore is expected to be recovered, because of problems of extraction related to closely spaced faults. Reductions of 18% for the Page property and 12% for the Chrome property have been applied, as recommended by Bateman (1942).
   b) "Indicated (or "probable") ore reserves: The reserves have been calculated in some places on the basis of extension of chromite bands and/or peridotite exposures, and in other cases (e.g. Petra Chromite Limited, Bloom claims) on the basis of limited drilling results. The reserves in this category are extended to the same depth as the adjacent "measured" reserves, except in the case of the Euclid deposit, where indicated reserves are extended to twice the depth of "measured" reserves on the basis of limited results.
   c) Total ore reserves (measured and indicated): Are the sum of a) and b) and do not include the inferred reserves, discussed below. Zwartendyk (1975, p. 20) states: "the inclusion of 'inferred' reserves in total reserve figures is not acceptable."

TABLE 9: SUMMARY OF CHROMITE RESOURCES, BIRD RIVER SILL

Data, sufficient for meaningful tonnage calculations, are available from only four deposits. Figures are in metric tons or tonnes.

I. Calculated reserves (measured and indicated)

Deposit	1. Page	2. Chrome	3. Bird Lake	4. Euclid
A) Measured:				
Length	762 m	640 m	1 646 m	373.4 m
Depth	0 - 99 m	0 - 198 m	0 - 61 m	0 - 122 m
Width	1.86 m	2.59 m	13.72 m	30.844 m
Cubic m, in situ	140 315	328 205	1 377 570	1 405 090
Deduct for faulting	18%	12%	-?	-?
Cubic m	115 060	288 820	1 377 570	1 405 090
Cubic m/tonne	0.2907	0.2969	0.3063	0.3094
S.G.	3.44	3.368	3.265	3.23
Metric tonnage	395 797	972 786	4 497 453	4 541 400
Grade % Cr_2O_3	25.2	18.2	7.0	4.57
Tonnes Cr_2O_3	99 741	177 047	314 822	207 542
Tonnes Cr	68 248	121 145	215 417	142 010
B) Indicated:				
Length	2 286 m	725 m	488 m	373.4 m
Depth	0 - 99 m	0- 198 m	61 m	122 m (122 to 244 m)
Width	1.86 m	2.59 m	13.72 m	30.844 m
Cubic m, in situ	420 944	371 795	408 417	1 405 090
Deduct for faulting	18%	12%	-?	-?
Cubic m	345 174	327 179	408 417	1 405 090
Cubic m/tonne	0.2907	0.2969	0.3063	0.3094
Metric tonnage	1 187 389	1 101 984	1 333 389	4 541 400
Grade % Cr_2O_3	25.2	18.2	7	4.57
Tonnes Cr_2O_3	299 222	200 561	93 337	207 542
Tonnes Cr	204 742	137 234	63 866	142 010
Total Reserves (measured and indicated)				
Metric tonnage	1 583 186	2 074 770	5 830 842	9 082 800
Grade % Cr_2O_3	25.2	18.2	7	4.57
Tonnes Cr_2O_3	398 963	377 608	408 159	415 084
Tonnes Cr	272 990	258 379	279 283	284 020

II. Additional inferred tonnage

Length	a) 3 048 m b) 457 m	1 365.5 m	2 134 m	373.4 m
Depth	a) 206 m (99 to 305 m) b) 0 -305 m	107 m (198 to 305 m)	122 m (61 to 183 m)	122 m (244 to 366 m)
Width	a) 1.86 m b) 1.86 m	2.59 m	13.72 m	30.844 m
Cubic m, in situ	a) 167 787 b) 259 256	378 421	3 571 975	1 405 090
Deduct for faulting	18%	12%	-?	-?
Cubic m	a) 957 655 b) 212 590	333 010	3 571 975	1 405 090
Cubic m/tonne	0.2907	0.2969	0.3063	0.3094
Metric tonnage (inferred)	4 025 610	1 121 625	11 661 686	4 541 400
Grade % Cr_2O_3	25.2	18.2	7	4.57
Tons Cr_2O_3	1 014 450	204 136	816 318	207 542
Tons Cr	694 140	139 680	558 566	142 010

NOTE: Figures in brackets refer to actual depth of slice for which tonnage is calculated.

d) <u>Inferred (or "possible" ore "reserves")</u>: "Ore tonnage for which quantitative estimates are based largely on broad knowledge of the geological character of the deposit, and for which there are few, if any, samples or measurements." The estimate should include a statement of the specific limits within which the inferred material may be.

For the chromite in the Bird River Sill, the inferred "reserves" are based generally on extrapolation to depth of 183 m (Petra Chromite); 305 m (Page and Chrome properties) and 366 m (Euclid Lake), as well as a 457 m lateral extension of the Page deposit, based on geological and geophysical evidence, but no analyses. Bateman (1942) noted that "the depth of some of the deposits is likely to be measured in thousands of feet." Brownell (1942) noted that "Drilling soon gave evidence that the ore was not continuous in a downward direction, but apparently was offset by flat longitudinal faults." For purposes of this report, extrapolations to depth have been made only to limits related to exploration drilling; those limits are specified in Table 9, in which a summary of tonnage and grade estimates are listed.

In calculating the life of the ore reserves, figures have been determined separately for total ore reserves (measured and indicated) and for the "inferred reserves". The latter figure is included only to supply a potential maximum figure based on interpretation of known data, and to point out that more drilling data, particularly from the deeper parts of the deposits, would be required to confirm longer term reserves.

Zwartendyk (1975, p. 20) advises that "Gross monetary values should be avoided, that is to say, the dollar value of mineral commodities in marketable form should not be applied to tonnages of those commodities in the ground." This implies that exploration, development, mining and milling costs, including capital costs, should be determined up to the stage where the chromite concentrate is available, so that the price of this concentrate as a source of chrome for the final product can be compared with presently available or competitive sources of chrome.

A detailed feasibility study would be necessary to determine all the various costs involved, and would be useful in determining the true value of the chromite deposits in the Bird River Sill.

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Appendix 1: Aeromagnetic maps of the area of the Bird River Sill

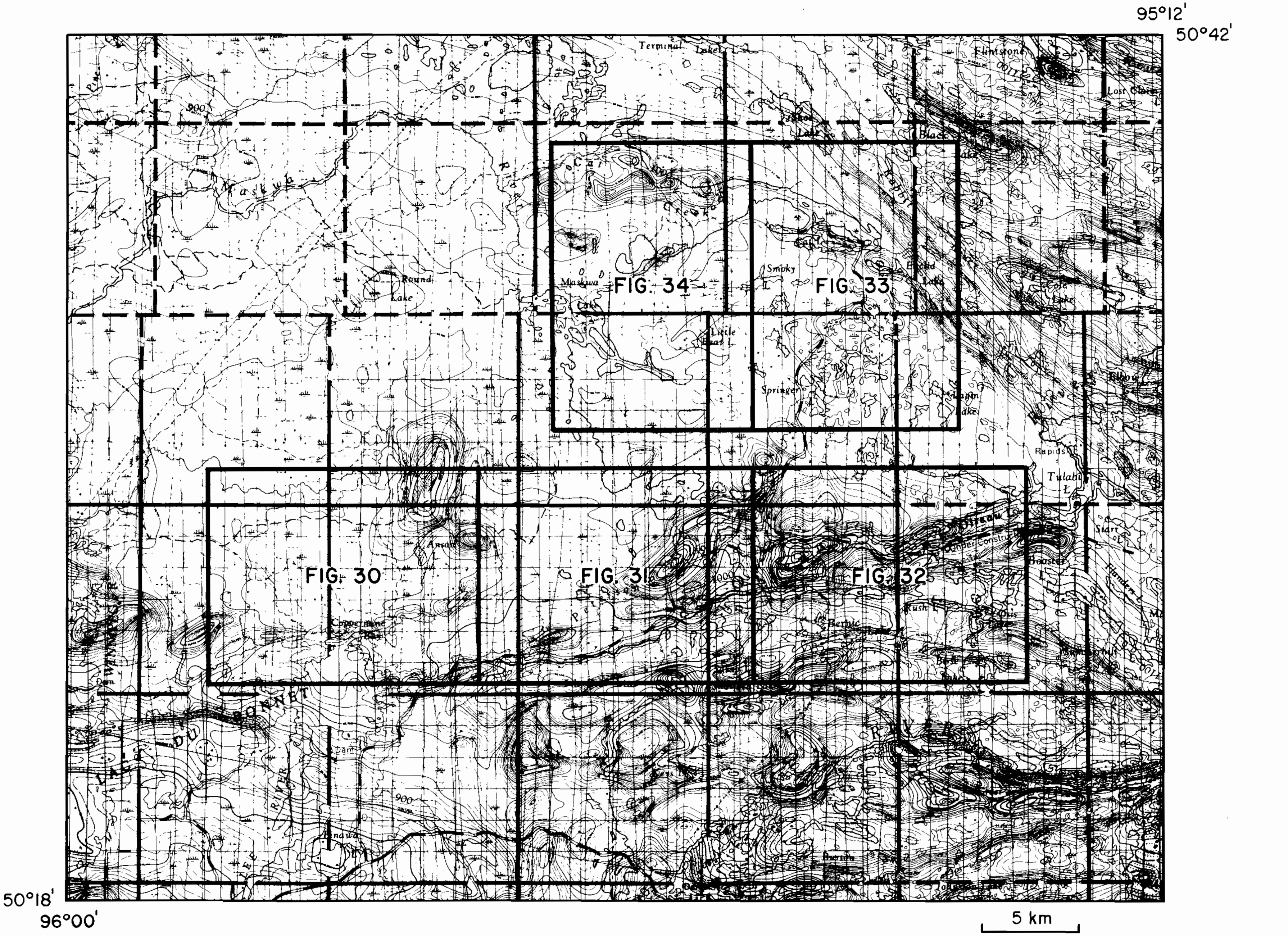

Figure 29. Aeromagnetic map of the Bird River Sill area, indicating location of Figures 30 to 34 from Geological Survey of Canada Map 7124G.

