

MAR 19680007: WATERTON LAKES

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ECONOMIC MINERALS

FILE REPORT No.

CU-AF-009(1)
CU-AF-010(1)

REPORT
on the
PHOTOGEOLOGY
of the
WATERTON LAKES MINERAL PROSPECTING PERMITS

Prepared by

Orhan Baykal, P. Eng., P. Geol.

July 4, 1968

for

McGregor Telephone and Power Construction Company

INDEXING DOCUMENT NOS. 700218
700219

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PHOTOGEOLOGY
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WATERTON LAKES MINERAL PROSPECTING PERMITS

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19680007

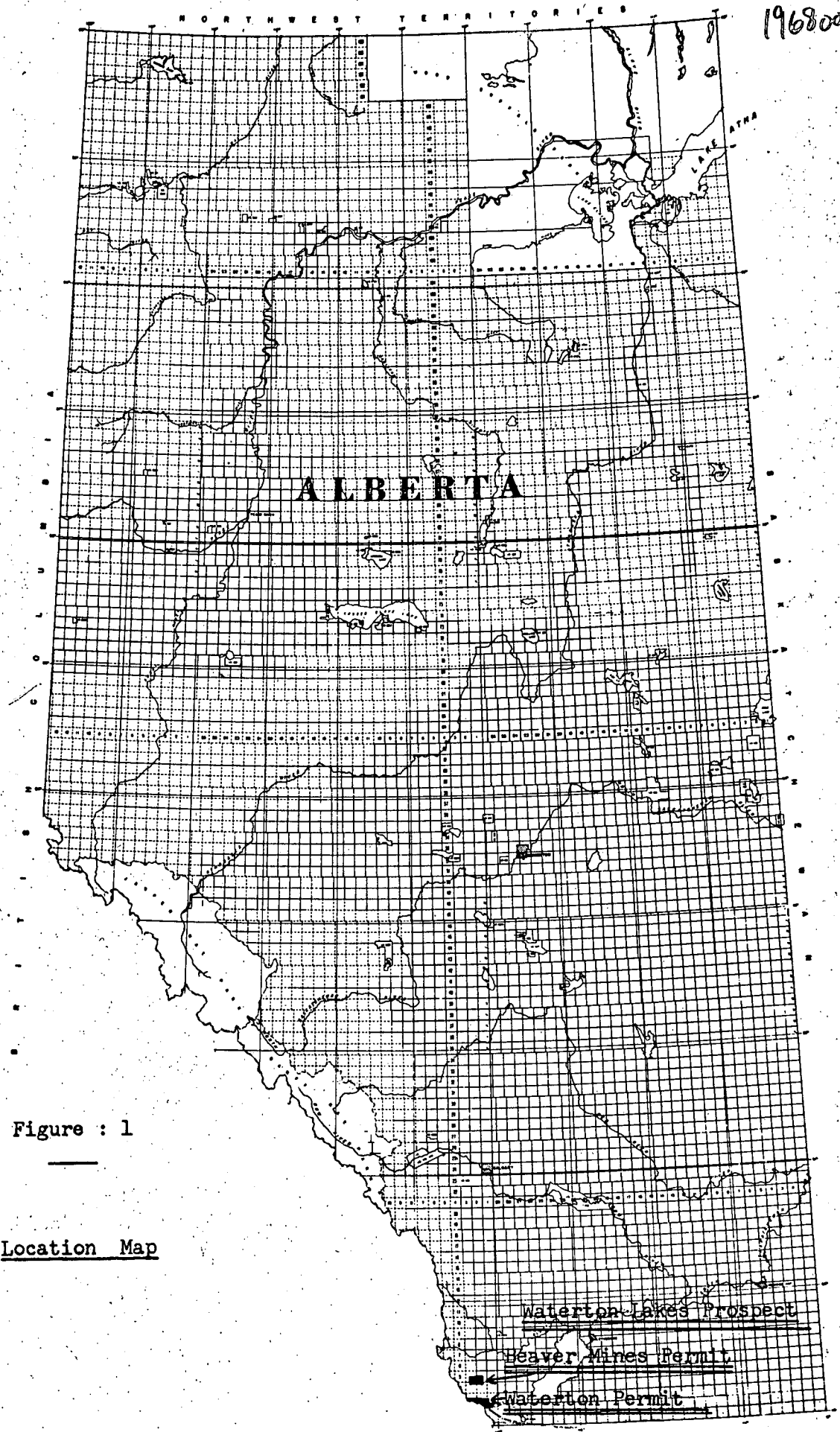


Figure : 1

Location Map

Waterton-Lakes Prospect
Beaver Mines Permit
Waterton Permit

REPORT
on the
PHOTOGEOLOGY
of the
WATERTON LAKES MINERAL PROSPECTING PERMITS
Waterton Lakes - Alberta

INTRODUCTION:

The present report outlines the photogeology of two Mineral Prospecting Permits held by McGregor Telephone and Power Construction Company in the Waterton Lakes district of southwestern Alberta (Figure 1). The northern permit, comprised of 8 sections, 5120 acres, is located in the southern portion of Townships 4 and 5, Ranges 2 and 3 W5, (Figure 2). The southern permit named the Waterton Permit, comprised of about 20 sections, 12,800 acres, is located in Township 3, Ranges 2 and 3 W5 (Figure 3), immediately north of the Waterton Lakes National Park and east of British Columbia - Alberta Boundary.

The permits are accessible by a gravel road which follows Castle River and extends from Beaver Mines to its headwater located within the Waterton Permit.

CONCLUSION & RECOMMENDATIONS:

Photogeological maps of the two permits have been made with the use of aerial photography.

The presence of copper within the general area has been ascertained and mineralization is thought to be related to intrusions.

The intrusives appear to be extensive in areal extent and may possibly generate an economic low-grade copper ore deposit.

Following this preliminary assessment of the properties it is recommended that a field study be made of the intrusive bodies and of the amount of mineralization that the intrusives may have caused to occur in the invaded rocks. The mineralized zones should be sampled and assayed.

The gabbro sills are probably responsible for the copper occurrence. They have extensively invaded the Grinnell formation, partly the underlying Appekunny formation, and subordinately the overlying Siyeh formation. Based on this observation it is possible to think that no post - Siyeh intrusion has taken place. However, intrusive activities present in the younger sections suggest a post - Kintla injection. Therefore, the sill intrusions may have either occurred periodically starting from the Appekunny time or may have taken place in post - Kintla time. Under the last condition most of the Precambrian formations may be expected to show some mineralization in the vicinity of the intrusions.

The above are the arguments to be taken into consideration and resolved directly by field observation. Also the intrusive stock found south of La Coulotte Peak should be investigated and ascertained whether or not it has also caused the invaded host rocks to be mineralized.

METHOD OF STUDY:

Aerial photographs were used and analyzed stereoscopically to outline the geology of both permits. The photogeological work was restricted only to the permit areas. Consequently features of interest from

regional geological standpoint could not be followed into the permit areas.

The photos were of good quality. However in the Beaver Mines Permit, the mosaic secured from the Alberta Department of Lands and Forests had too much distortion to be usable. A new mosaic had to be made.

The data secured from air photos were transferred to the mosaics, an overlay made and superimposed to the negative of the mosaics.

