

FT. MCPHERSON, N.W.T.

GEOLOGICAL REPORT

PERMITS 692 & 693

PEEL PLATEAU AREA

YUKON TERRITORY

Prepared for:

HONOLULU OIL CORPORATION

by

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ABSTRACT

Surface geological studies conducted in the area surrounding Permits 692 and 693 during the summer field season of 1958 were designed to provide detailed stratigraphic information of geologic sections which are expected to underlie these permits. Two important facies changes and a possible unconformity were noted as a result of the survey. Bitumen deposits, which were mapped by earlier surveys in the vicinity of Peel Anticline, are conspicuously absent from sections studied in other localities and hence have added significance. Additional surface stratigraphic studies would be valuable before embarking upon a drilling program. A work program to include additional detailed stratigraphic studies and drilling program is recommended.

INTRODUCTION

General Statement

Permits 692 and 693 enclose most of Peel River Anticlinal Structure. The permit areas and Peel River Anticline have been studied on two previous occasions. Information obtained during those studies is contained in two separate reports as follows:

"Geological Report on Permits 692, 693, 694, 695, 696, 697, & 698 Peel River Area, Yukon Territory" by D. B. Bullock, March 1954.

"Geologic Report, Yukon Territory, Permits 692 and 693. March 1958, by Dr. R. D. Hughes.

The reader is referred to the first of these reports for general information concerning accessibility, climate, topography, history of exploration, and general geological data. The second report referred to above contains detailed stratigraphic information obtained through studies of bedrock exposures in Lower Peel Canyon and in the vicinity of Margery Dome. Detailed structural data concerning Peel River Anticline was obtained from plane table traverses and is set out in Dr. Hughes report referred to above.

The survey carried out during the summer of 1958 and reported herein, was designed to provide stratigraphic detail of Paleozoic formations in areas adjacent to Permits 692 and 693. The data derived from this study

is vital to the evaluation of the subsurface of these two permits. This report sets out the information obtained during the survey.

Type and Method of Survey

The geological survey, which was conducted in connection with the evaluation of Permits 692 and 693, commenced on August 13th from a base camp established on Margaret Lake. Work on the project was carried out in conjunction with work on Permits 1416 to 1422 inclusive, and the overall project continued in the field until September 22, 1958. Initial studies were concentrated in the Mackenzie Mountains to the south of the permits where geologic sections are exposed at altitudes which are subject to early snowfall. Subsequent studies were moved to sections at lower altitudes.

Techniques employed in the survey, involved the use of a two-man and sometimes a three-man fly camp to study the detailed stratigraphy of selected sections. These fly camps were set out and serviced by helicopter (or fixed wing aircraft where possible). The general aerial distribution of the strata was mapped by the writer as an aid to the selection and interpretation of the inter-relationship of sections to be studied.

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Acknowledgements

The writer wishes to acknowledge with thanks the assistance given him by the survey crew which consisted of four geologists (Dr. Robert Greggs, Nels Meyers, Don Hamling, and Marshall Hironaka), helicopter pilot Evan Bullock, helicopter assistant engineer Curtiss Bullock, Norseman pilot and helicopter engineer Eduard Amann, and cook Glenn Goodland. Special thanks are given to Dr. Greggs whose conscientious stratigraphic studies and fossil identifications assisted greatly in the success of the survey.

The writer also wishes to acknowledge the assistance afforded the survey party by the merchants and residents of Ft. McPherson and Dawson City in the matter of supplies and accomodations. The party enjoyed the visit of N. W. Taylor, chief geologist of Honolulu Oil Corporation who gave helpful direction during his short stay at base camp.

The survey was under the direct supervision of D. Bruce Bullock, P. Eng.

GEOLOGYSTRATIGRAPHY

A thick series of sedimentary rocks are believed to underlie Permits 692 and 693. Strata of Cambrian, Ordovician, Silurian, Devonian, Cretaceous, and Tertiary ages were studied at exposed sections south of the permits. Each of these groups are discussed in detail in this report. Detailed lithologic descriptions of all measured sections are contained in Appendix "A" of this report.

CAMBRIAN

Cambrian strata are exposed along the valley walls of Noisy Creek beyond the southern boundary of Permits 692 and 693. These strata also crop out south of the permits in Knorr Range. Cambrian quartzites form the bedrock which underlies much of the area southwest of the permits.

No attempt was made to sub-divide the Cambrian which is comprised of quartzites, slatey shales, conglomerate, limestones, and dolomites. The upper beds are exposed on Noisy Creek and these beds are briefly described as follows:

Sandstone, light grey to brown, medium grained, well bedded, containing small grains rusty material which leaches out giving appearance of good porosity, interbedded with shale, grey,

slatey, hard, a few quartz veinlets throughout. Underlain by conglomerate, quartzitic, very hard, with boulders up to 8 inches across, composed of rounded quartzite of various colors.

Cambrian strata are overlain by Ordovician strata with angular unconformity. Extensive exposures in the Knorr Range suggest an estimated thickness of more than 10,000 feet of Cambrian strata. Although detailed studies were not undertaken, largely because of the limited amount of time available, these strata are not considered to have any potential value with respect to the generation or accumulation of hydrocarbons.

ORDOVICIAN

An Ordovician age has been given to a series of black limestones and shales which unconformably overlie Cambrian quartzites and conglomerates. These strata are exposed on Noisy Creek where they were studied by Nels Meyers and Marshall Mironaka who used a rubbly dingy to traverse the creek.

The lower boundary of the Ordovician has been set at the top of the sandstone sequence described under the section on Cambrian. The contact between Cambrian and Ordovician at this locality appears to be conformable but elsewhere in the area the writer has found that generally the relationship between these two groups is one of angular unconformity. Ordovician strata can be briefly described as follows:

Shale, black, platy, graptolitic with occasional black limestone interbeds; underlain by limestone black, dense to cryptocrystalline with interbeds of black shale and black chert.

A detailed description of Ordovician strata, as exposed on Noisy Creek, is contained in Appendix "A" of this report.

The upper boundary of the Ordovician is apparently conformable. A total thickness of 1820 feet is present in the Noisy Creek section.

SILURIAN

The base of the Silurian section exposed on Noisy Creek has been arbitrarily placed at the base of a series of limestone conglomerate beds. The strata assigned a Silurian age are only partially exposed on Noisy Creek. The upper beds are covered. A generalized lithologic description of these beds is as follows:

Limestone and dolomite, dark grey, lithographic to cryptocrystalline, interbedded with shale grey fissile, calcareous hard. Several thin conglomerate beds at base of section.

A detailed lithologic description of these strata is set out in Appendix "A" of this report.

The lower boundary of the Silurian strata appears to be conformable with underlying Ordovician strata although the conglomerate beds would seem to indicate some type of hiatus between these two horizons. The significance of the

conglomerate is not apparent from the study to date.

The total thickness of the Silurian section is estimated to be 1500 feet of which only the lower 352 feet were studied in detail. The upper contact, between Silurian and Middle Devonian, is believed to be conformable.

DEVONIAN

Fossils collected during the study of Permits 692 and 693 indicate the presence of Lower, Middle, and Upper Devonian strata within the mapped area. The exposures studied are located on Noisy Creek.