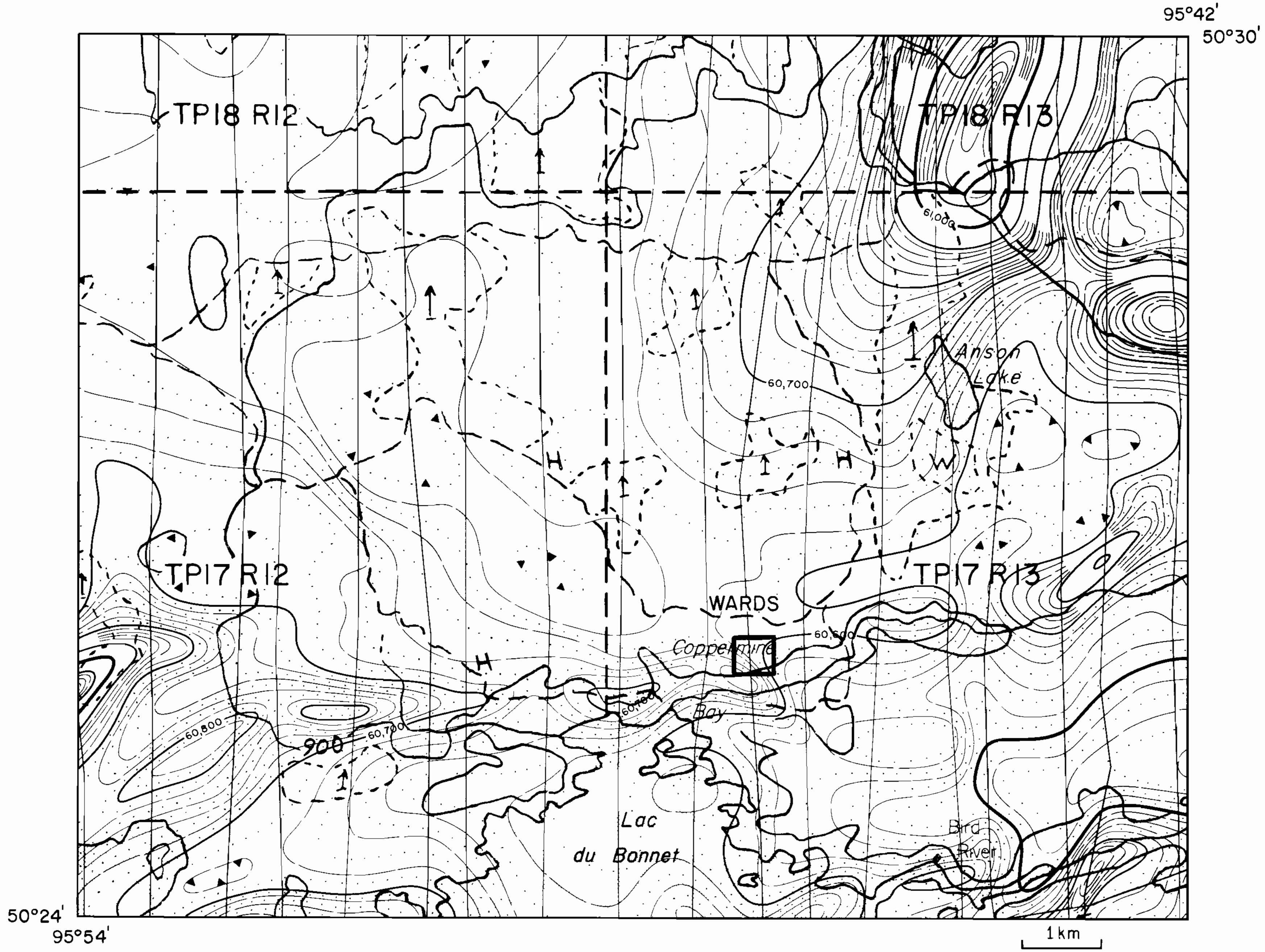

Figure 30. Aeromagnetic map: Wards claim; from Geological Survey of Canada Map 4070G.

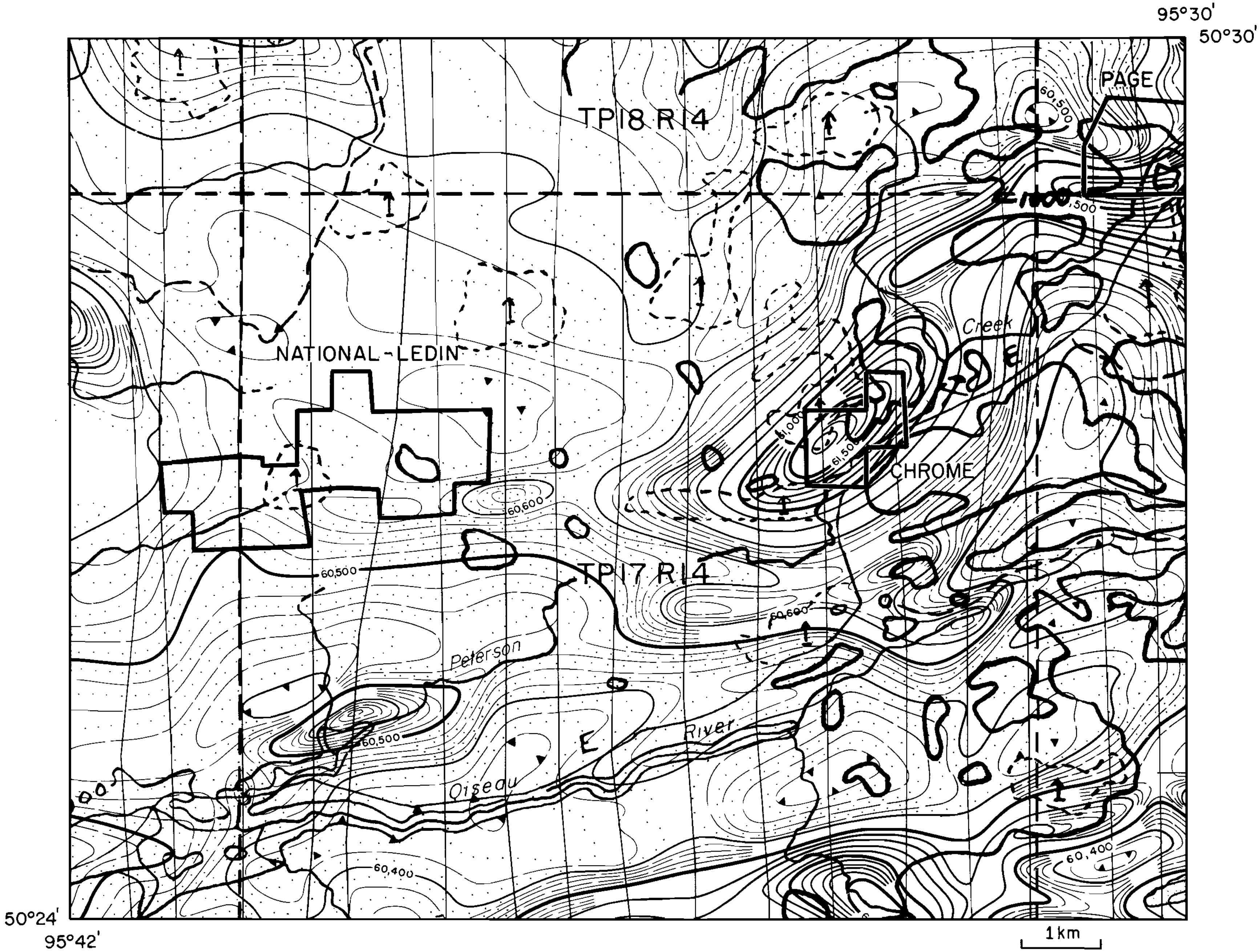

Figure 31: Aeromagnetic map: National-Ledin, Chrome and Page Claims: from Geological Survey of Canada Map 4070G.