This initial work was supplemented with field check to further refine the geology and assess the mineral possibilities of the permits.

GEOLOGICAL SETTING:

The formations present in both permits range from the Precambrian to the upper - Cretaceous. Most of the permit areas are covered by the Precambrian Purcell series found above the Lewis Overthrust (Figures 4 & 5)

PURCELL SERIES - PRECAMBRIAN:

WATERTON FORMATION:

The Waterton formations consists of greyish, very fine crystalline limestone, interbedded with light grey, finely crystalline dolomite; light green, argillaceous dolomite and argillite; brownish-red argillaceous dolomite and cryptocrystalline dolomite. A maximum thickness of 1500

feet has been encountered in the Pacific Atlantic Flathead #1 well. In the Clark Range the formation is highly faulted and folded and a maximum thickness of about 500 feet has been found to exist above the Lewis thrust.

ALTYN FORMATION:

The Waterton formation is transitional with the overlying Altyn formation which consists of dark grey to black, finely crystalline argillaceous limestone and dolomite interbedded with black fissile argillite.

In the Clark Range, the formation is approximately 1500 feet.

APPEKUNNY FORMATION:

The Appekunny formation outcrops around the periphery of the Clark Range. The formation is composed of white, grey and green quartzitic sandstone, quartzite and greenish to greenish grey argillite. Mud-cracks, ripple-marks and intraformational conglomerate consisting of argillite pebbles embedded in a quartzitic matrix are common occurrence in the formation. The thickness varies between 1500 to 2000 feet. In the Clark Range the thickness of the formation is about 1500 feet.

GRINNELL FORMATION:

Through a gradational contact the Appekunny beds grade into the red argillaceous sequence of the Grinnell formation.

This formation consists primarily of red argillite with sub-

ordinate bands of light green argillite interbedded with minor amounts of white coarse-grained quartzite and quartzitic sandstone and fine-grained red sandstone.

The formation forms a pronounced and distinctive marker. Mud-cracks, ripple-marks, cut-and-fills and conglomerate similar to that of the Appekunny formation are also found within the formation.

The thickness varies between 350 to 1700'. In the map - area a thickness of 500' has been assigned to the formation.

SIYEH FORMATION:

Above the Grinnel formation lies the thick, competent sequence of the Siyeh formation which can be divided into three units.

The lower part, about 30' thick, consists of green argillite, dolomitic argillite and silty dolomite. This unit grades into the thick cliff forming middle part which consists mainly of brownish, argillaceous, finely crystalline limestone, dolomite and dolomitic limestone. This middle unit is approximately 1500 to 2000' thick.

The upper part, about 460 feet thick, consists of green argillite interbedded with siltstone and fine-grained sandstone.

In the map area, the total thickness of the Siyeh has been considered to be about 2500 feet.

PURCELL FORMATION:

The Purcell lava flows consists of dark green, reddish and purplish andestitic pillow-lavas and chloritied andesite. In the Clark Range the formation forms a pronounced and easily discernable marker horizon.

The thickness varies between 0 to 600 feet. In the Clark Range and in the vicinity of the permits a thickness of about 450 feet, has been assigned to the formation.

SHEPPARD FORMATION:

The Sheppard Formation consists of light colored dolomite, yellowish grey and dark red sandstone and siltstone, light green dolomite sandstone and argillite. Locally, thin andesitic flows are found within the formation.

The thickness in the permit is thought to be about 500 feet.

KINTLA FORMATION:

In the Beaver Mines Permit, the Kintla has been taken as an undivided group, in the Waterton permit, it has been divided into three members.

The lower member known as the Gateway formation, consists of dark red and purplish red argillaceous and micaceous siltstone and argillite. A thickness of 1000 feet has been assigned to the formation.

The Phillips formation forms the middle member and consists of coarse to fine-grained, red to purplish red sandstone and red siltstone. Ripple-marks, mud-cracks and intraformational conglomerate are frequently found within the unit. In the map area, the thickness is about 700 feet.

The upper member, 600 feet thick and known as the Roosville formation, consists of greenish grey and green argillite, sandstone and siltstone with minor amount of quartzitic sandstone and light grey

argillaceous dolomite.

PALEOZOIC:

FLATHEAD FORMATION:

The Flathead formation, resting unconformably on the Precambrian beds, consists of yellowish brown and light grey coarse-grained quartzitic sandstone and quartzite; conglomeritic sandstone and quartz pebble conglomerate.

The upper part of the formation consists of light green and greenish grey fossiliferous fissile shale. In the Citadel and Font Mountains, the thickness is about 325 feet. This formation is present only in the Waterton Permit.

FAIRHOLME FORMATION:

In the Waterton permit map-area, the upper Devonian Fairholme formation lies unconformably on the Cambrian beds. It consists of a grey to dark grey argillaceous finely crystalline limestone. Only the lowermost section of the formation is present in this area.

The Mississippian formation does not outcrop within the map-area. It is found in the Flathead region and north of the North Kootenay Pass.

MESOZOIC - CRETACEOUS FORMATION:

BLAIRMORE FORMATION:

In the Beaver Mines Permit map - area, the Blairmore formation

occurs along the Castle River and immediately below the Lewis thrust. The formation consists of waxy green shale and greenish-grey, salt-and-pepper fine to medium-grained quartzitic sandstone. A greyish, finely crystalline limestone, about 20 feet thick, and conglomeratic coarse-grained sandstone occur in the lower part of the formation. In the Beaver Mines map-area, the thickness has been estimated to be about 1200 feet.

CROWSNEST FORMATION:

Unconformably resting on the Blairmore, the Crowsnest formation represent the extrusive stage of the late lower-Cretaceous.

The formation, approximately 460 feet thick, consists of coarse-grained tuff and agglomerate composed of trachyte and phonolite detritus.

BLACKSTONE FORMATION:

The Blackstone formation of Upper-Cretaceous age, consist mainly of dark grey, micro-micaceous, silty shale containing brown sideritic concretions and subordinate grey to dark grey fine grained sandstone and siltstone. The thickness of the formation is estimated to be about 400 feet.

CARDIUM FORMATION:

Overlying conformably the Blackstone, the Cardium formation consists of grey to brownish grey, very fined-grained siliceous sandstone. Dark grey silty shale separates the different sand units. The sand becomes somewhat conglomeratic toward top of each unit. The pebbles found in the

conglomerate are usually dark grey rounded cherts. This laminae of coal occurs within the shale sequence.

Along the Castle River the thickness of the Cardium formation is about 140 feet.

WAPIABI FORMATION:

The Wapiabi formation is a monotonous sequence of dark grey shale, containing sideritic concretions and interbedded with fine-grained argillaceous sandstone.

The formation in the Beaver Mines area is about 1600' thick.

BELLY RIVER FORMATION:

The Marine Wapiabi formation transitionally grades into the continental Belly River formation which consists of grey to greenish, fine to medium grained sandstone and grey to green silty shale.

In the map-area the formation is about 1200 feet thick.

INTRUSIVES:

Several intrusions are known to exist in the area. Some of the intrusions have been mapped in the Waterton map-area but has not been followed in the adjacent Beaver Mines or Castle River areas. Due to the restricted coverage of this report, it hasn't been possible to follow the trend of the intrusives into the Permit areas.