Lower Devonian

A limestone conglomerate which overlies Silurian strata is believed to be Lower Devonian in age and may be the stratigraphic equivalent of the Bear Rock formation. This conglomerate was first mapped by Stelck, during the Canol Project, at a location at the lower end of the Peel River Canyon. The conglomerate was mapped by Stelck as lying at the base of the Fort Creek formation whereas it actually lies below the Bumparts formation and has been faulted into its position at the Peel Canyon.

The conglomerate has been mapped as Bear Rock equivalent in this report. It crops out at map location E588-19-1. Elsewhere in the permit area it is not recognized as a conglomerate but as massive limestones. The

conglomerate is only about 50 feet thick. The shale beds immediately underlying the conglomerate are believed to be Devonian in age and have been included in the Lower Devonian sequence. Both the upper and lower boundaries are believed to be conformable. The significance of the conglomerate is not clear on the basis of work done to date.

Middle Devonian

A thick series of grey, soft, calcareous shales with interbeds of rubbly limestones constitute the rock assemblage herein assigned a Middle Devonian age. These strata are believed to be the stratigraphic equivalent of the Ramparts formation.

The base of the Middle Devonian is placed at the top of the massive limestones or conglomerates which have been described under the heading Lower Devonian. The contact appears to be conformable. The upper boundary is placed at the base of a black, platy shale sequence. This contact appears to be conformable. Good exposures of Middle Devonian were mapped along Noisy Creek and at map location B589-20-11.

The strata of Middle Devonian age, like those of Lower Devonian age, are tight and appear to be singularly lacking in any vestige of porosity. These beds do, how-

ever, possess good source and cap rock characteristics. A total thickness of 2500 feet is estimated.

Upper Devonian

Strata of Upper Devonian age can be readily subdivided into two formations:

Imperial Formation

Fort Creek Formation

The Fort Creek Formation, as discussed in this report, is believed to be the stratigraphic equivalent of the type section of the Fort Creek Formation in the Norman Wells area. It is composed of a thick series of black, platy, shales with few black limestone interbeds. Both the upper and lower contacts appear to be conformable. The upper contact between Fort Creek shales and Imperial sandstones is gradational. There is an estimated total thickness of 1000 feet of these shales present in the mapped area.

Imperial Formation

Sandstones, in part continental and in part marine, crop out along the Peel River in the vicinity of Calamites Creek and on Noisy Creek. These strata are thinly bedded and in part lensing to cross bedded. They exhibit no reservoir characteristics where studied. The sandstones

are argillaceous and hard.

Imperial sandstones are unconformably overlain by shales and sandstones of Pennsylvanian age at two separate map locations along Noisy Creek. The lower contact with Fort Creek formation shales is conformable and gradational. Typically, the Imperial formation is composed of Sandstone, light grey, hard, thinly bedded with some interbeds of shale dark, grey, hard, and sandy. The upper beds of the Imperial formation often carry wood fragments and ironstone nodules indicative of a continental environment of deposition for those beds. The lower strata of the Imperial formation are almost surely marine.

The total thickness of these beds is estimated to be 200 feet in the area of the permits.

PENNSYLVANIAN

Shales and sandstones of Pennsylvanian age crop out at two separate and isolated localities along Noisy Creek. The best exposure of these beds occurs at map location 589-20-3 where about 50 feet of sandstones are exposed in the valley wall of the creek. The exposed section is described as follows:

<u>10 feet</u>	Sandstone, light buff, light brown weathering, very fine grained and in part silty, thinly bedded with numerous irregular shale partings.
<u>10 feet</u>	Sandstone as above and becoming massive bedded. Underlain by a thin coaly shale seam.

30 feet Shale, dark grey, clayey, very sandy, heavily iron stained and containing numerous ironstone nodules and lenses. Few ripple marked sandstone beds.

The age of these strata is established from their stratigraphic position and the presence in the sandstone members of the fossil tree Stigmaria.

A sandstone and conglomerate bed which crops out at map location E588-17-3 is also believed to be of Pennsylvanian age although no fossils were found. The lithologic character of the sandstone is the only reason for this tentative age assignment, because its stratigraphic relationship to other outcroppings of either Pennsylvanian or Cretaceous ages is obscure. The sandstone is clean and porous, however, and warrants additional study.

The presence of Pennsylvanian beds in this area is unique. The outcrops studied are apparently isolated erosional remnants as their aerial distribution does not appear to be extensive. Additional detailed studies of the outcrops and contiguous areas may provide additional data which would permit the field geologist to recognize other outcrops of Pennsylvanian strata. The porosity evident at map location E588-17-3 justifies additional studies on the distribution of the Pennsylvanian in this area so as to better predict its potential in areas where adequate Cretaceous cover exists.

CRETACEOUS

Strata of Cretaceous age can be divided into three main lithologic units:

Upper Sandstone

Middle Shale

Lower Sandstone

Of the three, only the Middle Shale unit was studied in any detail whereas the others were given only a cursory examination.

The Lower Sandstone unit crops out in the area south of the permits. It consists of a series of hard, well indurated sandstones, some of which are conglomeratic, with shale interbeds. There were no reservoir characteristics noted. The relationship of this Lower Sandstone unit to the Pennsylvanian strata is not known. Detailed studies should be programmed to include an evaluation of that relationship. This sandstone unit is about 1500 feet thick and is probably Lower Cretaceous in age.

The Middle Shale unit of the Cretaceous crops out over most of the area east of the Trevor Range. Strata making up this unit are described as:

Shale, dark grey, brownish weathering, thinly bedded, soft, with numerous thin siltstone bands and lenses.

Some isolated sandstones of limited areal extent are known to develop in the lower portion and again in the

in the upper portion. The Middle Shale unit is about 2000 feet thick and is believed to be Lower Cretaceous in age.

The Upper Sandstone unit is composed of thinly bedded - lensing continental sandstones. These sandstones may be Upper Cretaceous in age. They are about 300 feet thick. No unconformities were noted in the Cretaceous section. These sandstones cap the Trevor Range.

TERTIARY

Poorly consolidated sandstones and clays which carry coal seams up to 18 inches thick, overlie Cambrian and Ordovician strata in the map area. These beds are Tertiary in age but are of no economic value to the purposes of this study.

QUATERNARY

Glacial boulder clays have been deposited over most of the area. In some creek bottoms along the northern side of the Trevor Range, huge granite boulders up to 10 feet across have been deposited by glacial action. Glacial erratics are present on the tops of most ridges.

The thickness of the glacial till in the map area varies from zero to 150 feet.

STRUCTURAL GEOLOGY

The structural geology of Permits 692 and 693 has been studied in detail by previous survey crews and the results of these studies are contained in reports by Bullock (March 1954) and Hughes (March 1958). The reader is referred to the above reports for details of the structural geology of the permits. The study herein reported does little to alter the structural pattern within Permits 692 and 693 as outlined in those reports. A clearer understanding of the extension of Solo Creek Fault was obtained during the survey. The southern extension of the fault has been traced into the Trevor Range where it remains a thrust fault associated with the Richardson Mountains uplift.