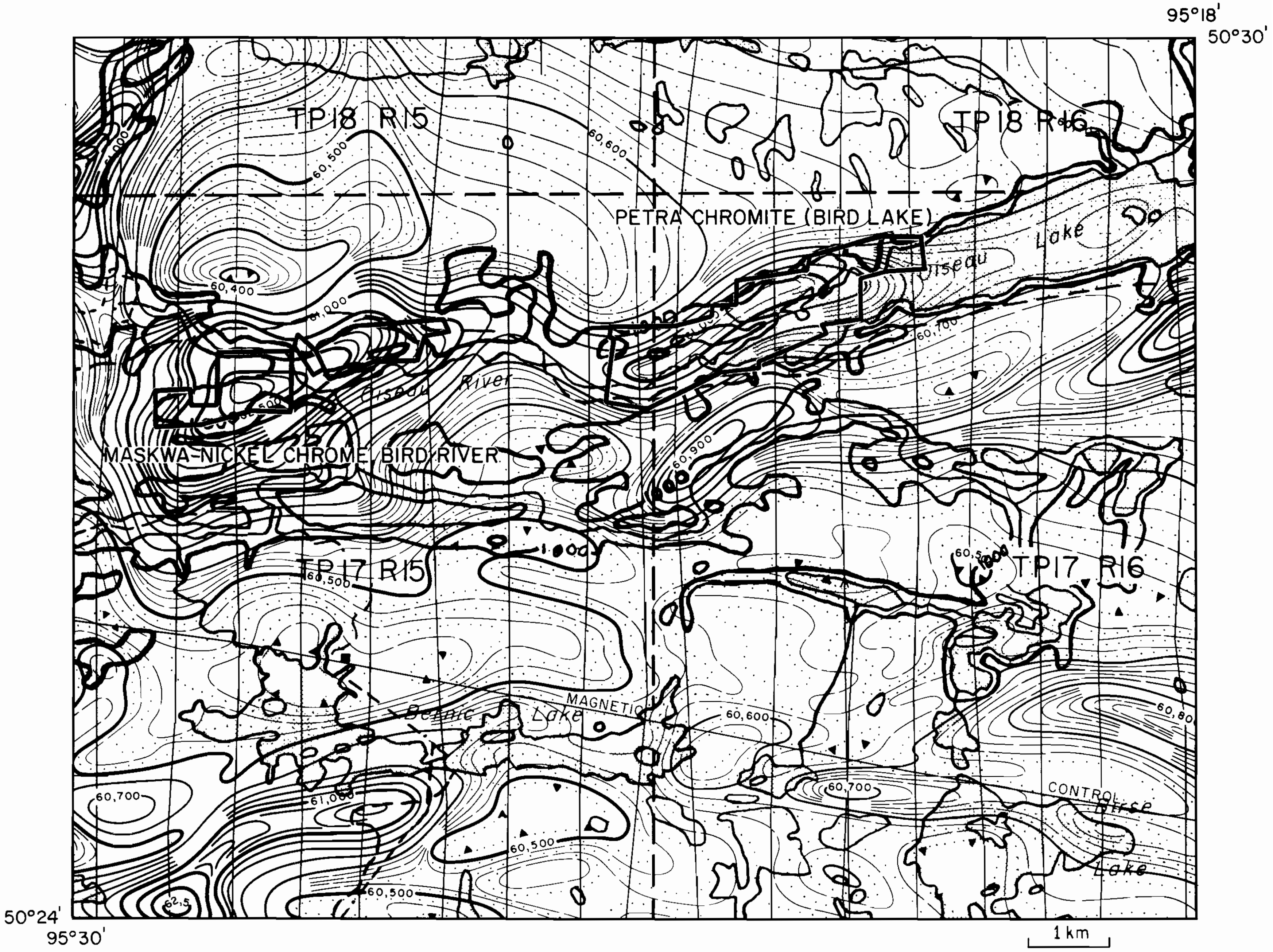

Figure 32. Aeromagnetic map: Bird River-Bird Lake Area; from Geological Survey of Canada Map 1194G.

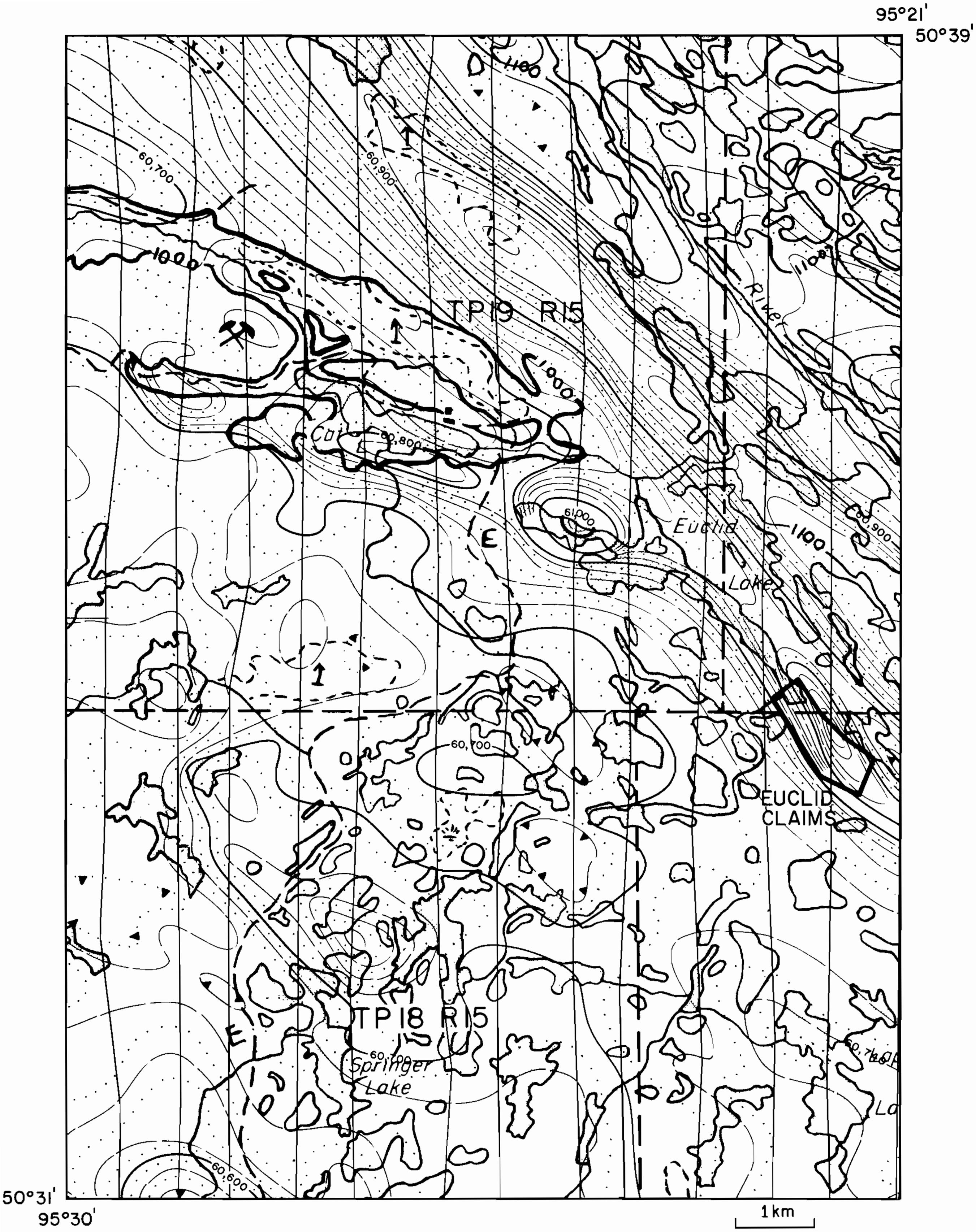

Figure 33. Aeromagnetic map: Euclid claims; from Geological Survey of Canada Map 4047G.

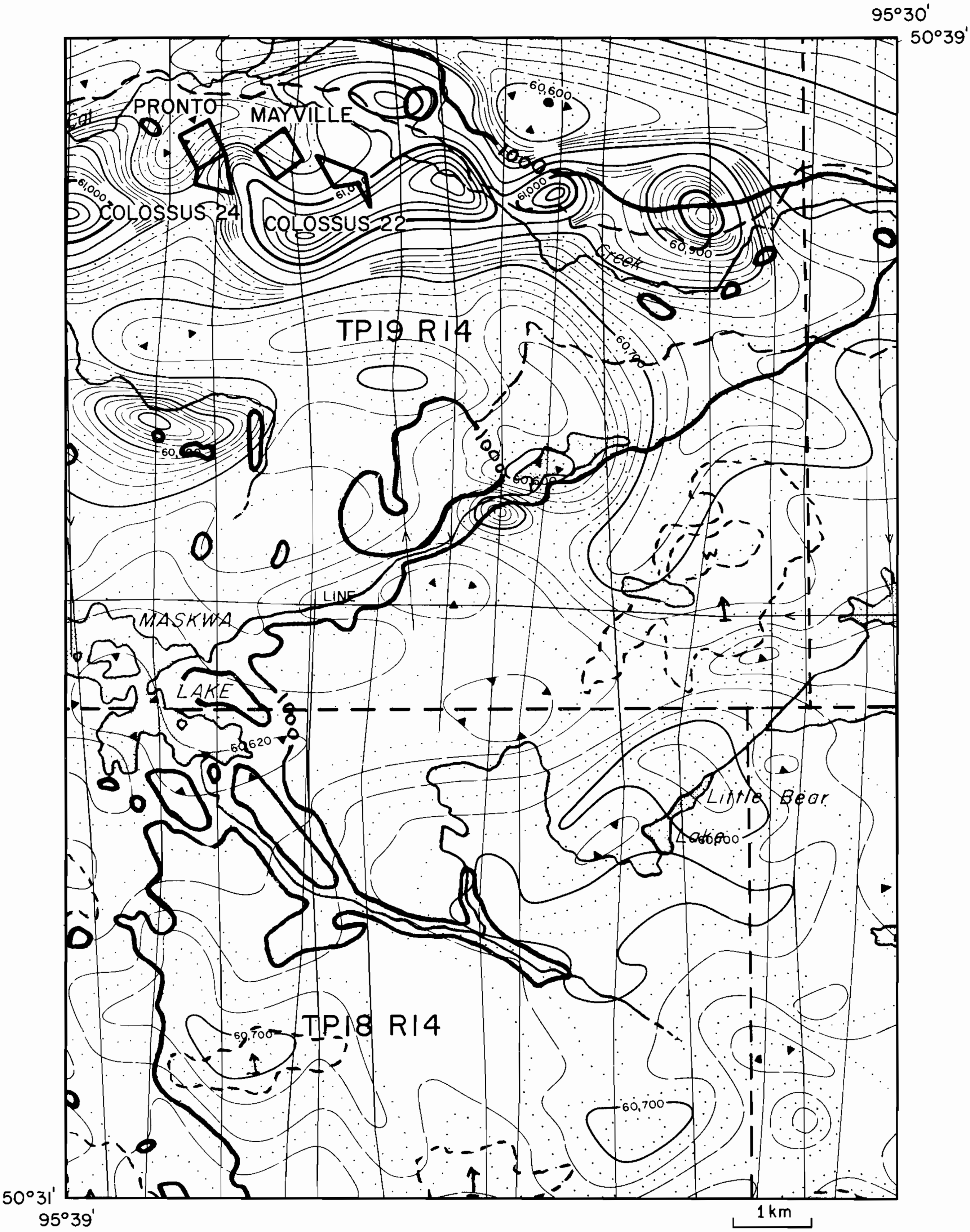

Figure 34. Aeromagnetic map: Mayville and Pronto claims; from Geological Survey of Canada Map 4071G.