An intrusive body is located immediately south of Waterton Permit (Figure 5) and south of La Caulotte Mountain. This leucocratic alkalic intrusion consists of trachyte, syemite, latite and felsite. It pierces both the Precambrian and Mississippian formation.

Along the eastern front of the Lewis thrust, an intrusion of gabbro occurs between the Grinnell and Appekunny formations. The intrusive appears to be a sill following roughly the bedding planes of the invaded formations.

STRUCTURAL GEOLOGY:

The most pronounced structural feature of the area is the Lewis Overthrust. The trace of the thrust can be seen in the Beaver Mines Permit (Figures 4 & 6) and at depth underlies the Waterton Permit. The fault has thrust the Precambrian rocks area younger formations ranging in age from possibly Mississippian to upper Cretaceous.

The Lewis thrust forms the boundary between two principal structural units. The foothills which lie between the thrust and the Alberta syncline, and the Front Range which begins with the thrust.

In the Beaver Mines area (Figures 4 & 6) both structural units are represented. The Foothills subparallel faults involving the Cretaceous formation can be seen along Castle River. Above the Lewis thrust the numerous fault slices are imbrications found above the thrust (Figure 6).

In the Waterton Permit the tectonic pattern (Figure 7) is quite simple. It consists of a gently folded synclinorium involving the upper Precambrian beds.

MINERALIZATION:

A field trip was made to Yarrow Creek where the copper is known to occur. At this locality, midway up the mountain and on the north east side of the creek, Kennecott had a rig in the process of drilling. ? The Gabbro sill intrusion at this location, follows the Grinnell-Appekunny contact and also occurs further up the section, in the Siyeh formation.

The copper is found mostly as malachite disseminated in a matrix of white, fine-grained quartzite. In some specimens, malachite was the only mineral present in others the malachite was associated with azurite and chalcocite. Hand picked samples from this area have assayed 0.1 to 2.23% copper. The mineralization appears to be neither continuous nor uniform. The average assay value of copper will be hard to predict for this area. Deposits of this type may have extensive lateral and vertical extent and usually yields a low-grade copper ores.

On samples secured from this area no leaching appears to be present. The copper carbonates occur in disseminated form in the quartzite and in thin fractures. From the above observation the presence of supergene enrichment appears doubtful. However too little of the area and too few specimens have been seen to determine the possibility of secondary enrichment.

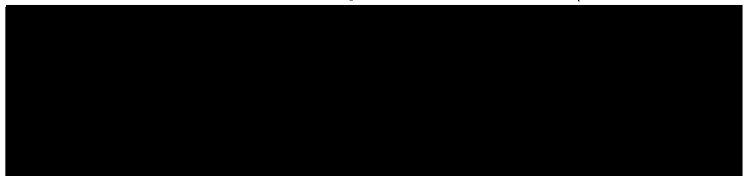
The gabbro intrusion in Yarrow Creek following the Grinnell - Appekunny contact appears to be a sill. This intrusion, probably responsible for the existing mineralization do not appear to be related to faulting. It is cut and displaced by faulting indicating that it was

injected prior to displacement caused by faulting. A careful and detailed study of the intrusives will be necessary for the location of possible ore bodies.

It appears that there may be two stages of intrusion. The first and earlier intrusion is the above gabbro sill whose mineralizing solution has caused the copper occurrence in Yarrow Creek and adjacent areas. The second intrusion located south of Coulotte Peak, Waterton Permit, may be younger. This relatively small stock pierces both the Precambrian and Mississippian rocks. The mineralizing effect of this intrusion is not known and has to be determined by field observation.

The gabbro intrusions are known to occur mostly in the Grinnell, the Grinnell-Appekunny contact and in the Siyeh formations. Based on this behavior it can be assumed that no post - Siyeh intrusion has taken place. However, due to the presence of intrusives higher in the section, a post - Kintla injection appears to be more feasible and in which case the total Precambrian section may potentially be copper-bearing.

Respectfully submitted



Orhan Baykal, P. Eng., P. Geol.