CONCLUSIONS AND RECOMMENDATIONS

Results of the survey of the area adjacent to Permits 692 and 693 prove the presence of good source, reservoir and cap rock strata within the map area. Reservoir horizons exposed in the Mackenzie Mountains south of the permits are present in the Ordovician, Silurian, and Lower Devonian sections. Of these porous horizons, only the Silurian retains its porosity into the area contained by Permits 692 and 693. However, in the area of these permits the Ordovician and the Lower part of the Silurian section have become marine shales which afford excellent source rock materials for the overlying Silurian reef horizon.

The writer recommends that additional surface studies be programmed for the summer of 1959. The presence of bitumen in bedrock exposures in the vicinity of Peel Anticline coupled with the known presence of source, reservoir and cap rock strata underlying this anticline, makes Peel Anticline a good prospect for oil accumulation. If recommended surface surveys continue to support the evidence presented herein, a slim hole drilling program would be warranted on Peel Anticline.

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Appendix "A"
Detailed Lithologic Descriptions

MOISY CREEK SECTION NO. 1

Date: September 8, 1958.

Weather: Cloudy.

Measured by: N. A. Meyers, M. Hironaka.

<u>Unit</u>	<u>Thick</u>	<u>Description</u>	<u>Total</u>
1	72'	Dolomite black to dark grey, lithographic tight, thinly bedded, platy, weathers grey buff and dark grey, alternating slightly limy, very argillaceous in part, shaly.	72'
2	21'	Dolomite black, lithographic, tight, very thinly bedded, platy, limy, weathers buff. Slight folding and faulting on south flank of anticline. Covered interval.	93'

MOISTY CREEK SECTION NO. 2

Date: September 9, 1958.
 Weather: Cloudy.
 Measured by: W. A. Myers, K. Mironaka.

<u>Unit</u>	<u>Thick</u>	<u>Description</u>	<u>Total</u>
1	3.5"	Started section in core of anticline after covered interval. Dolomite dark grey to black, lithographic, argillaceous, tight, thinly bedded, well jointed, slightly limy. Strike N 45° W, Dip 15° NE	3.5"
2	6"	Shale-blocky, slightly limy, pyrite nodules, some calcite thinly bedded, platy.	6.5"
3	3"	Dolomite black, lithographic tight, massive, trace of pyrite, slightly limy and argillaceous, thickly bedded.	12.5"
4	12"	Same as unit 2.	24.5"
5	40"	Same as unit 3 with thin black shale interbedded Fossil - Lingula in Talus. Linguloid brach. fragment, Ord. - Perm.	64.5"
6	10"	Covered	74.5"
7	4"	Shale, black, platy, very limy.	78.5"
8	1.5"	Dolomite, same as unit 3.	80"
9	10"	Shale, same as unit 2.	90"
10	6"	Dolomite same as unit 3 with thin shale (black) interbeds.	96"

(3)

<u>Unit</u>	<u>Thick</u>	<u>Description</u>	<u>Total</u>
11	35'	Dolomite, same as unit 3, buff-yellow weathering. Fossil in talus, Linguloid brach. - Ord.-Perm.	131'
12	10'	Covered (estimated).	141'
13	15'	Shale as in unit 2 with thin dolomite band, as in unit 3.	156'
14	30'	Limestone dark grey, lithographic, tight, argillaceous at base of unit. Fault gouge material, fault cannot be ascertained.	186'
15	3'	Limestone, dark grey to black, lithographic, argillaceous, thin to medium bedded.	189'
16	9'	Shale, dark grey to black, thin bedded, very limy.	198'
17	40'	Limestone dark grey to black, same as unit 15, alternating thick and thin beds.	238'
18	8'	Limestone dark grey to brown, lithographic, thin bedded, well jointed, weathers brown and dark grey, much iron stain, argillaceous	246'
19	82'	Limestone dark grey, lithographic, thinly bedded, trace of dissemination pyrite, argillaceous.	328'
20	8'	Covered interval.	333'
21	8'	Dolomite black, lithographic, tight, slightly limy, argillaceous, thinly bedded, well jointed, massive.	341'
22	59'	Limestone dark grey, cryptocrystalline, tight argillaceous, very thinly bedded, platy.	400'
23	30'	Limestone dark grey to black, lithographic, thick bedded with few	

<u>Unit</u>	<u>Thick</u>	<u>Description</u>	(4)	<u>Total</u>
		thin bedded bands, argillaceous, trace of pyrite.		430'
24	15'	Limestone, dark grey to black, lithographic, very thinly bedded, platy, argillaceous.		445'
25	50'	Covered.		495'
26	15'	Dolomite dark grey to black, lithographic, medium bedded, slightly limy, well jointed, argillaceous.		510'
27	5'	Limestone black, lithographic, very thinly bedded, platy, argillaceous.		515'
28	43'	Limestone dark grey, lithographic, medium bedded, argillaceous, with shaly interbeds.		558'
29	8'	Limestone dark grey, lithographic, very thinly bedded, argillaceous, well jointed.		565'
30	25'	Covered.		591'
31	14'	Dolomite dark grey, lithographic, thick bedded, argillaceous, well jointed.		605'
32	68'	Limestone, dark grey, lithographic, is very thinly bedded, in part shaly, thin black chert bands, near top of interval.		673'
SEPTEMBER 10, 1958 VERY CLOUDY.				
33	17'	Shale dark grey, fissile to platy, slightly calcareous, soft, abundant galena veins, minor interbeds of black thin bedded dolomite.		690'
34	13'	Dolomite dark grey to black, lithographic, thinly bedded, hard, thin bands of blocky chert, alternating with thin bands of black fissile shale, abundant pyrite.		703'
35	61'	Shale dark grey fissile, slightly		

<u>Unit</u>	<u>Thick</u>	<u>Description</u>	<u>Total</u>
		calcareous, thin band of black chert.	784'
36	5'	Dolomite black, thinly bedded, lithographic, slightly limy, argillaceous tight.	789'
37	110'	Shale, same as unit 35.	899'
38	30'	Covered, probably shale, same as unit 35.	949'
39	18'	Limestone black, lithographic, thinly bedded, very shaly with interbeds of shale.	967'
40	10'	Dolomite black, lithographic, medium bedded, interbedded with shales.	977'
41	63'	Shale black, fissile, slightly calcareous, trace of pyrite.	1040'
42	15'	Dolomite black, lithographic, thinly bedded, numerous pyrite nodules, interbedded with black fissile calcareous shales.	1055'
43	125'	Covered (probably black fissile calcareous shales).	1180'
44	55'	Shale dark grey to black fissile, slightly calcareous. Tetragraptus terexacum-(L.Ord.?) Ord. at least Tetragraptus sp. Ordovician.	1235'
45	15'	Shale, same as unit 44 with pyrite nodules Graptolite fragments - unidentifiable with any certainty, but very probably Ordovician in age. Linguloid sp. Ord.-Perm.	1250'