PRODUCT CHROMITE | PROVINCE OR TERRITORY MANITOBA 156 | N.T.S. AREA 52L/5 | REF. Cr 2

NAME OF PROPERTY Page Group (Page No. 1)

OBJECT LOCATED Center of Page No. 1 M.C.

UNCERTAINTY IN METERS 100 m. Lat. 50° 29.12' Long. 95° 30.81'

Mining Division District Winnipeg

County Township or Parish

Lot Concession or Range

Sec 6 Tp. 18 R. 15 EPM

OWNER OR OPERATOR AND ADDRESS

1973 - Manitoba Chromium Limited
c/o Hudson Bay Expl. & Dev. Co. Ltd.
Flin Flon, Man.

DESCRIPTION OF DEPOSIT

The deposit is situated within a serpentinized peridotite near the center of the Precambrian Bird River Sill which intruded into the metavolcanic part of the Rice Lake Series. Chromite and chromite-bearing peridotite occur as layers in a 2,500-foot main band with an average width of 6.1 feet, and which strikes westerly and dips 60-85° S. The sharply defined black, fine-grained, massive layers range from 1/2" to 18" thick. The chromite band has been proven to a depth of 650 feet. Forty feet north of the main band is a narrow parallel layer of chromite having an average width of 2.4 feet.

Associated minerals or products of value

HISTORY OF EXPLORATION AND DEVELOPMENT

The deposit is a few hundred feet northwest of Peterson Creek, a tributary of Oiseau (Bird) River, and about 1½ miles northeast of the junction of Provincial Roads 314 and 315.

In 1937 R. W. Sweezey staked the property as Page No. 1 (W8692), area 62.51 acres, and a year later assigned it to George H. Page. In 1942 J. D. Bateman discovered chromite in two bands (see Fig. 1) on an adjacent claim, Page No. 2 (W8693). The main south band was sampled over its exposed length. Six chip samples, each consisting of more than 200 chips, returned 26.05% chromic oxide. The Cr:Fe ratio is 1.2:1. Four channel samples across a typical section returned an average of 25.46% chromic oxide over a width of 7.4 feet, including approximately 1 foot of rocky material. The chrome-iron ratio of this sample is 1.3:1. The narrow chromite band lying to the north of the main band has a higher chromic oxide content.

Hudson Bay Exploration and Development Co. Ltd. took an option on the property in late 1942, and diamond drilling was done. At least 28 drill holes were put down on Page (W8691) and Page No. 1 to a depth of 250 feet, and these indicated that the chromite zone is substantially the same at depth as at surface. A half-ton sample had been sent to the Bureau of Mines, Ottawa for concentration tests in 1942 and a 100-ton sample was sent in 1943. Metallurgical tests were also run by the Hudson Bay Mining and Smelting Company, At Flin Flon.

Partial Analyses of Dense Chromite Ore

	Cr_2O_3	SiO_2	Al_2O_3	FeO*	MgO	CaO	P_2O_5	S	Pt
(1)	26.3	13.1	18.7	18.4	5.2	1.1	0.1	tr.	tr.
(2)	29.3	9.4	19.4	19.5	4.3	0.7	0.1	--	--

*Determined as iron and calculated as FeO.

(1) Average of several partial analyses of Page ore; constituents reported by Hudson Bay Mining & Smelting Co.
(2) Reported by Hudson Bay Mining & Smelting Co. from Page ore.

Mineral Resources Branch, Department of Energy, Mines and Resources, Ottawa.

(cont'd - 2)

NAME OF PROPERTY Page Group (cont'd - 3)

HISTORY OF EXPLORATION AND DEVELOPMENT

In addition to the constituents reported, the ore contains small amounts of MnO, TiO_2, and NiO, ranging from 0.1 to 0.5 per cent; H_2O, although not reported, is probably appreciable.

Analyses of Cleaned Chromite and Concentrates

	Cr_2O_3	SiO_2	Al_2O_4	FeO*	MgO	CaO	MnO	P_2O_5	S	Total
1)	40.9	4.2	13.8	27.5	9.2	0.28	-	0.08	-	95.96
2)	40.0	2.9	12.7	27.0	6.9	3.4	0.2	0.07	tr.	93.17
3)	41.6	2.72	21.74	24.53	9.35	0.39	-	-	-	100.33

*Iron calculated as FeO.

(1, 2) Table concentrates of Page ore, reported by Hudson Bay Mining & Smelting Co.

(3) Table concentrate of Page ore, reported by Bureau of Mines, Ottawa.

Results of Concentration Tests

Ore		Concentrate	
% Cr_2O_3	Cr:Fe	% Cr_2O_3	Cr:fe
26.8	1.48:1	42.4	1.48:1
26.4	1.42:1	41.6	1.49:1

In 1943 J. D. Bateman estimated the reserves on the Page claims, not including the additional information from diamond drilling.

(cont'd - 3)

HISTORY OF EXPLORATION AND DEVELOPMENT

Ore Reserves, Page Property

Length exposed (feet)	2,500
Average width of main band (feet)	6.6
Average dip	68.6°
True thickness (feet)	6.1
Area (square feet)	15,250
Number of cubic feet per ton	9.3
Tons per vertical foot of depth	1,640
Tons of ore per vertical foot after adjustment for faults*	1,345
Average chromic oxide content	25.2%
Tons of chromic oxide per vertical foot	340

* Owing to the gaps in the main band resulting from faulting, the calculated tons per vertical foot are reduced by 18 per cent in the case of the Page deposit.

The property was assigned to Manitoba Chromium Limited, a subsidiary of Hudson Bay Mining and Smelting Co., Limited in 1944. A year later a 21-year lease M-1601 was issued to Manitoba Chromium Limited.

In 1951 J.F. Davies visited the property and described its geology in Man. Mines Br. Publ. 51-3. In 1958 Davies revised Bateman's figures on ore reserves because of drill hole data.

Manitoba Chromium Limited (Page claims)

Exposed length	2,500 feet
Average thickness	6.1 feet
Indicated tonnage to 650 foot depth	874,250 tons
Grade	25.2% Cr_2O_3
(Probable length	11,500 feet
(Possible reserves to 650 foot depth	4,200,000 tons)

In 1954 five drill holes and a horizontal loop geophysical survey was made on the Page Group. The lease

(cont'd - 4)

HISTORY OF PRODUCTION

HISTORY OF EXPLORATION AND DEVELOPMENT

was renewed in 1966 for an additional 21-year period. In 1967 Manitoba Chromium Limited completed an exploration program which consisted of approximately of 3,000 feet of diamond drilling, in six holes, and a recheck of electromagnetic surveys previously carried out on the property. In 1968 the Province imposed a Special Lien on the property under "The Mineral Exploration Assistance Act" under which the above work was completed.

In 1970 D. L. Trueman mapped the Geology of the Chrome (see Cr 1) and Page properties in his Preliminary Map 1970A-1. A final map and report are in preparation.

MAP REFERENCES

*Map 52L/5, East, Pointe du Bois (Topo.), Sc. 1:50,000.
Map 4070G, Pointe du Bois (Aeromag.), Sc. 1" = 1 mile.
Map 51-3, Bird River Area (Geol.), Sc. 1" = ½ mile - Accomp. rept. by Davies (1952).
Preliminary Map 1970A-1, Geology of the Chrome and Page Properties: Bird River Sill (Geol.), Sc. 1" = ¼ mile - D.L. Trueman, Manitoba Mines Branch.
Map (Unpublished), Page No. 1 W8692, Lot 1773, Group 124, Plan 4982, (Survey, 1944), Sc. 1" = 200 ft.

REMARKS

The deposits on the Page and Chromite (see Cr 1) Groups are the same, but two or more faults have displaced the Page segment more than a mile northward. Small accommodated faults also occur on the Page Group. The principal direction of displacement is progressively southward toward the east.

Comp. Re. by JP
Date Sept 73

REFERENCES

Bateman, J.D.; Field Report on Chromite North of Oiseau River, Manitoba; 8 p., Unpublished report in Non-confidential Assessment Files, Manitoba Mines Branch, 1942.

Bateman, J.D.; Bird River Chromite Deposits, Manitoba; Trans. CIM, vol. 46, pp. 154-183, 1943.

Bateman, J.D.; Composition of Bird River Chromite, Manitoba; Am. Min., vol. 30, pp. 596-600, 1945.

Davies, J.F.; Geology of the Oiseau (Bird) River Area; Publ. 51-3, pp. 19-22; Manitoba Mines Branch, 1952.

Davies, J.F.; Chromite Deposits of Southeastern Manitoba; Can. Mining Journal, April, pp. 112-114, 1958.

Investigations in Ore Dressing and Metallurgy; Investigation No. 1492; Bureau of Mines, Ottawa, 1943.

Page No. 1; W8692; NE5, 52L in Non-confidential Assessment Files, Manitoba Mines Branch.

Page No. 1; File No. 24299 in Mining Recording Files, Manitoba Mines Branch.

PRODUCT CHROMITE

PROVINCE OR TERRITORY MANITOBA 155

N.T.S. AREA 52L/5 NE

REF. Cr 1

NAME OF PROPERTY Chrome Group (Chrome No. 5)

OBJECT LOCATED Center of Chrome No. 5 M.C.