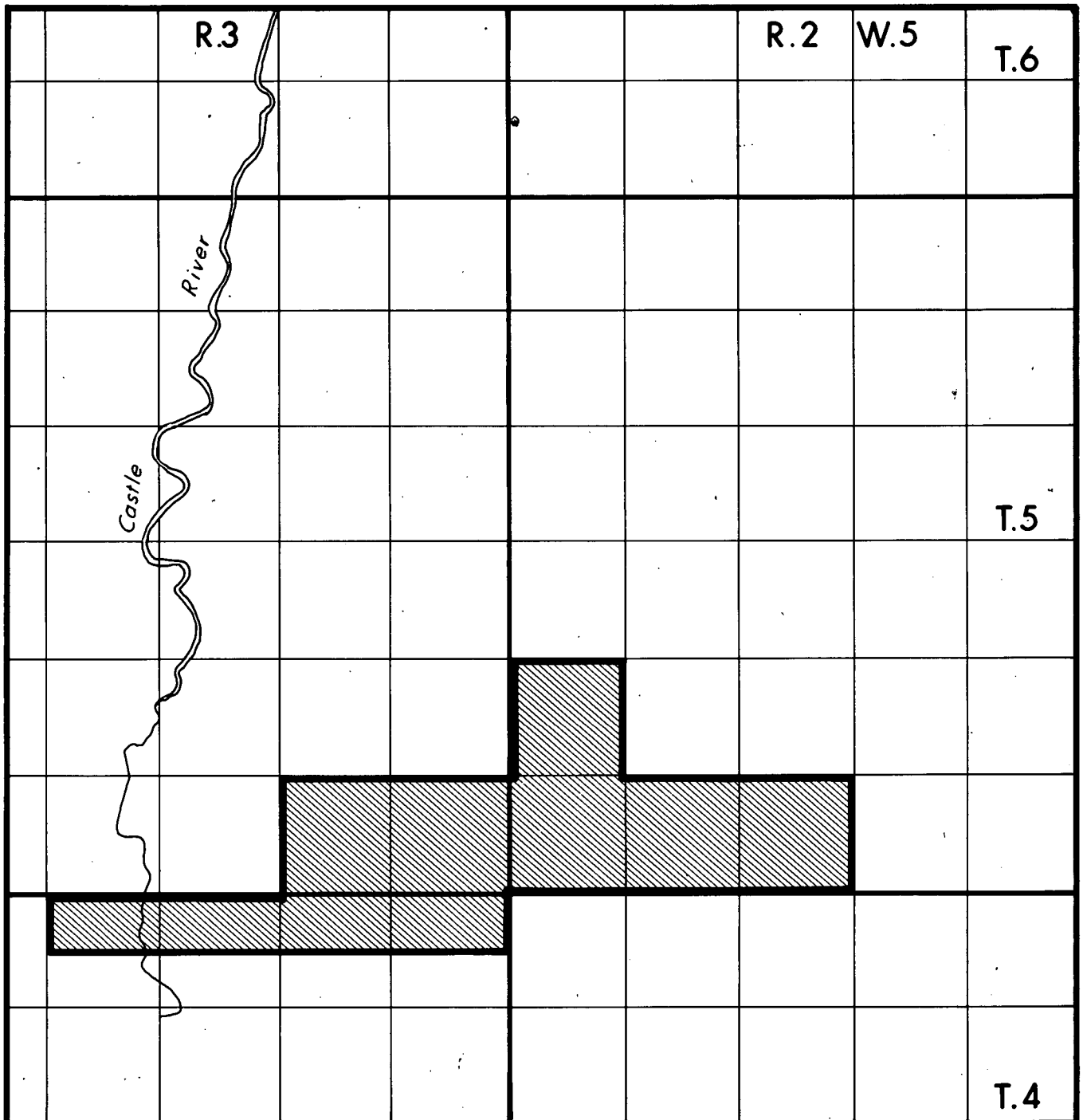


FIGURE : 2

LAND MAP
of

BEAVER MINES

MINERAL PROSPECTING PERMIT

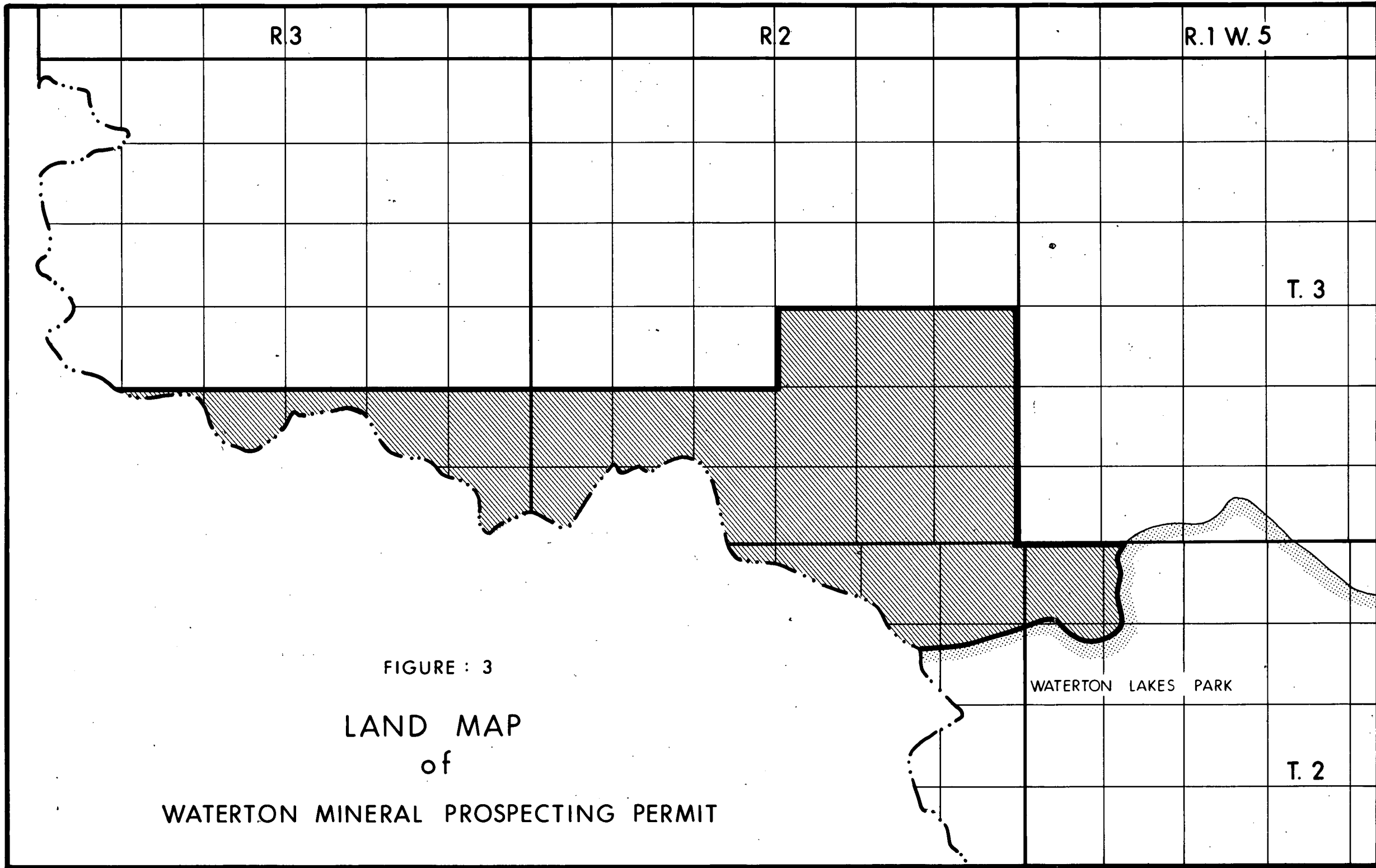
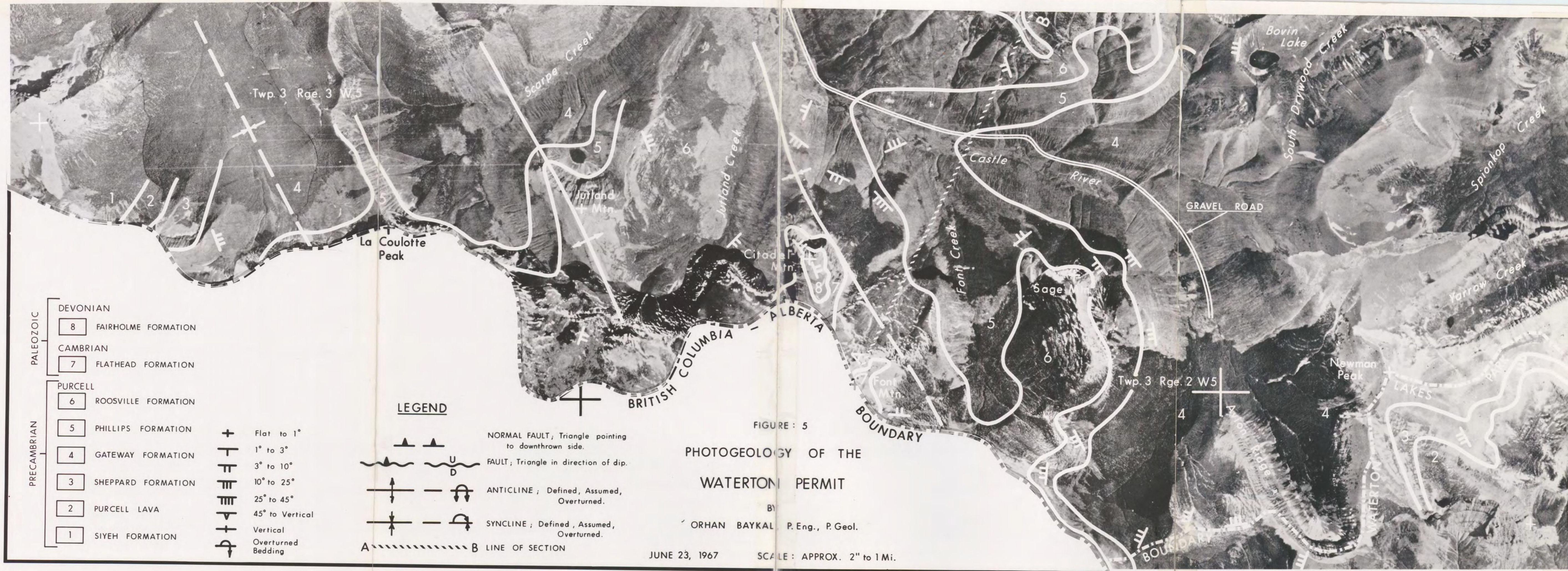