<u>Unit</u>	<u>Thick</u>	<u>Description</u>	<u>Total</u>
46	5'	Dolomite dark grey, lithographic, to crypto-crystalline, medium bedded, black chert bands.	1255'
47	75'	Shale black to dark grey, fissile, slightly calcareous. Strike N 30° W, Dip 20° N	1333'
48	35'	Covered.	1398'
49	48'	Shale, dark grey, fissile, slightly calcareous.	1438'
50	13'	Dolomite black, lithographic, thickly bedded, with thin shales, interbeds well jointed with calcite veins throughout.	1451'
51	58'	Shales black, fissile to blocky, slightly calcareous.	1509'
52	80'	Shale black fissile to blocky, slightly calcareous, interbedded with Dolomite, dark grey to black, thinly bedded, lithographic.	1589'
53	120'	Shale black, fissile in part blocky, slightly calcareous.	1709'
54	125'	Chert black, hard, blocky, with thin shale stringers.	1834'
55	1'	Shale black, fissile, weathers brown. CONTACT BETWEEN ORDOVICIAN AND SILURIAN.	1835'
56	34'	Conglomerate, consisting of boulders of black chert, Quartzite and Dolomite.	1869'
56	5'	Limestone grey, crypto-crystalline, thinly bedded, interbedded with black fissile shales.	1874'
57	10'	Conglomerate boulder conglomerate consisting of black dolomite and quartzite.	1884'

<u>Unit</u>	<u>Thick.</u>	<u>Description</u>	<u>Total</u>
58	25'	Shale black fissile, slightly calcareous, thinly interbedded with limestone (grey).	1909'
59	20'	Limestone, black, lithographic, thinly bedded, argillaceous, interbedded with black hard chert.	1929'
60	15'	Limestone, black, lithographic, medium bedded with thin interbeds of black chert.	1942'
61	10'	Limestone grey to dark grey, crypto-crystalline to fine crystalline, slightly argillaceous, thin shaly interbeds upper part very fossiliferous, almost a coquina.	1952'
62	70'	Limestone grey to dark grey, crypto-crystalline, medium bedded, to thin bedded, argillaceous.	2022'
63	50'	Covered (estimated).	2072'
64	25'	Bolomite grey to dark grey, lithographic, hard, thick bedded, may be siliceous, interbedded with black fissile shales. 1½' thick beds.	2097'
65	5'	Mudstone light brown, soft, limy.	2102'
66	5'	Limestone grey, lithographic to crypto-crystalline, medium bedded, weathers buff, interbedded with mudstone as in unit 65.	2107'
67	2'	Conglomerate, pebble, consisting of dark grey, lithographic limestone and fine grained grey limestone, abundant calcite.	2109'
68	6'	Bolomite as in unit 64 interbedded with grey fissile calcareous shale.	2115'
69	1'	Limestone, coquina very fossiliferous Fossils: Productid Brachiopod	2116'

(8)

<u>Unit</u>	<u>Thickness</u>	<u>Description</u>	<u>Total</u>
70	5'	Limestone gray, finely crystalline to crypto-crystalline, thinly bedded, tight.	2121'
71	5'	Shale gray fissile to blocky, slightly calcareous.	2130'
72	15'	Limestone dark gray, crypto-crystalline, argillaceous, interbedded with shale dark gray fissile, calcareous.	2145'
73	52'	Shale dark gray fissile, calcareous.	2197'