UNCERTAINTY IN METERS 500 m. Lat. 50° 27.38' Long. 95° 33.58'

Mining Division — District Winnipeg

County — Township or Parish

Lot — Concession or Range

Sec 26 Tp. 17 R. 14 EPM

OWNER OR OPERATOR AND ADDRESS

O.H.G. Zeemel
42 - Willowmeade Crescent
Winnipeg, Manitoba

DESCRIPTION OF DEPOSIT

The deposit is situated within a serpentinized peridotite near the center of the Precambrian Bird River Sill which intruded into the metavolcanic part of the Rice Lake Series. Chromite and chromite-bearing peridotite occur as layers in a 2,100-foot main band with an average width of 8.7 feet, and which strikes northeasterly and dips steeply north and south. The sharply defined black-grained, massive layers range from 1/2" to 18" thick. The chromite band has been proven to a depth of 650 feet. Forty feet north of the main band is a narrow parallel layer of chromite having an average width of 2.3 feet.

Associated minerals or products of value

HISTORY OF EXPLORATION AND DEVELOPMENT

The deposit is 1/4 mile northwest of Peterson Creek, a tributary of the Oiseau (Bird) River, and about 2 miles southwest of the junction of Provincial Roads 314 and 315.

In 1937 the deposit was staked as parts of Daniel-B No. 1 (W8240) and Daniel-B No. 8 (W8247) by Paul Lyce. He probably staked the ground in the search of sulphides with copper-nickel mineralization, and the claims were cancelled in 1939.

G.M. Brownell staked the Chrome claims in 1942 after choosing the most likely prospecting area on a geological map. The main band of chromite-bearing rock outcrops on Chrome No. 5 (W10640), area 52.39 acres, as well as on other Chrome claims along its northeast strike. Brownell blasted 13 samples across the main band in 3 sections each 20 feet apart.

No. of samples	With sampled (ft.)	% Cr_2O_3
5	8.3	18.29
4	7.8	16.23
4	7.0	21.05
Average	7.7	18.51

Also, in 1942 J. D. Bateman sampled the main band over its exposed length. Five chip samples, each of more than 200 chips, returned 26.17% chromic oxide. The Cr:Fe ratio is 1.2:1. A half-ton sample was sent to the Bureau of Mines, Ottawa for concentration tests and during the fall and winter of 1942 the Chrome Group was drilled.

In 1943 the property was assigned to Humphrey R. Drummond-Hay and Fred Larn of God's Lake Gold Mines Limited. A 100-ton sample of chromite ore was shipped to the Bureau of Mines for testing on a commercial scale, and metallurgical tests of the ore were run by Gods Lake-Gunnar Chrome Project, at Ottawa.

Analysis of Cleaned Chromite and Concentrates

Cr_2O_3	SiO_2	Al_2O_3	FeO*	MgO	CaO	MnO	TiO_2	NiO	Total
42.5	1.37	15.7	31.2	6.65	0.66	0.65	0.72	0.10	99.55

* Iron calculated as FeO.

(cont'd - 2)

NAME OF PROPERTY Chrome Group (cont'd - 3)

HISTORY OF EXPLORATION AND DEVELOPMENT

Results of Concentration Tests

Ore		Concentrate	
% Cr_2O_3	Cr:Fe	% Cr_2O_3	Cr:Fe
20.6	1.13:1	35.8	1.24:1

J. D. Bateman estimated the reserves on the Chrome claims in 1943. His figures do not include the information from diamond drilling.

Ore Reserves - Chrome Property

	Chrome
Length exposed (feet)	2,100
Average width of main band (feet)	8.7
Average dip	79.4°
True thickness (feet)	8.5
Area (square feet)	17,850
Number of cubic feet per ton	9.5
Tons per vertical foot of depth	1,880
Tons of ore per vertical foot after adjustment for faults*	1,655
Average chromic oxide content	18.2%
Tons of chromic oxide per vertical foot	300

*Owing to the gaps in the main band resulting from faulting, the calculated tons per vertical foot are reduced by 12 per cent in the case of the Chrome deposit to determine the net tons of ore per vertical foot.

The property, Chrome No. 5, was leased for 21 years, M-2058, by Drummond-Hay and Larn in 1948. In 1951 J. F. Davies visited the Chrome Group and described the geology in Man. Mines Br. Publ. 51-3. The property was assigned to Thomas P. O'Connor in 1952, and to Strannar Mines Limited in 1958. The latter was a joint subsidiary of Gunnar Mines Limited and Strategic Materials Corporation.

(cont'd - 3)

HISTORY OF EXPLORATION AND DEVELOPMENT

In 1958 J. F. Davies revised Bateman's figures on ore reserves. This was done because of additional drill hole data.

Gunnar Mines Limited

(a) Chrome claims

Exposed length	2,100 feet
Average thickness	8.5 feet
Indicated tonnage to 650 foot depth	1,220,000 tons
Grade	18.2 % Cr_2O_3
(Probable length	4,400 feet)
(Possible reserves to 650 foot depth	2,560,000 tons)

The property was assigned to A. O. Zeemel in 1965 and the lease renewed for an additional 21-year period in 1969.

In 1970 D. L. Trueman mapped the Geology of the Chrome and Page (see Cr 2) Properties, Preliminary Map 1970A-1. A final map and report are in preparation.

EAL No. 25

HISTORY OF PRODUCTION

MAP REFERENCES

*Map 52L/5, East, Pointe du Bois (Topo.), Sc. 1:50,000.
Map 4070G, Pointe du Bois (Aeromag.), Sc. 1" = 1 mile.
Map 51-3, Bird River area (Geol.), Sc. 1" = ½ mile - Accomp. rept. by Davies (1952).
Preliminary Map 1970A-1, Geology of the Chrome and Page Properties: Bird River Sill (Geol.), Sc. 1" = ¼ mile, D.L. Trueman, Man. Mines Branch.
Map (Unpublished), Chrome No. 5, W10640, Lot 1740, Group 124, Plan 4877, (Survey, 1943), Sc. 1" = 200 ft.

#Claim Map Series NE5, 52L, Sc. 1:31 680, Circa 1973, Mining Recording, Man. Mines Br.

REMARKS

The deposits on the Chromite and Page (see Cr 2) Groups are the same, but two or more faults have displaced the Page segment more than a mile northward. Small accommodated faults also occur on the Chrome Group. The principal direction of displacement is progressively northward toward the east.

Comp./Rev. By	JB					
Date	Sept/73					

REFERENCES

Bateman, J.D.; Field Report on Chromite North of Oiseau River, Manitoba; 8 p.; Unpublished report in Non-confidential Assessment Files, Manitoba Mines Branch, 1942.

\+ Bateman, J.D.; Bird River Chromite Deposits, Manitoba; Trans. CIM, vol. 46, pp. 154-183, 1943.

Bateman, J.D.; Composition of the Bird River Chromite, Manitoba; Am. Min., vol. 30, pp. 596-600, 1945.

Chrome No. 5; File No. 27485 in Mining Recording Files, Manitoba Mines Branch.

Davies, J.F.; Geology of the Oiseau (Bird) River Area; Publ. 51-3, pp. 19-22; Manitoba Mines Branch, 1952.

++ Davies, J.F.; Chromite Deposits of Southeastern Manitoba; Can. Mining Journal, April, pp. 112-114, 1958.

Investigations in Ore Dressing and Metallurgy; Investigation No. 1492; Bureau of Mines, Ottawa, 1943.

PRODUCT CHROMITE | PROVINCE OR TERRITORY MANITOBA /86 | N.T.S. AREA 52L/6 NW | REF. CR 1

NAME OF PROPERTY Bird Lake Chrome (Fisher M.C.)

OBJECT LOCATED Centre of Fisher M.C.

UNCERTAINTY IN METERS 500 m Lat. 50° 28.04' Long. 95° 23.00'

Mining Division District Winnipeg

County Township or Parish

Lot Concession or Range

Sec 30 Tp. 17 R. 16 EPM

OWNER OR OPERATOR AND ADDRESS

1973 - Petra Chromite Limited
c/o James Richardson & Sons Limited
1 Lombard Place
Winnipeg, Manitoba
R3B 0X2

DESCRIPTION OF DEPOSIT

The deposits are situated within the Precambrian Bird River Sill which intruded between the metavolcanics and metasediments of the Rice Lake Group. Both deposits are in peridotite. "On the north side of the outcrops south of a wide swamp ..* for a length of a few hundred feet" (Davies, 1955).

"The chromite occurs below the top of the peridotite ... in more or less regularly spaced bands across the entire width of the deposit. Ten or more such bands, up to two feet wide, and grading up to 25 per cent chromic oxide occur within the chromite zone" (Davies, 1955).

*"pyrrhotite, chalcopyrite and pyrite are sparingly disseminated"

Associated minerals or products of value

Copper, Nickel

HISTORY OF EXPLORATION AND DEVELOPMENT

The mineralization occurring a few hundred feet to the west of the northwest bay of Oiseau (Bird) Lake consists of two adjacent deposits that have been investigated at different times. These deposits are about a 1/4 mile north of Provincial Road No. 314.

In 1921 Joseph Drawson staked the Fisher M.C. (30310) over the deposits and assigned 1/2 interest to Peter Osis. The claim was cancelled in 1922 and a year later restaked as Fisher M.C. (31782) by Michael Osis. During this time four prospect pits from 2 to 15 feet deep were sunk on copper and nickel-bearing "rotten schistose peridotite" on the north part of the claim. After the death of Mr. Osis, the property was almost brought to a lease, but in 1939 it was cancelled and immediately restaked as Fisher M.C. (W9167) by Peter Osis.