FIGURE : 3
LAND MAP
of
WATERTON MINERAL PROSPECTING PERMIT

AG20007



PALEOZOIC	DEVONIAN	8	FAIRHOLME FORMATION
	CAMBRIAN	7	FLATHEAD FORMATION
PRECAMBRIAN	PURCELL	6	ROOSVILLE FORMATION
		5	PHILLIPS FORMATION
		4	GATEWAY FORMATION
		3	SHEPPARD FORMATION
		2	PURCELL LAVA
		1	SIYEH FORMATION

+	Flat to 1°
├─┤	1° to 3°
├─┤├─┤	3° to 10°
├─┤├─┤├─┤	10° to 25°
├─┤├─┤├─┤├─┤	25° to 45°
├─┤├─┤├─┤├─┤├─┤	45° to Vertical
├─┤├─┤├─┤├─┤├─┤├─┤	Vertical
├─┤├─┤├─┤├─┤├─┤├─┤├─┤	Overturned Bedding

LEGEND	
	NORMAL FAULT; Triangle pointing to downthrown side.
	FAULT; Triangle in direction of dip.
	ANTICLINE; Defined, Assumed, Overturned.
	SYNCLINE; Defined, Assumed, Overturned.
A-----B	LINE OF SECTION

ALBERTA
BRITISH COLUMBIA
BOUNDARY

FIGURE: 5
PHOTOGEOLOGY OF THE
WATERTON PERMIT
BY
ORHAN BAYKAL, P. Eng., P. Geol.
JUNE 23, 1967 SCALE: APPROX. 2" to 1 Mi.

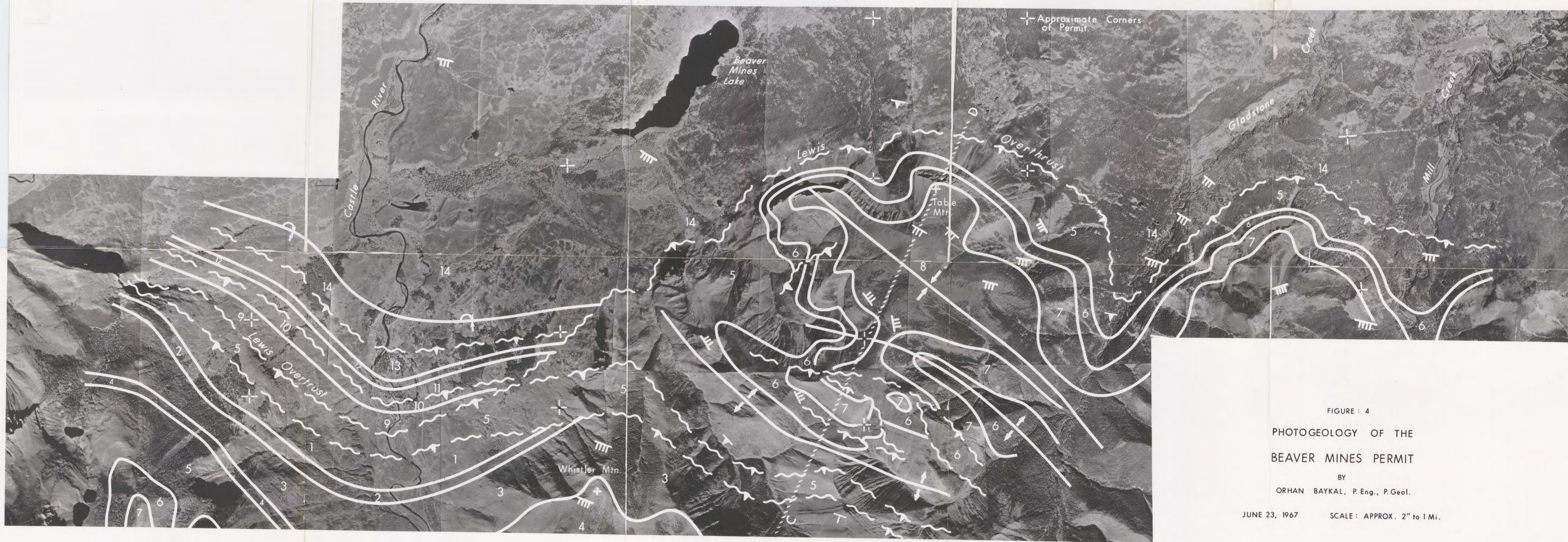


FIGURE : 4
 PHOTOGEOLOGY OF THE
 BEAVER MINES PERMIT
 BY
 ORHAN BAYKAL, P. Eng., P. Geol.

JUNE 23, 1967 SCALE: APPROX. 2" to 1 Mi.

- | | | |
|------------------|---------------------|-----------------------|
| MESOZOIC | CRETACEOUS | |
| | UPPER CRETACEOUS | |
| | 14 | BELLY RIVER FORMATION |
| | 13 | WAPIABI FORMATION |
| | 12 | CARDIUM FORMATION |
| | 11 | BLACKSTONE FORMATION |
| LOWER CRETACEOUS | | |
| 10 | CROWSNEST VOLCANICS | |
| 9 | BLAIRMORE FORMATION | |
| PRECAMBRIAN | 8 | KINTLA FORMATION |
| | 7 | SHEPPARD FORMATION |
| | 6 | PURCELL LAVA FLOWS |
| | 5 | SIYEH FORMATION |
| | 4 | GRINNELL FORMATION |
| | 3 | APPEKUNNY FORMATION |
| 2 | ALTYN FORMATION | |
| 1 | WATERTON FORMATION | |

- | | |
|-----|-----------------|
| + | Flat to 1° |
| ⊥ | 1° to 3° |
| ≡ | 3° to 10° |
| ≡≡ | 10° to 25° |
| ≡≡≡ | 25° to 45° |
| ⊥ | 45° to Vertical |
| ⊥ | Vertical |
| ⊥ | Overturned |
| ⊥ | Bedding |

LEGEND

	NORMAL FAULT; Triangle pointing to downthrown side.
	FAULT; Triangle in direction of dip.
	ANTICLINE; Defined, Assumed, Overturned.
	SYNCLINE; Defined, Assumed, Overturned.
	LINE OF SECTION

19680007

QUARTZ MINERAL EXPLORATION PERMIT No. 17

(826/8)