Appendix "B"
Photographs



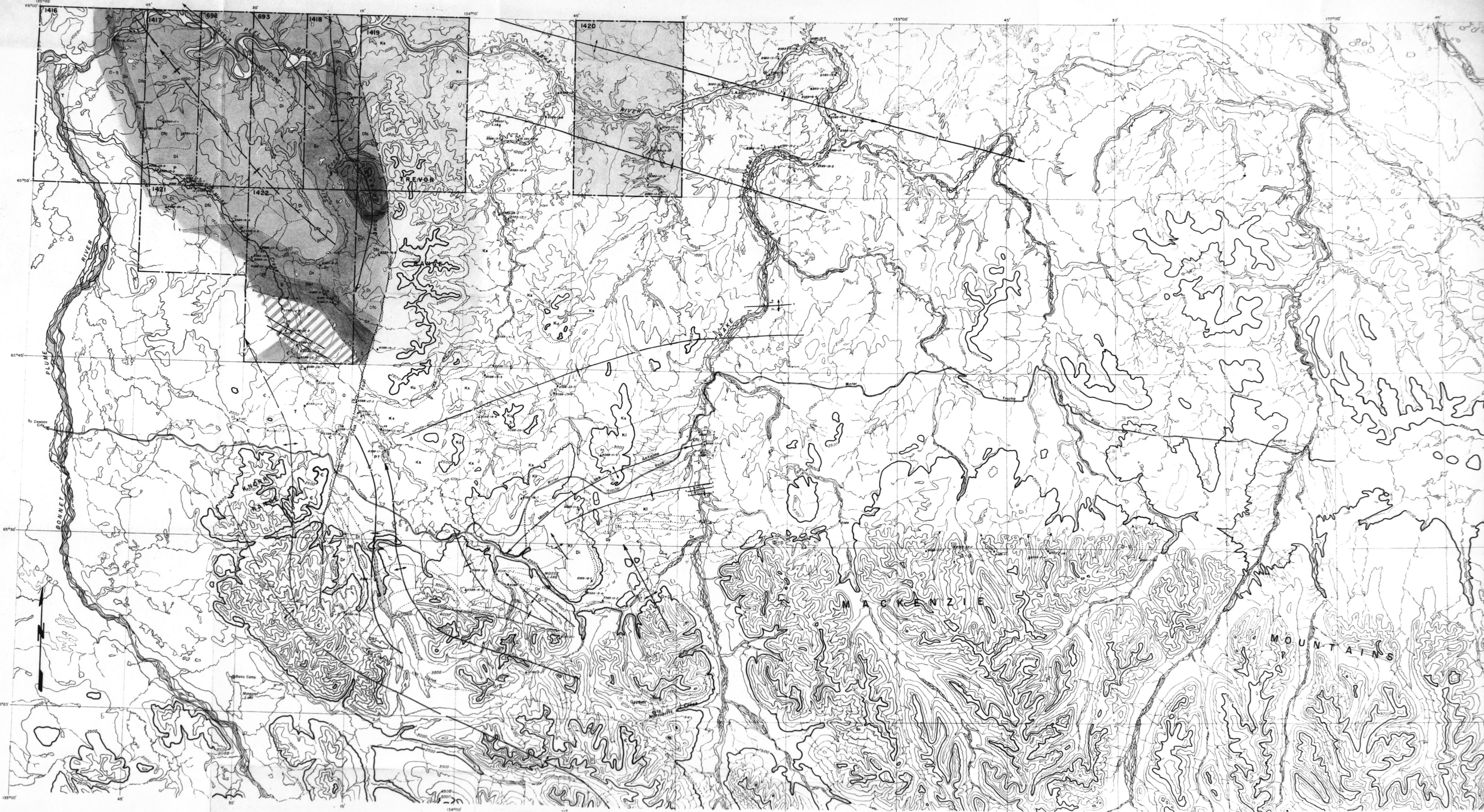
KNORR RANGE FROM BASE CAMP



RUBBER DINGY TRANSPORTED BY HELICOPTER



WINTER TRACTOR ROAD



PRELIMINARY GEOLOGICAL MAP
PERMITS 692 & 693

PEEL PLATEAU AREA, YUKON TERRITORY
Scale: 1 inch to 2 miles

March, 1959

MAP No. C58-9

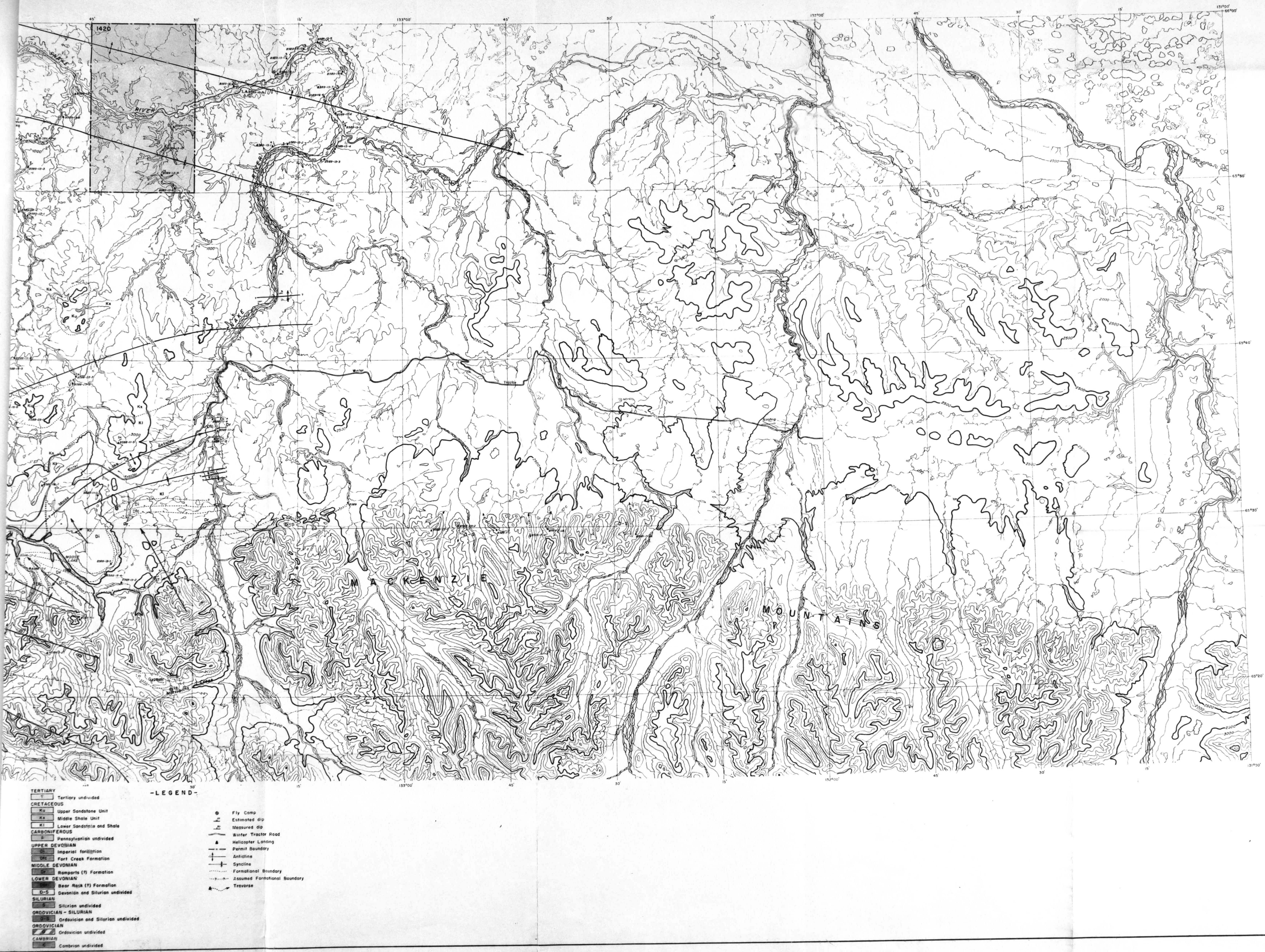
BULLOCK, HUGHES & TILMAN LTD.
Consulting Geologists

60-16-1

TERTIARY	Territory undivided
CRETACEOUS	
Ku	Upper Sandstone Unit
Ki	Middle Shale Unit
P	Lower Sandstone and Shale
CARBONIFEROUS	
P	Pennsylvanian undivided
UPPER DEVONIAN	
Di	Imperial formation
Df	Fort Creek Formation
MIDDLE DEVONIAN	
Dr	Romperts (?) Formation
LOWER DEVONIAN	
Br	Bear Rock (?) Formation
D-S	Devonian and Silurian undivided
SILURIAN	
S	Silurian undivided
ORDOVICIAN - SILURIAN	
O	Ordovician and Silurian undivided
ORDOVICIAN	
O	Ordovician undivided
CAMBRIAN	
C	Cambrian undivided

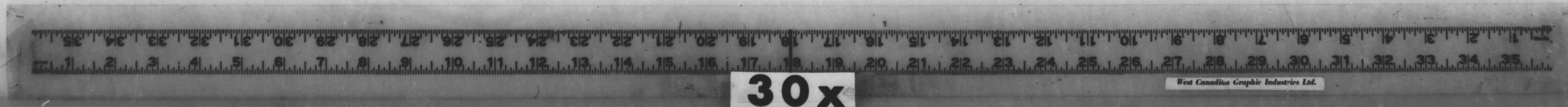
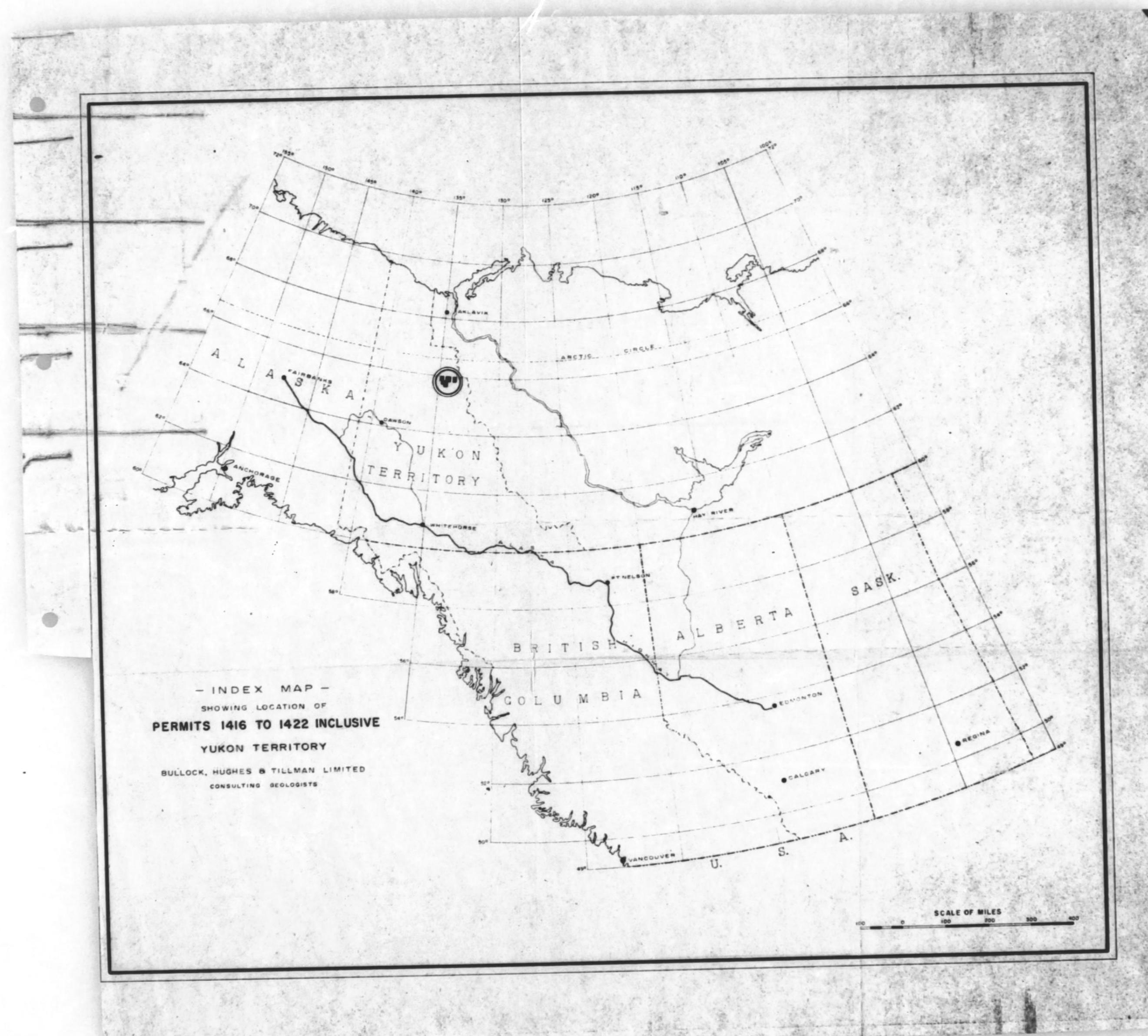
-LEGEND-