Central Manitoba Mines, Limited optioned the property in 1942 and using a magnetometer survey and diamond drilling located, on the south part of the claim, large tonnage of low-grade chromite which does not outcrop (See Fig. 1). Bateman (1943) estimated "The indicated reserves, after allowing for faulting, are 7,000 tons of ore averaging 18.9 per cent chromic oxide per vertical foot of depth". In 1944 the property was assigned to John Drybrough and after a 21-year lease, M-1638 was issued to him in 1945, he assigned it to Petra Chromite Limited.

Davies (1955) stated that "the entire chromite-bearing section is over 7,000 feet long and averages about 45 feet wide" ... on this basis it is estimated that there are close to three millions tons of material, grading about seven per cent Cr_2O_3, to a depth of 200 feet."

In 1966 the Lease, M1638, was renewed for an additional 21-year period.

Mineral Resources Branch, Department of Energy, Mines and Resources, Ottawa.

MAP REFERENCES (cont'd. 2)

*Map 52L/6, West, Ryerson Lake (Topo.), Sc. 1:50,000, Mines & Tech. Surveys, Can.

Map 1194G, Ryerson Lake (Aeromag.), Sc. 1"=1 mile, Man. Mines Br. & Geol. Surv. Can.

Map 49-7, Cat Lake-Winnipeg River Area (Geol.), Sc. 1"=1 mile - Accomp. rept. by Springer (1950), Man. Mines Br.

Map 54-1, Bird Lake Area (Geol), Sc. 1"=1,000 feet - Accomp. rept. by Davies (1955), Man. Mines Br.

Preliminary Map 1972 F-1, Geological Compilation Map of the Bird River Area (Geol.), Sc. 1"=1/2 mile - D.L. Trueman, Man. Mines Br.

#Claim Map Series NW6, 52L, Sc. 1"=1/2 mile, circa 1974, Mining Recording, Man. Mines Br.

Map (unpublished), Fisher M.C., 31782, Lot 1505, Group 124, Plan 3793 (Survey 1938), Sc. 1"=200'.

Map (unpublished), Fisher M.C., W9167, Lot 1826, Group 124, Plan 5054 (Survey 1945), Sc. 1"=200'.

Comp./Rev. By		JB					
Date	Dec. 70	Dec.73					

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REFERENCES

Bateman, J.D.; Bird River Chromite Deposits, Manitoba; Trans, vol. 46, pp. 154-183; C.I.M., 1943.

+ Davies, J.F.; Geology and Mineral Deposits of the Bird Lake Area; Publ. 54-1, pp. 37-38; Man. Mines Br., 1955.

Davies, J.F.; Chromite Deposits of Southern Manitoba; vol. 79, No. 4, pp. 112-114; Can. Mining Jour., 1958.

++ Davies, J.F.; Bannatyne, B.B.; Barry, G.S.; and McCabe, H.R.; Geology and Mineral Resources of Manitoba; pp. 38-40; Man. Mines Br., 1962.

Fisher M.C.; File No. 1805 in Mining Recording Files, Man. Mines Br

Mineral Resources Branch, Ottawa; Resource file: 167-C1-2-2.

Springer, G.D.; Cat Lake-Winnipeg River Area; Pub. 49-7, pp. 6; Man. Mines Br., 1950.

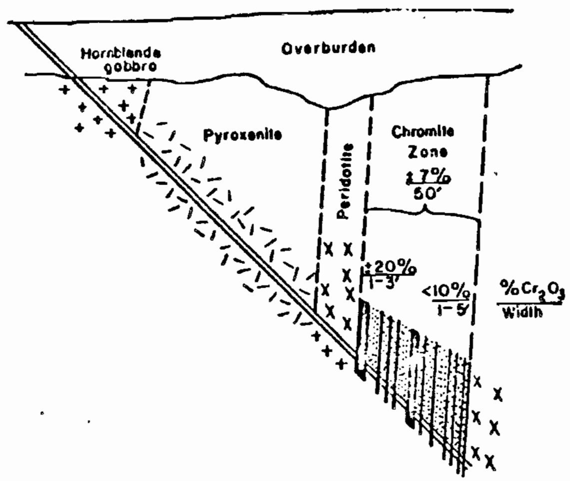

Fig. 1 Typical Drill hole intersection. BIRD LAKE Deposit
(Davies et al., 1962)

PRODUCT COPPER | PROVINCE OR TERRITORY MANITOBA 163 | N.T.S. AREA 52L/5 NE | REF. Cu 6

NAME OF PROPERTY National Group (Morning No. 3)

OBJECT LOCATED Centre of Morning No. 3 M.C.

UNCERTAINTY IN METRES 500 m Lat. $50^{0}27.15'$ Long. $95^{0}37.45'$

Mining Division District Winnipeg

County Township or Parish

Lot Concession or Range

L.S. 13 Sec 21 Tp. 17 R. 14 EPM

OWNER OR OPERATOR AND ADDRESS

1979 - Open

DESCRIPTION OF DEPOSIT

The deposit is situated within the metavolcanic portion of the Archean Rive Lake Group. Gabbroic rock has intruded into andesite lava. The gabbro has been sheared and the shear zones locally are sparingly mineralized with pyrrhotite and chalcopyrite. According to Davies (1952) dense and disseminated chromite were found on a 200 to 300-foot wide peridotite in a drill hole on Ledin No. 3.

Associated minerals or products of value

Chromite

HISTORY OF EXPLORATION AND DEVELOPMENT

The deposit is located 5 miles east of Anson Lake, 3 miles north of the Oiseau River, and 2 3/4 miles north of Provincial Road No. 315.

In 1922 a copper deposit was staked by the National Group (National, 31586; National No. 1, 31582; National No. 6, 31589; and National No. 7, 31584).

W. Le B. Ross and E.L. Murray staked National and National No. 1, respectively. In 1924 Wright (1926) visited the deposit and noted that although a number of scattered prospect pits were examined, "no commercial ore (at 1924 prices) was noted". In 1929 National No. 1 was assigned to W.L. Ross, and in the same year National and National No. 1 were leased (1096 and 1097, respectively) for 21 years by W. Le B. Ross.

In 1942 G.A. McCartney optioned the leases and assigned them to A.B. Mortimer. The option was dropped in 1947 and the leases assigned to Frank Clark. The claims were cancelled in 1951.

In 1951 National and National No. 1 were restaked under the same names (W18414 and W18415, respectively) by Robert Helgason on behalf of Frank Clark. In 1953 J.C. McDonald restaked the former claims as Excelsior No. 1 (W19847) and No. 5 (W19851), respectively, and then assigned them to Frank Clark.

G.H.Drawson restaked the preceding claims as Morning No. 5 (W20972) and No. 3 (W20970) in 1954. In 1955 the property was assigned to Anglo-Barrington Mines Limited, who made airborne magnetometer and electromagnetic surveys at 1/8 mile intervals ("Bird River Survey"). Apparently results were not encouraging and the claims were assigned back to G.H. Drawson in 1956, and then in 1958 he assigned 1/2 interest to Hilding Johnson. After the death of Hilding Johnson in 1965, his interest was vested in his estate.

National No.6 and National No. 7 were restaked as New National (19875) and New National No. 1 (10876) by C.P. Kelpin and F.J. Drysdale, respectively, in 1929 and cancelled in 1931.

(Cont'd. - 2)

HISTORY OF PRODUCTION

MAP REFERENCES

*Map 52L/5, East, Pointe du Bois (Topo.), Sc. 1:50,000.
Map 4070G, Pointe du Bois (Aeromag.), Sc. 1" = 1 mile.
Map 2059, Oiseau River Area (Geol.), Sc. 1" = 1 mile - accomp. rept. by Wright (1924).
Map 51-3, Bird River Area (Geol.), Sc. 1" = ½ mile - accomp. rept. by Davies (1952).
Preliminary Map 1972F-1, Compilation Map of Bird River Area (Geol.), Sc. 1" = ½ mile - D.L. Trueman, Manitoba Mines Branch.
Map (unpublished), National, 31586 and National No.1, 31582, Lot 642 and 643, Group 124, (Survey, 1929), Sc.1" - 200'.
Map (unpublished), Ledin No. 5, W16881 and Ledin No.4, W16880, Lot 2163 and 2162, Group 124, Plan 7821 and 7820 (Survey, 1955), Sc. 1" = 200'.

REMARKS

#Claim Map Series NE5, 52L, Sc. 1:31 680, circa 1973, Mining Recording, Man. Mines Br.

Comp./Rev. By		JB					
Date	Feb.68	Sept.73					

REFERENCES

++ Davies, J.F.; Geology of the Oiseau (Bird) River Area; Publ. 51-3, pp. 21-22, Manitoba Mines Branch, 1952.

Ledin No. 5 and No. 4; File No's 37721 and 37720 in Mining Recording Files, Manitoba Mines Branch.

Morning No. 5 and No. 3; File No's 42400 and 42398 in Mining Recording Files, Manitoba Mines Branch.

National and National No. 1; File No's 1296 and 1298 in Mining Recording Files, Manitoba Mines Branch.

+ Wright, J.F.; Geology and Mineral Deposits of Oiseau River Map-area; Summ. Rept. for 1924, Pt. B, pp. 96-97; G.S.C., 1926.