MCGREGOR TELEPHONE & POWER
CONSTRUCTION COMPANY LIMITED,
9925 - 62 AVENUE,
EDMONTON, ALBERTA

DATE OF ISSUE - OCTOBER 23, 1967
AREA - 5, 120 ACRES

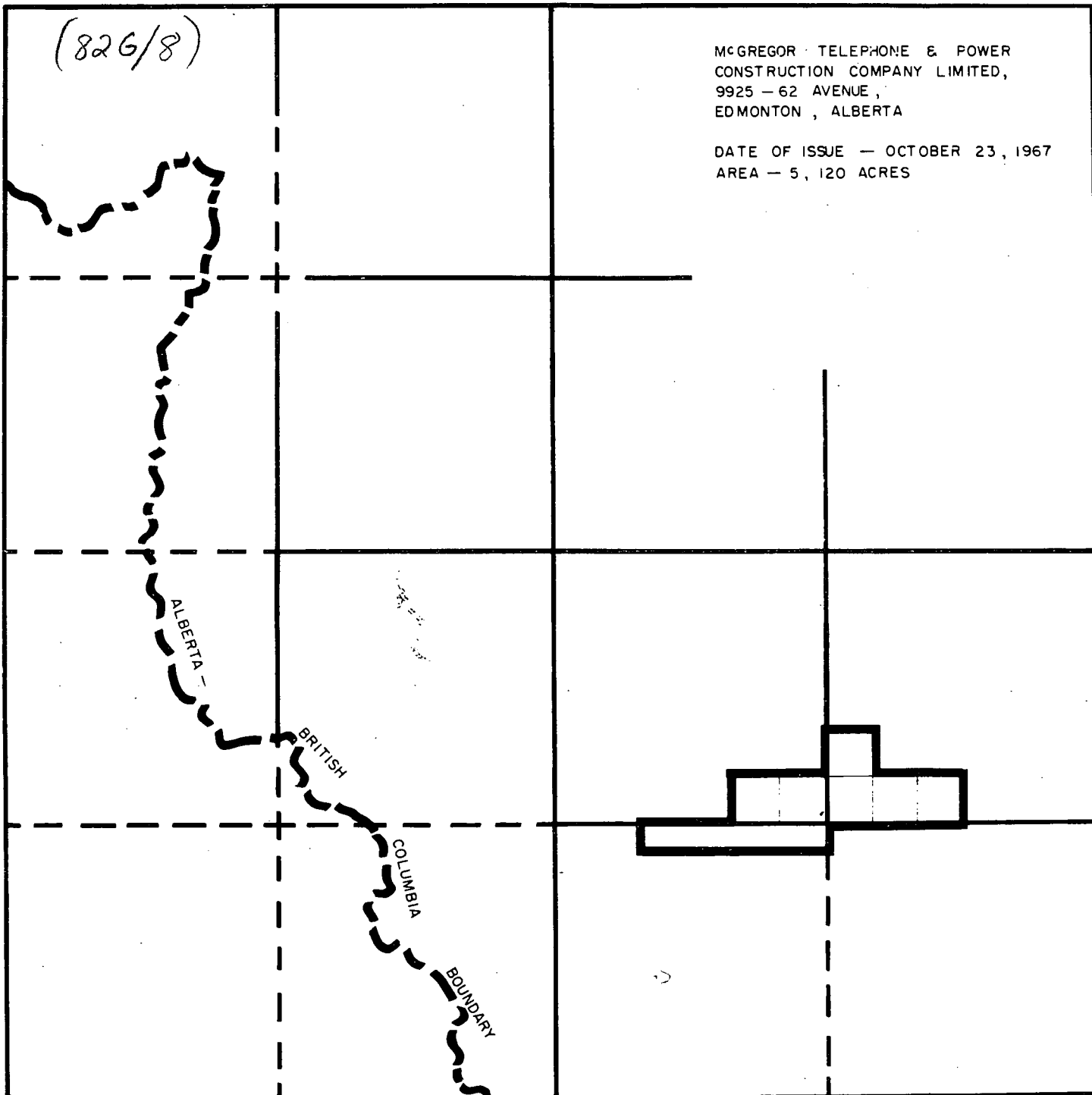
TP.

TP. 5

TP. 4

R. 3

R. 2 W 5 M.



BEAVER MINES PERMIT

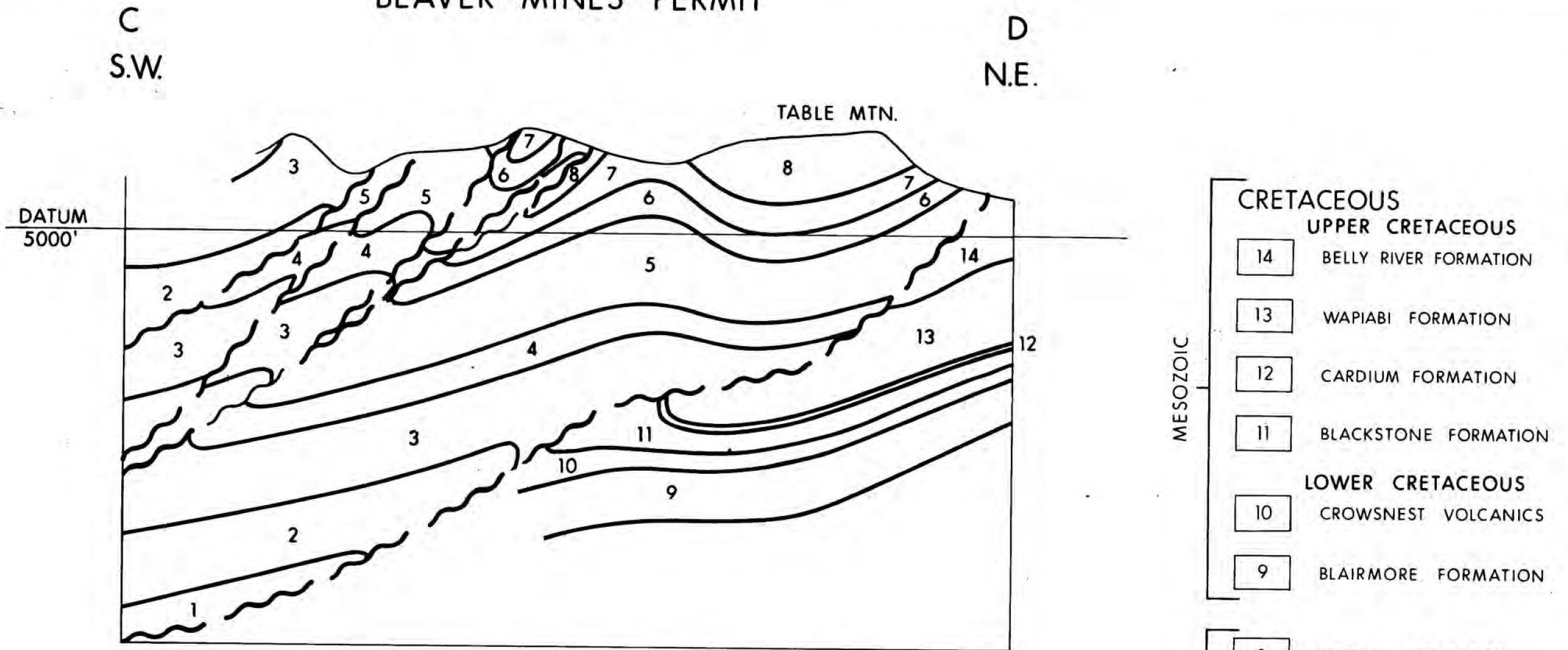


FIGURE : 6
 DIAGRAMMATIC CROSS-SECTION
 ALONG LINE C-D

BY
 ORHAN BAYKAL, P. Eng., P. Geol.