- Fly Camp
- Estimated dip
- Measured dip
- Bitter Tractor Road
- ▲ Helicopter Landing
- Permit Boundary
- Anticline
- Syncline
- Formation Boundary
- Assumed Formation Boundary
- Traverse



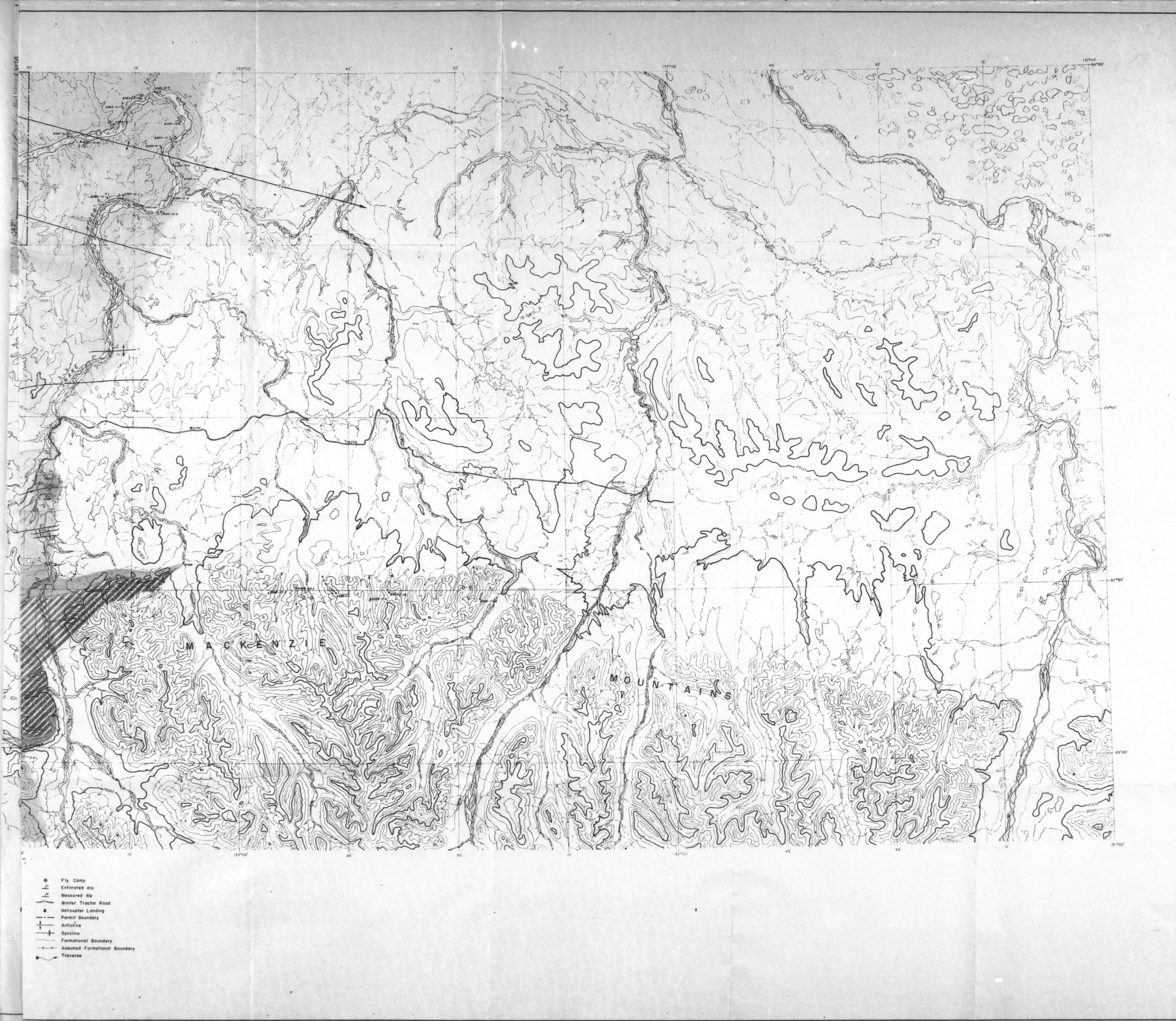
30x

West Canadian Graphic Industries Ltd.