HISTORY OF EXPLORATION AND DEVELOPMENT

In 1942 James Wrathall restaked the preceding claims as W.J. No. 4 (W10712) and W.J. No. 3 (W10711), and a year later they were assigned to Humprey R. Drummond-Hay and Fred Larn. In 1945 the claims were cancelled and in 1948 restaked as National No. 22 (W16088) and No. 21 (W16087), respectively, by Norman S. Black. Robert Ledin restaked the properties as Ledin No. 5 (W16881) and No. 4 (W16880) in 1949 and assigned them to Howe Bay Gold Mining Company Limited NPL. In 1950 Ledin No. 5 and No. 4 were restaked under the same names (W18130 and W18129), respectively) by Robert Ledin and again assigned to Howe Bay Gold Mining Company Limited NPL. In 1951 a total of 913 feet of diamond drilling was performed on Ledin No. 3 (W18128), a claim lying immediately southwest of Ledin No. 4.
J.F. Davies (1952) indicated that chromite is present at locality No. 7 on his map accompanying Publ. 51-3.

In 1955 21-year leases were issued to Howe Bay Gold Mining Company Limited NPL on Ledin No. 5 (M-3753) and on Ledin No. 4 (M-3752).

PRODUCT CHROMITE | PROVINCE OR TERRITORY MANITOBA 157 | N.T.S. AREA 52L/5 NW | REF. Cr 3

NAME OF PROPERTY Wards (Star)

OBJECT LOCATED Centre of Wards M.C.

UNCERTAINTY IN METRES 500 m Lat. $50^{\circ}25.8'$ Long. $96^{\circ}46.7'$

Mining Division District Winnipeg

County Township or Parish

Lot Concession or Range

Sec 17 Tp. 17 R. 13 EPM

OWNER OR OPERATOR AND ADDRESS

DESCRIPTION OF DEPOSIT

The deposit is the most westerly occurrence of chromite on the south limb of the anticline in which the Precambrian Bird River Sill lies. Chromite occurs in short, dark bands of varying thickness (from a few feet to about 50 ft.) lying within a hundred feet away from each other along a northeasterly direction. These bands lie in hornblende gabbro. The chromite occurrence would appear not to be sufficiently large or regular to form a commercial deposit.

Associated minerals or products of value

MRB-124

HISTORY OF EXPLORATION AND DEVELOPMENT

The occurrence lies roughly two miles north and one mile west of the mouth of the Oiseau (Bird) River, and roughly 3.2 miles from Provincial Road No. 315.

In 1937, C. Lagsdin staked the property as Star M.C. (W7859). After a few months in the same year he assigned it to John Lapin. Apparently, Mr. Lagsdin did not recognize the occurrence of chromite. However, Mr. Lapin did and showed the chromite to Dr. G.M. Brownell of the University of Manitoba who investigated the occurrence but found it small, irregular, and not of likely commercial interest. However, this initiated the interest in prospecting for other chromite occurrences in the area (see Cr 1 and Cr 2).

In 1942, Mr. Lapin staked another claim which he called Wards claim, area 55.95 acres. However it appeared from his plan that the claim lies in about the same position of the Star mineral claim. Hence, in the same year the Star M.C. was cancelled and relocated as Wards M.C. (W10544). After a few months in the same year, Mr. Lapin granted Findlay McCallum an option to purchase but Mr. McCallum did not exercise the option. The following year, the Wards claim and its adjoining Trimpas and Cuba mineral claims were grouped and on this group Mr. Lapin put down several trenches and test pits. Finally, in 1948, he decided to assign it to R.A. Copland who later in 1953 obtained a 21-year lease, M-3369, and held the claim until 1970. Additional pits and trenches were put down and some diamond drilling was performed on the Wards and the other two claims in the group in the period 1943 to 1950.

In 1970, under the Trustee Act the Court of Queen's Bench assigned the claim to Macroy Mining and Exploration Limited.

Mineral Development Sector, Department of Energy, Mines and Resources, Ottawa.

HISTORY OF PRODUCTION

MAP REFERENCES

*Map 52L/5, West, Pointe du Bois (Topo.), Sc. 1:50,000.
Map 4070G, Pointe du Bois (Aeromag.), Sc. 1" = 1 mile.
Map 51-3, Bird River Area (Geol.), Sc. 1" = ½ mile - Accomp. rept, by Davies (1952).
Preliminary Map 1970A-1, Geology of the Chrome and Page Properties: Bird River Sill (Geol.), Sc. 1" = ¼ mile - D. L. Trueman, Manitoba Mines Branch.
Map (Unpublished), Wards, W10544, Lot 2082, Group 124, Plan 7256 (Survey, 1952), Sc. 1" = 200 ft.
Map, Detail of Chromite areas, Wards Claim; Sc. 1" = 20 ft. - J. D. Bateman (1942).
Map, Plan Showing Localization of Chromite, Wards Claim, Sc. 1" = 50 ft. - J. D. Bateman (1942).

REMARKS

Comp./Rev. By	RS						
Date	Sept. 73						

REFERENCES

Bateman, J.D.; Bird River Chromite Deposits, Manitoba; Trans. CIM, vol. 46, pp. 154-183, 1943.

+Bateman, J.D.; Field Report on Chromite North of Oiseau River, Manitoba; 8 p.; unpublished report in Non-confidential Assessment Files, Manitoba Mines Branch, 1942.

++Davies, J.F.; Chromite Deposits of Southeastern Manitoba, Can. Mining Journal, April, pp. 112-114, 1958.

Star M.C.; W7859; File No. 2292 in Mining Recording Files, Manitoba Mines Branch.

Wards M.C.; W10544; File No. 27368 in Mining Recording Files, Manitoba Mines Branch.

PRODUCT CHROMITE | PROVINCE OR TERRITORY MANITOBA 216 | N.T.S. AREA 52L/11 SW | REF. CR 1

NAME OF PROPERTY Euclid M.C.

OBJECT LOCATED Centre of Euclid M.C.

UNCERTAINTY IN METRES 500 m Lat. $50^{0}34.3'$ Long. $95^{0}21.6'$

Mining Division District Winnipeg

County Township or Parish

Lot Concession or Range

Sec Tp. 19 R. 16EPM

OWNER OR OPERATOR AND ADDRESS

O.H.G. Zeemel
42 - Willowmeade Crescent
Winnipeg, Manitoba

DESCRIPTION OF DEPOSIT

Chromite occurs as stratiform deposits within the upper part of the lower peridotite portion of the Bird River ultrabasic sill which is Precambrian in age. The sill is folded into an easterly plunging anticline, with the Euclid M.C. lying on the north limb. The continuity of the sill is interrupted by faulting and by the intrusion of a younger granite. The sill itself is intrusive into early Precambrian greenstones and associated sedimentary rocks.

The sill comprises an upper layer of hornblende gabbro and a lower layer of serpentinized peridotite and ranges from 500 to 3500 feet thick. The chromite zone is within and near the top of the peridotite layer. This zone includes dense and disseminated ores, which occur as stringers, ribbons and bands in the altered peridotite. There is no massive chromite within the deposit. The dense ore consists of closely packed, small octahedral crystals of chromite in an interstitial gangue of chlorite and tremolite. This dense ore normally contains 20-30% chromic oxide. The disseminated ores are mineralogically similar but contain less chromite.

Associated minerals or products of value

HISTORY OF EXPLORATION AND DEVELOPMENT

The Euclid M.C. is located approximately 2500 feet southeast of the southern tip of Euclid Lake, and 4 miles east of Provincial Road No. 314.

The Euclid M.C. was first staked for chromite by F. Zeemel in 1942. Exposures were found at two intervals, 2200 feet apart along strike, with continuous exposures of 300 feet. In 1942 the claim was assigned to G.A. LaBine and in early 1943 to Gunnar Gold Mines Limited. The same year 3208' of diamond drilling were completed and this work disclosed parallel bands of chromite and extended the chromite-rich zone for an additional 200'. This zone contained two chromite sections separated by 6.7' of chromiferous peridotite of 11.9% Cr_2O_3 over 5.6' and 11.9% Cr_2O_3 over 6.7'.

The claim went to lease (M2556) in 1946 and was surveyed at 75.9 acres. In 1951 a magnetometer survey was completed, tracing the chromite zone through the overburden. This survey was followed by diamond drilling which traced the zone for 2000'. The company reports an indicated tonnage of 11,000,000 tons grading 4.6% Cr_2O_3 down to 1000' level and an additional 676,000 tons grading 6.7% Cr_2O_3. The company feels that a considerable portion of the lower grade tonnage would be available to open pit mining (Annual Report for 1952).

Gunnar Gold Mines Limited changed their name to Gunnar Mines Limited (N.P.L.) in 1954 and in 1959 assigned the property to Strannar Mines Limited.

Strannar Mines Limited held the claim until 1965 and at that time assigned it to A.O. Zeemel. Zeemel renewed the lease in 1970

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Mineral Development Sector, Department of Energy, Mines and Resources, Ottawa.

HISTORY OF PRODUCTION

MAP REFERENCES

*Map 52L/11, West, Flintstone Lake (Topo.), Sc. 1 : 50,000 , Mines & Tech. Surveys, Can.

Map 4047G, Flintstone Lake (Aeromag.), Sc. 1" = 1 mile, Man. Mines Br. & Geol. Surv. Can.

Map 49-7, Cat Lake-Winnipeg River Area (Geol.), Sc. 1" = 1 mile - accomp. report by Springer (1950), Man. Mines Br.

#Claim Map Series SW11, 52L, Sc. 1" = ½ mile, circa 1974, Mining Recording, Man. Mines Br.

REMARKS

Comp./Rev. By		GGS					
Date	June 68	Nov 73					

REFERENCES

216

Bateman, J.D.; Bird River Chromite Deposits; Trans. C.I.M., vol. 46, 1943.

Bateman, J.D.; Memo report on chromite north of Oiseau River; Unpublished information (Chromite), Man. Mines Br., 1942.

Canadian Mines Handbook; 1943-51.

Davies, J.F., Bannatyne, B.B., Barry, G.S., and McCabe, H.R.; Geology and Mineral Resources of Manitoba, Man. Mines Br., 1962.