HORIZONTAL & VERTICAL
 SCALE : 2" to 1 Mi.
 JUNE 23, 1967

- | | | | |
|----------|--------------------|-----------------------|--------------------|
| MESOZOIC | CRETACEOUS | | |
| | UPPER CRETACEOUS | | |
| | 14 | BELLY RIVER FORMATION | |
| | 13 | WAPIABI FORMATION | |
| | 12 | CARDIUM FORMATION | |
| | 11 | BLACKSTONE FORMATION | |
| | LOWER CRETACEOUS | | |
| | 10 | CROWSNEST VOLCANICS | |
| | 9 | BLAIRMORE FORMATION | |
| | PRECAMBRIAN | 8 | KINTLA FORMATION |
| | | 7 | SHEPPARD FORMATION |
| | | 6 | PURCELL LAVA FLOWS |
| | | 5 | SIYEH FORMATION |
| | | 4 | GRINNELL FORMATION |
| 3 | | APPEKUNNY FORMATION | |
| 2 | | ALTYN FORMATION | |
| 1 | WATERTON FORMATION | | |

19670007

WATERTON PERMIT

A
S.W.

B
N.E.

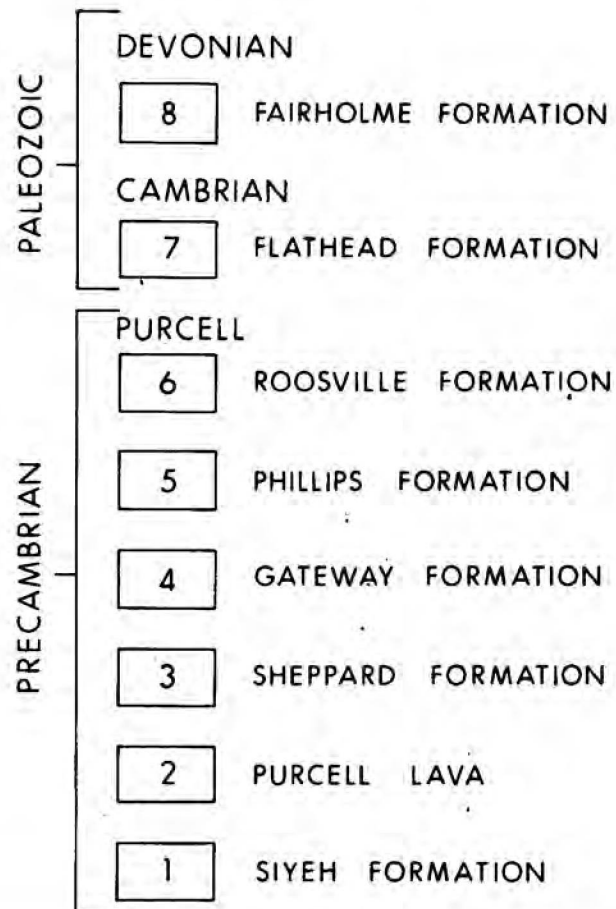
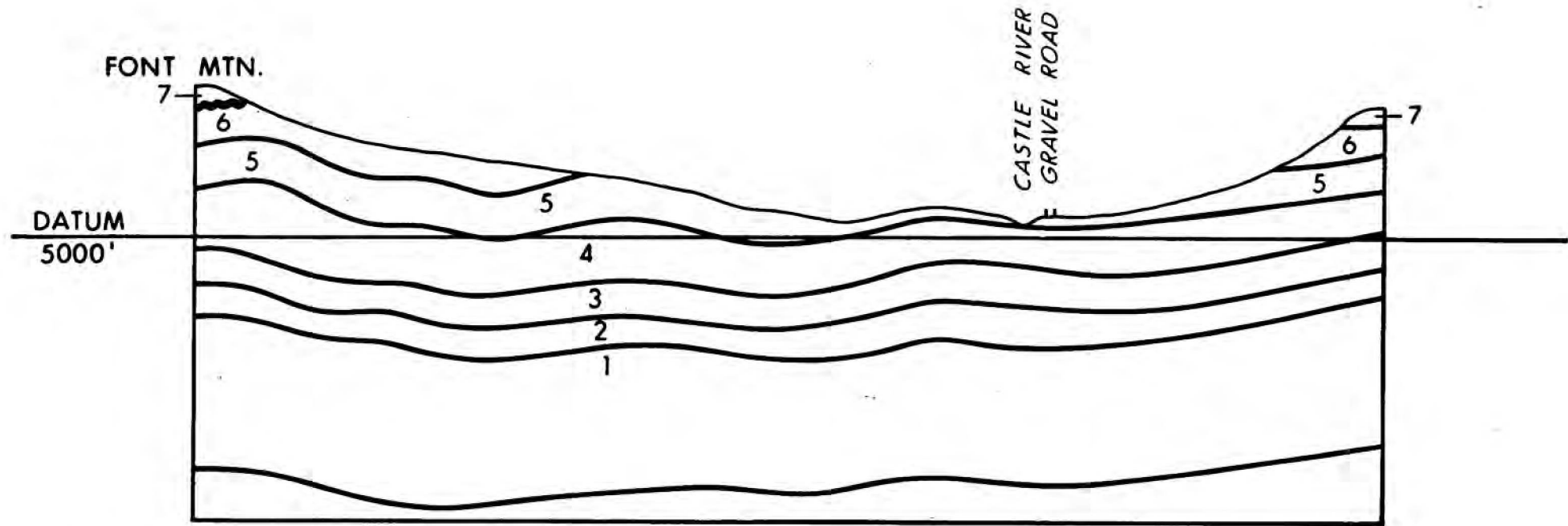