Davies, J.F.; Chromite Deposits of Southeastern Manitoba; Canadian Mining Journal, vol. 79, 1959.

Springer, G.D., Mineral Deposits of the Cat Lake-Winnipeg River Area, Publ. 49-7, Man. Mines Br., 1950.

Western Miner; December, 1952.

PRODUCT COPPER | PROVINCE OR TERRITORY MANITOBA 228 | N.T.S. AREA 52L/12 NE | REF.CU 2

NAME OF PROPERTY Mayville M.C. (Mayville Group)

OBJECT LOCATED Centre of Claim

UNCERTAINTY IN METERS 500 m Lat. 50°38.08' Long. 95°36.75'

Mining Division District Winnipeg

County Township or Parish

Lot Concession or Range

Sec Tp. 19 R. 14 EPM

OWNER OR OPERATOR AND ADDRESS

1973 - Maskwa Nickel Chrome Mines Limited
c/o Falconbridge Nickel Mines Limited
7 King Street East
Toronto 1, Ontario

DESCRIPTION OF DEPOSIT

The deposit is situated on the south side of the north limb of the Archean Bird River Sill. Sulphide minerals form replacement bodies in andesite and gabbro. Trenching has exposed the body for 200 feet in a northwesterly direction along the strike. The dip of the deposit is to the south. Pyrrhotite, pentlandite, and chalcopyrite were deposited in that order, with the latter replacing the earlier. A small amount of titaniferous magnetite is also present (Springer, 1950). "The cores of the diamond drill holes made in 1923, showed alternating gabbro dykes and andesite. One of the dykes intersected in the drilling consists almost entirely of labradorite crystals from 1/2 to 2 inches long; other dykes hold large hornblende crystals. The large feldspar and hornblende crystals are cut by veinlets of sulphides following cracks and cleavage planes" (Wright, 1932).

Associated minerals or products of value

Nickel

HISTORY OF EXPLORATION AND DEVELOPMENT

The deposit is located about 3 1/2 miles north-northeast of Maskwa Lake, 5 1/2 miles northwest of Smoky Lake, and 5 1/2 miles from the north end of Provincial Road No. 314.

The deposit was first staked as the Mayville M.C. (26684) by Amos May in 1917. This claim became the central claim in a 3 mile by 1 mile core area which was explored in great detail. Many claims have been staked in an area surrounding the core, but these subsequently were cancelled after little or no mineralization was discovered (See: Remarks).

The core area was studied by R.J. Colony (1920) and by W.S. McCann (1921). The following assays were reported by McCann:

	I	II	III	IV	V	VI	VII
	%	%	%	%	%	%	%
Copper	1.35	0.27	3.23	0.68	1.84	1.07	0.16
Nickel	none	0.19	0.59	1.68	0.36	0.40	0.15
Gold	trace	trace	.....	.....	.....	trace	trace
Platinum	none	none	0.02	0.01	0.03	none	none

I. From Chinook claims
II. From Hititrite claim.
III. From Hititrite claim.
IV. From Hititrite claim.
V. From Nova claim.
VI. From Mayville claim.
VII. From Copper Dome claim.

In 1921 the Mayville M.C. and surrounding claims were optioned to The Devlin Mining and Development Company, Limited, which purchased them a year later. Seven diamond drill holes were drilled to depths between 200 and 350 feet in 1923. In 1924 a 21-year Lease 461 was issued on the property. Four years later, Thayer Lindsley, representing Ventures Limited, optioned the property along with claims owned by the Manitoba Copper Company Limited. At that time it was estimated that the 80-85 foot wide ore body contained 4% copper. A diamond drilling program was carried out in 1929. Three vertical holes to 530, 506 and 508 feet and two, steeply inclined from the southeast towards the outcrop to a depth of 1,501 and 1,401 feet were drilled.

The Maville Group was assigned to Great Falls Mining &

Mineral Resources Branch, Department of Energy, Mines and Resources, Ottawa.

(cont'd. .. 2)

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PRODUCT	COPPER	PROVINCE OR TERRITORY	MANITOBA 228	N.T.S. AREA 52L/12 NE	REF.CU 2

NAME OF PROPERTY Mayville M.C. (Mayville Group) (cont'd.)

OBJECT LOCATED

UNCERTAINTY IN METERS Lat. Long.

Mining Division District

County Township or Parish

Lot Concession or Range

Sec Tp. R.

Wpg. Free Press →
Nov. 16, 1935
1.17% Ni
0.78% Cu
Mines Br. No. 847

OWNER OR OPERATOR AND ADDRESS

DESCRIPTION OF DEPOSIT

Associated minerals or products of value

HISTORY OF EXPLORATION AND DEVELOPMENT

Smelting Limited in 1935. It was reported that 2,000 feet of diamond drilling indicated 300,000 tons of ore averaging better than 2% nickel-copper In 1936 the Great Falls Mining & Smelting Limited optioned its property (46 claims in the Bird and Bear River Areas, see 52L/6, Ref. NI 1) to A.J. Milligan, representing Thayer Lindsley. Milligan assigned his option to Northfield Mining Company Limited which, in 1936, incorporated a new company, Stanmore Mining & Smelting Limited.

A geological study by S.E. Wolfe and a geophysical study by L. Gilchrist were completed in 1937. The Hititrite M.C. (27704) and 16 other mining claims were acquired from Dr. J. Ellis McDonald of Philadelphia, Pa. for 200,000 shares of Stanmore stock. Shortly after Dr. McDonald optioned the property and funds received were used for diamond drilling.

The Lease was renewed for an additional 21-year period in 1945. Springer (1950) reported that the largest visible sulphide is on the Mayville M.C.

In 1951 the property was assigned to Maskwa Nickel Chrome Mines Limited and two anomalies were found in a second geophysical survey. Three years later Maskwa Nickel Chrome Limited allowed Strike No's. 1-18, Tom No's. 1 and 2, Moose No's. 1-5, and Rod No's. 1-8 "to lapse after geological and geophysical examinations failed to reveal anything of economic interest" (Assessment Files). These claims bordered the core area.

In 1955, it was reported that previous drilling on the Mayville Group had indicated short intersections of low grade nickel and copper mineralization. The anomalies found during the previously mentioned 1951 geophysical survey were tested in 1956. Ten drill holes with a total length of 4141 feet were made. Seven holes intersected the northern conductor on the Gilroy, Mayville, Colossus No. 16 and 24 claims. The conductor was attributed to be "disseminated sulphides containing 0.25% nickle and less than 1% copper" (Maskwa Nickel Chrome Mines Limited; Report to Shareholders, May, 1957). Three holes penetrated the southern conductor on Copper Contact, Copper Bottom and Red Cloud No. 6 claims. The electromagnetic coductors are due to "low grade copper and nickel sulphides."

Spartan Air Services Ltd. made an airborne magnetic survey

Mineral Resources Branch, Department of Energy, Mines and Resources, Ottawa.

cont'd.

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HISTORY OF PRODUCTION

HISTORY OF EXPLORATION AND DEVELOPMENT

over the core area for the Federal and Provincial governments in 1965. Magnetic "highs" of over 61,400 gammas are indicated within the core area.

The lease was renewed for an additional 21-year period in 1966.

MAP REFERENCES

*Map 52L/12E, Maskwa Lake (Topo.), Sc. 1:50,000, Mines & Tech. Surveys, Can.

Map 4071G, Maskwa Lake (Aeromag.), Sc. 1"=1 mile, Man. Mines Br. & Geol. Surv. Can.

Map 49-7, Cat Lake-Winnipeg River Area (Geol.), Sc. 1"=1 mile - Accomp. rept. by Springer (1950), Man. Mines Br.

Prelim. Map 1972 F-1, Geological Compilation Map of the Bird River Area (Geol.), Sc. 1"=1/2 mile - D.L. Trueman, Man. Mines Br.

Map (unpublished), Mayville M.C., 26684, Lot 248, Group 124 (Survey 1924), Sc. 1"=200'.

#Claim Map Series NE12,52L, Sc. L'=1/2 mile, circa 1974, Mining Recording, Man. Mines Br.

REMARKS

Claims staked outside the core include: Mond, Mond No's. 1-17 (W7825-42); Will No's. 1-14 (W22486-99); Ray No's. 1-18 (W22500-17); Bud No's. 1-15 (W22518-32); Strike No's. 1-18 (18410,11,36-51); Rod No's. 1-8 (W18570-77); Inco No's. 1-7

Comp./Rev. By	JB						
Date	Dec.73						

REFERENCES

Ann. Rept. on Mines and Minerals; 10th - pp. 132; 11th - pp. 114; Man. Mines Br.

Manitoba Mines Branch; Corporation Files: "The Devlin Mining and Development Company Limited; Great Falls Mining & Smelting Limited; Red Cloud Mining and Smelting Company; Bear River Copper Company, Limited; Gold Rock Mines Ltd.".

McCann, W.S.; The Maskwa River Copper-Nickel Deposit, Southeastern Manitoba; Summ. Rept., Part C, pp. 19-29; Geol. Surv. Can. 1921.

Mayville M.C.; File No. 1067 in Mining Recording Files, Man. Mines Br.

Springer, G.D.; Mineral Deposits of the Cat Lake-Winnipeg River Area; Pub. 49-7, pp. 3; Man. Mines Br., 1950.

Various claims; NE12,52L; Non-confidential Assessment Files, Man. Mines Br. (see: Remarks).

Wright, J.F.; Geology and Mineral Deposits of a Part of Southern Manitoba; Mem. 169, pp. 91-98; Geol. Surv. Can., 1932.

REMARKS

(W15724-30); Moose No's. 1-5 (W18468-72); Tom No's. 1,2 (W18473,74); Jan No's. 1-7 (W16820-26).