FIGURE : 7

DIAGRAMMATIC CROSS - SECTION ALONG LINE A - B

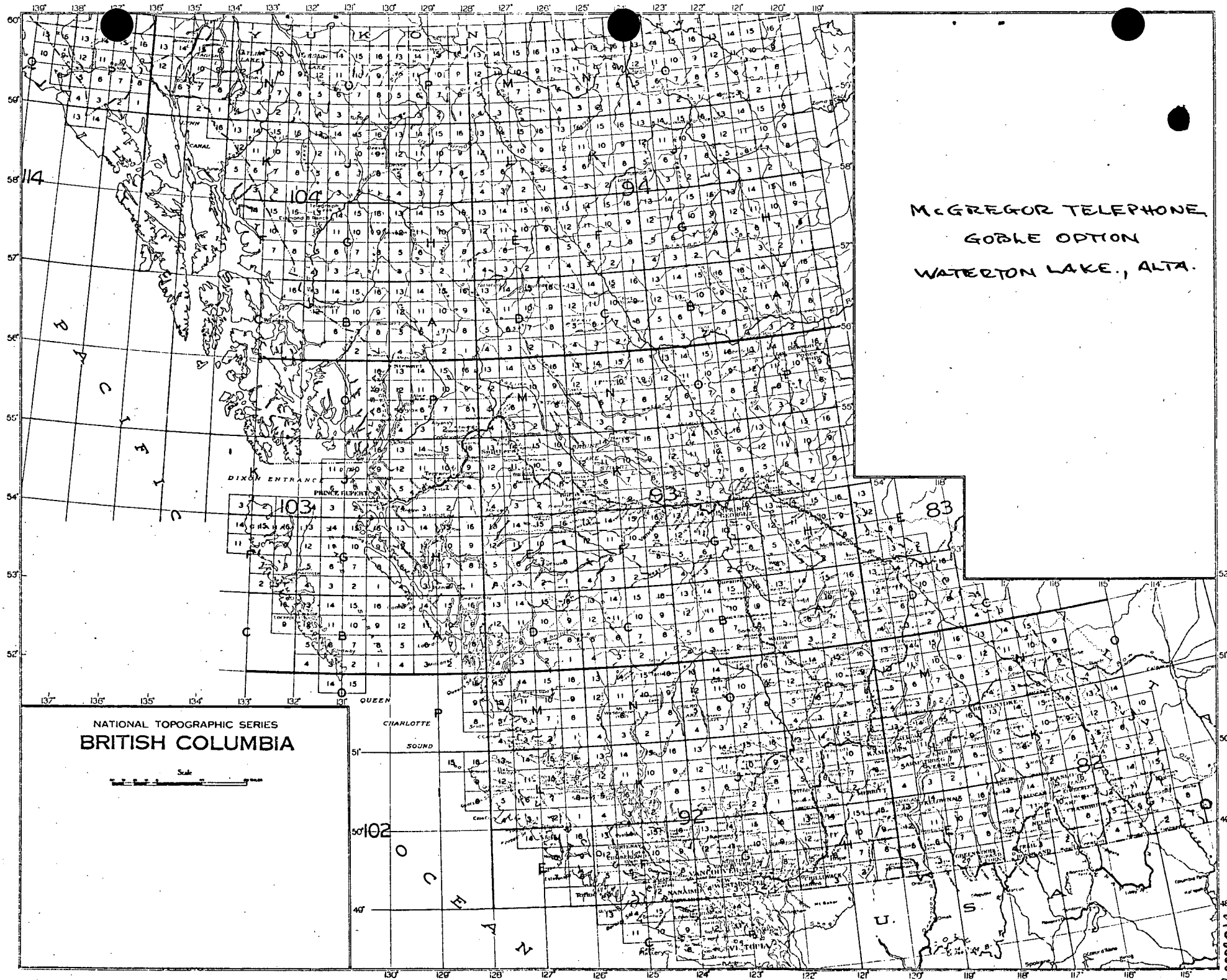
BY

ORHAN BAYKAL, P. Eng., P. Geol.

JUNE 23, 1967

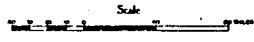
HORIZONTAL & VERTICAL
SCALE : 2" to 1 Mi.

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McGREGOR TELEPHONE
 GOBLE OPTION
 WATERTON LAKE., ALTA.

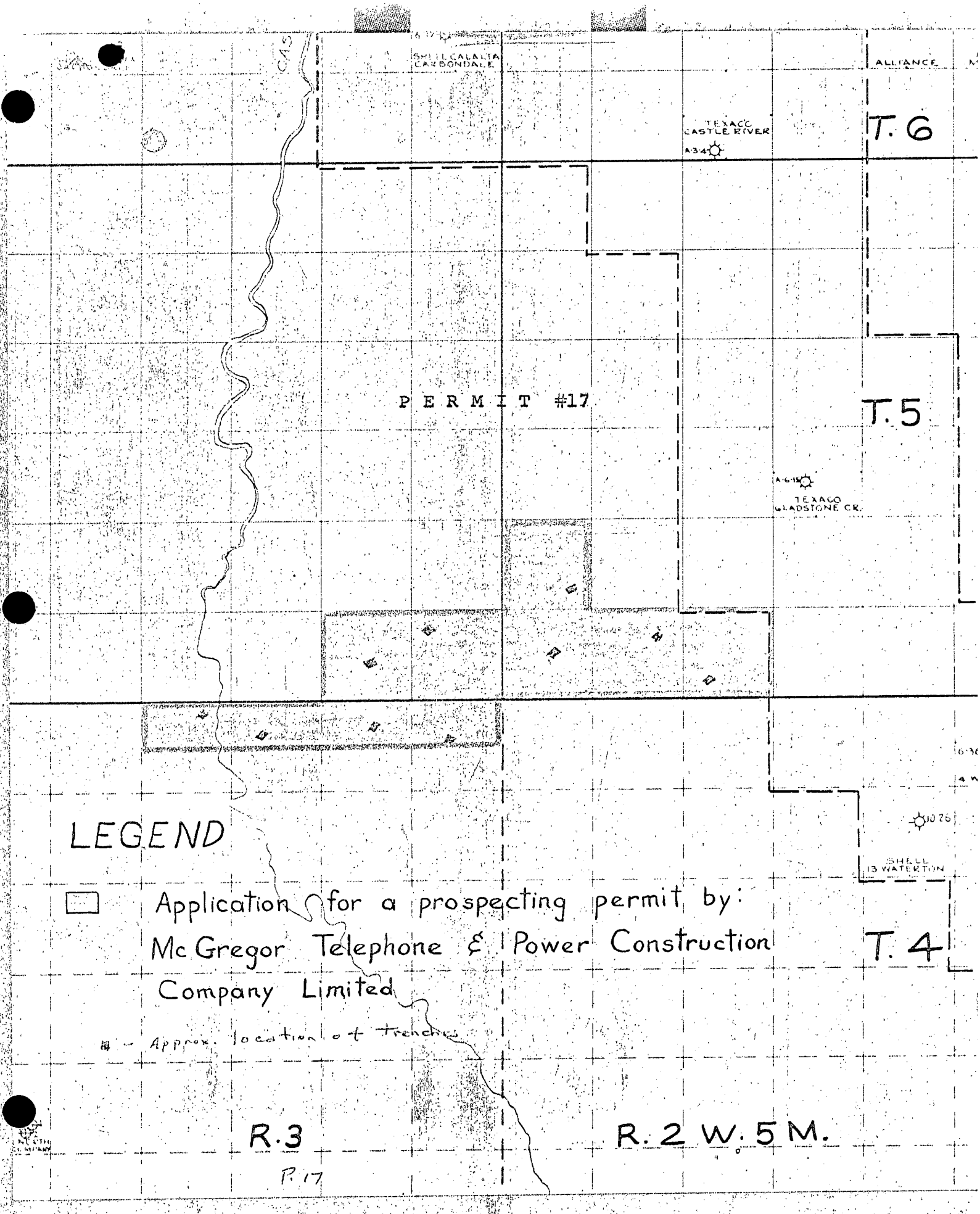
NATIONAL TOPOGRAPHIC SERIES
BRITISH COLUMBIA



102

83

Map. No. 1
 19680007



SHELL CALALTA
CARBONALE

ALLIANCE

TEXACO
CASTLE RIVER
A34

T. 6

PERMIT #17

T. 5

A-615
TEXACO
GLADSTONE CR.

LEGEND



Application for a prospecting permit by:
McGregor Telephone & Power Construction
Company Limited

- Approx. location of trenches

0075
SHELL
WATERTON

T. 4

R. 3

R. 2 W. 5 M.

R. 17

SHELL
12 WATERTON

SHELL
7 WATERTON

P E R M I T #16

T.3

T.2

T.1

LEGEND

□ Application for a prospecting permit by:
Mc Gregor Telephone & Power Construction
Company Limited.

■ Approx. location of trenches.

PROVINCE

OF

R.3

BRITISH COLUMBIA

R.2

WATERTON

R.1 W.5M.

70009261