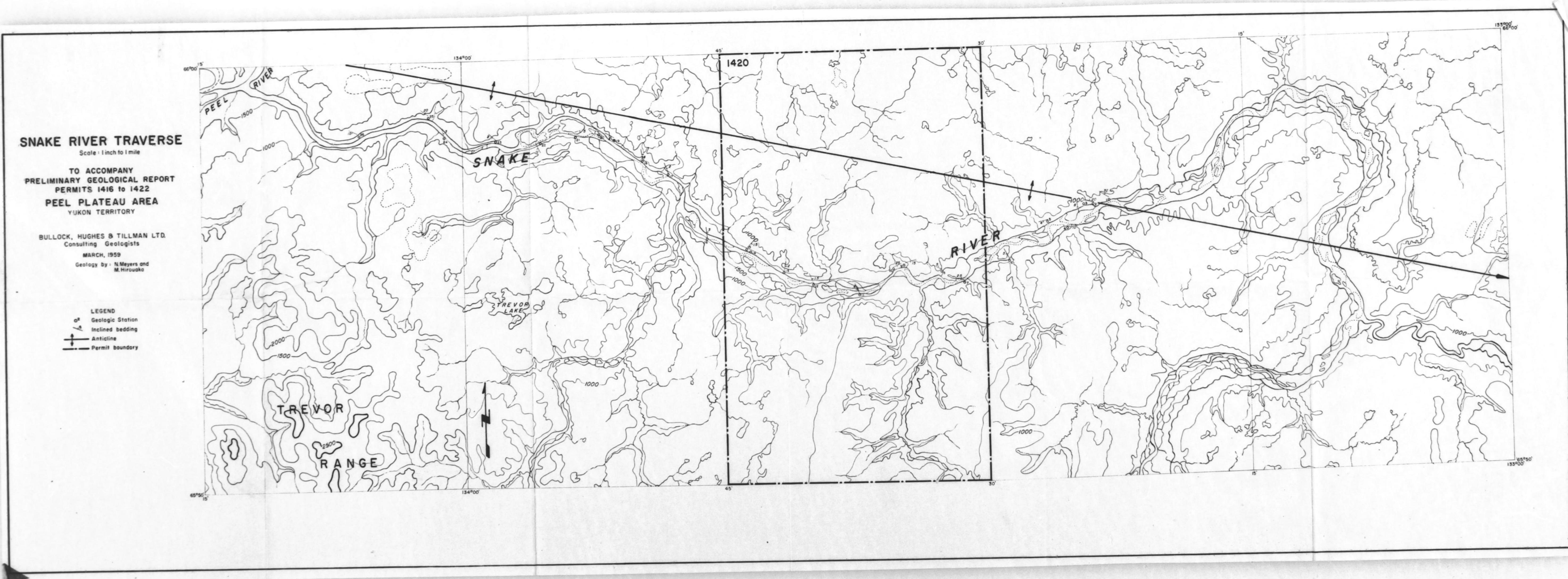


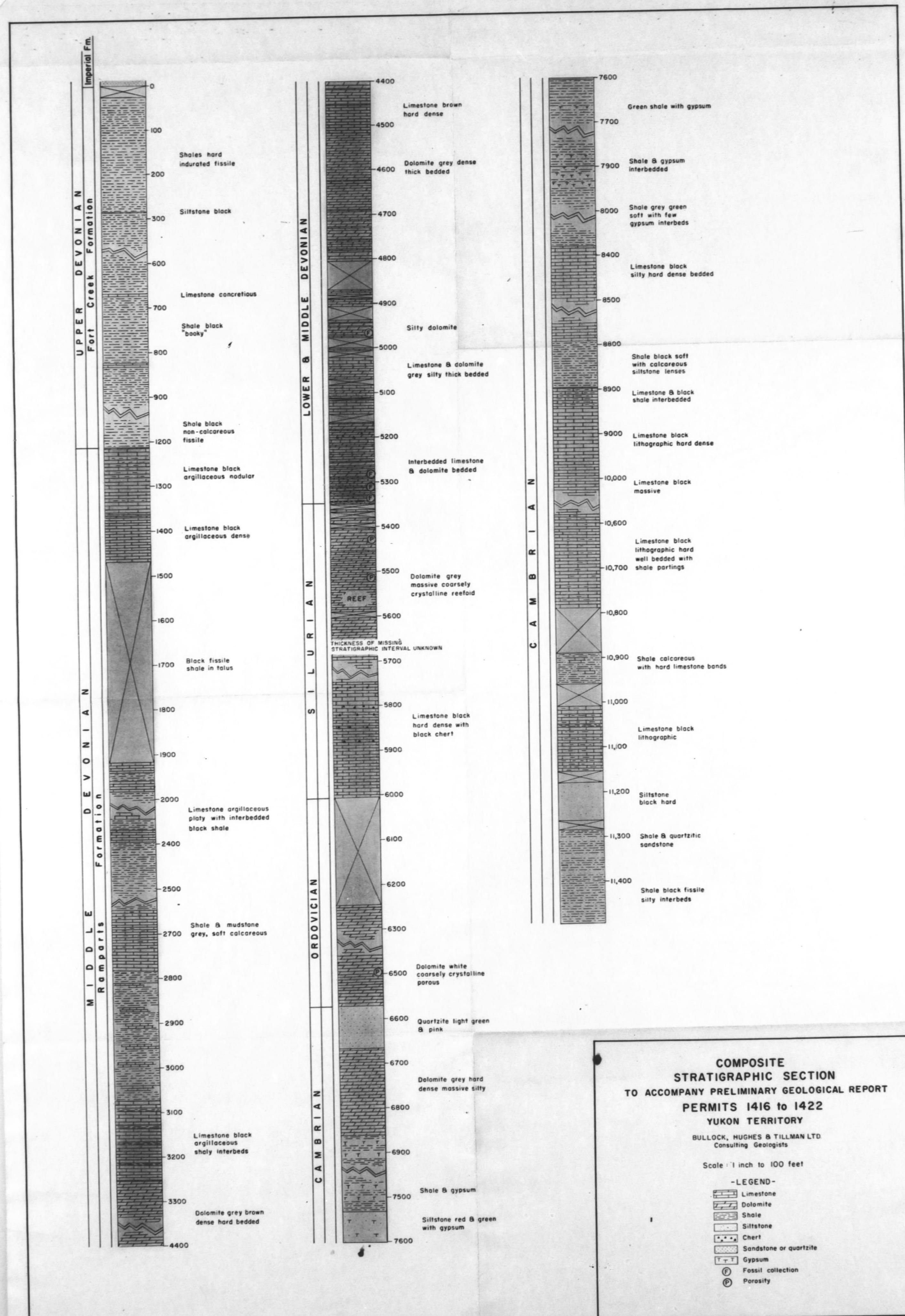


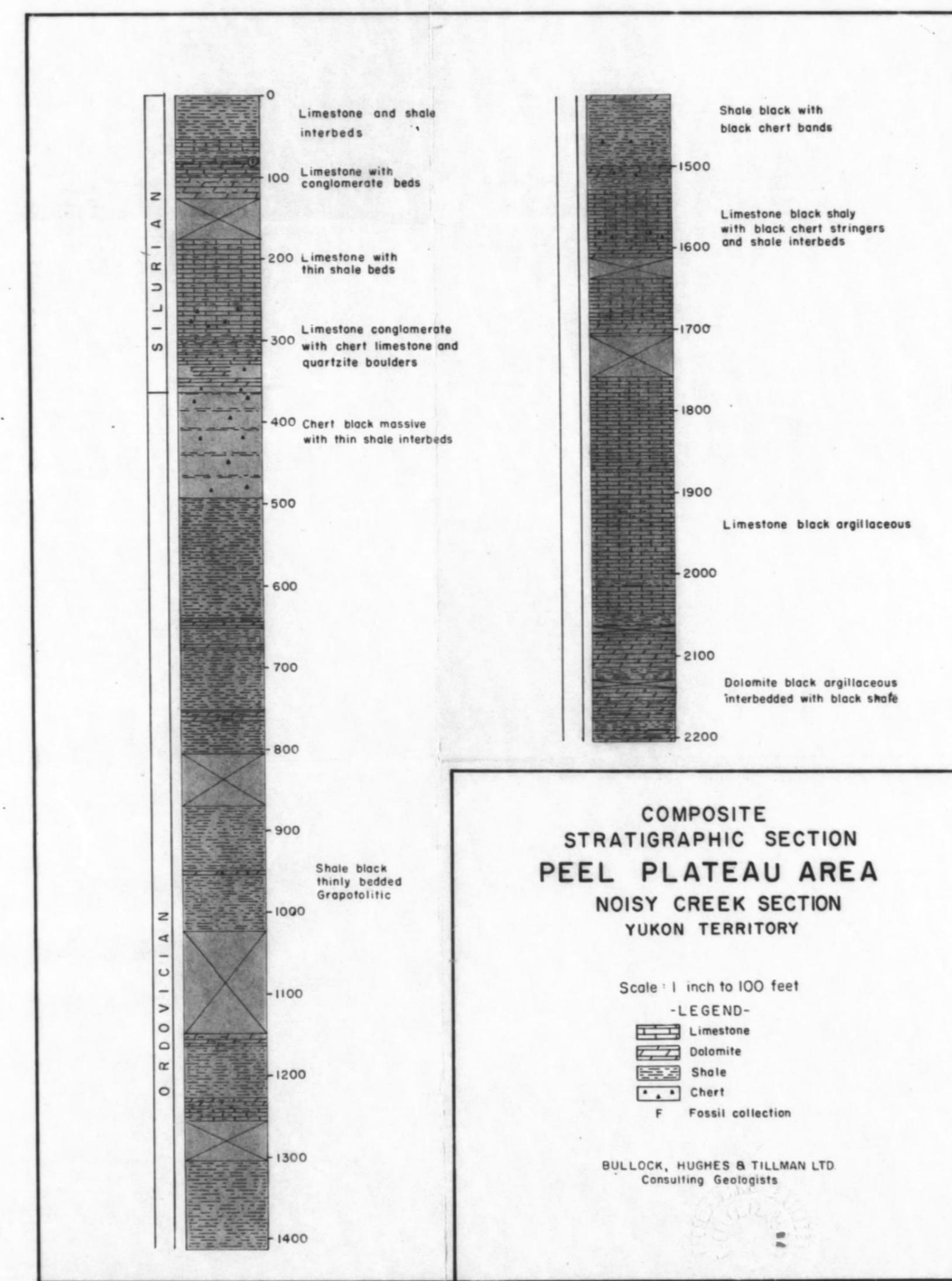
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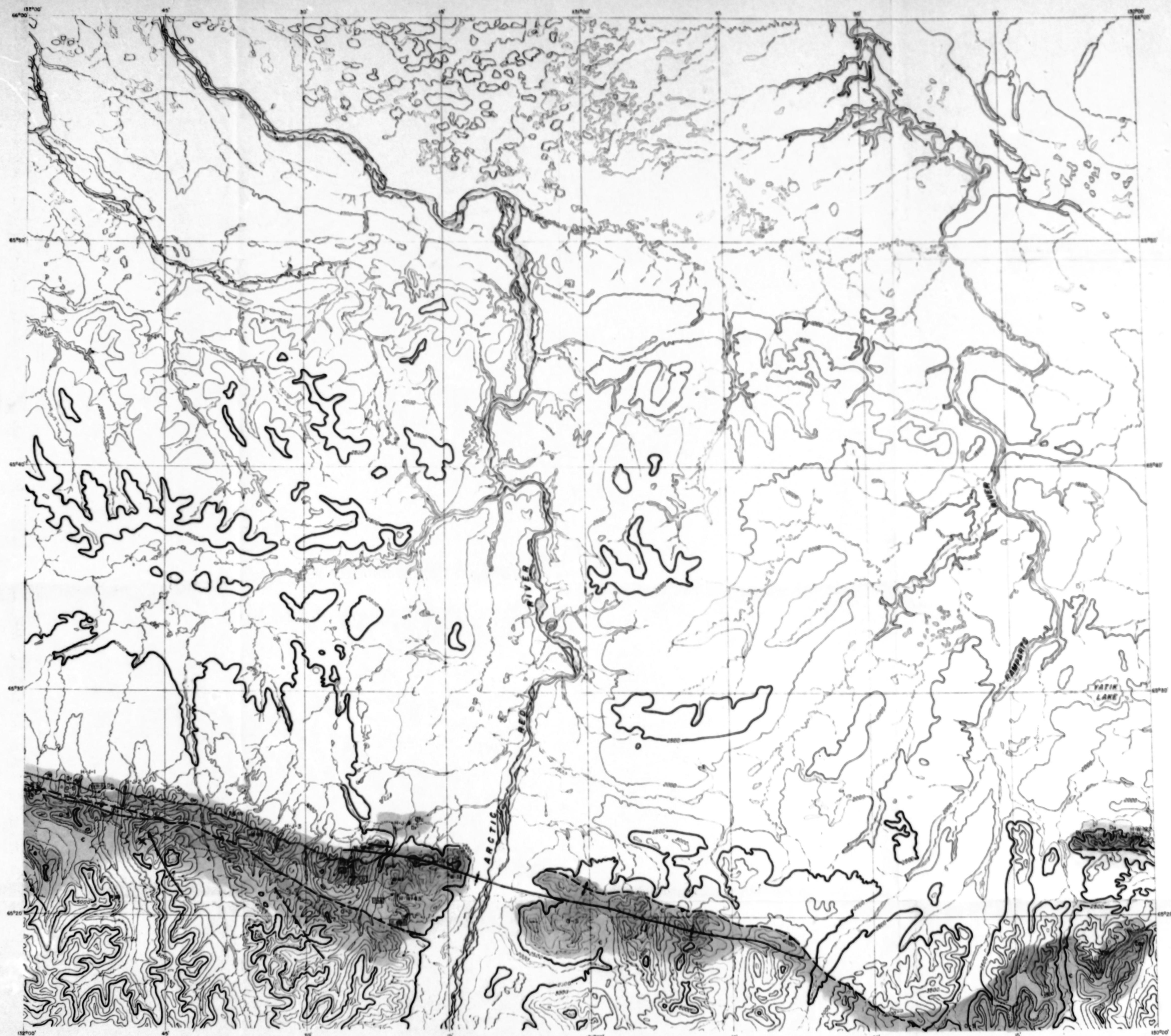


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35









— L E G E N D —

T	Tertiary
K	CRETACEOUS
Ku	Undivided
Ku	Upper Sandstone Unit
Kx	Middle Shale Unit
Kl	Lower Sandstone Unit
J	JURASSIC
P	PENNSYLVANIAN
Du	UNPENNSYLVANIAN
Di	Imperial Formation
Dfc	Fort Creek Formation

MIDDLE DEVONIAN	
Dr	Ramparts Formation Undivided
Dra	Upper Limestone
Drm	Shale
Drl	Lower Limestone
Dbr	Bear Rock Formation
Db	Buff Unit (Possibly Lower Devonian)
S	SILURIAN
0-S	ORDOVICIAN - SILURIAN Undivided
O	ORDOVICIAN
C	CAMBRIAN

- Outcrop and station number
- Bedrock attitude - horizontal, inclined, and overturned
- Apparent dip
- Anticline
- Syncline
- Geological contact
- Fault, triangle indicates dip of fault plane
- Location and number of Stratigraphic Section
- Color photograph showing Plate number and direction of camera
- Sill
- Dyke
- Permit boundary

GEOLOGICAL MAP
UPPER RAMPARTS RIVER
MACKENZIE AND RICHARDSON MOUNTAINS

YUKON & N.W.T.

JANUARY, 1960

Scale: 1 inch to 2 miles

60-148-5



GEOLoGICAL MAP
SNake RIVER
MACKENZIE AND RICHARDSON MOUNTAINS

YUKON & NWT

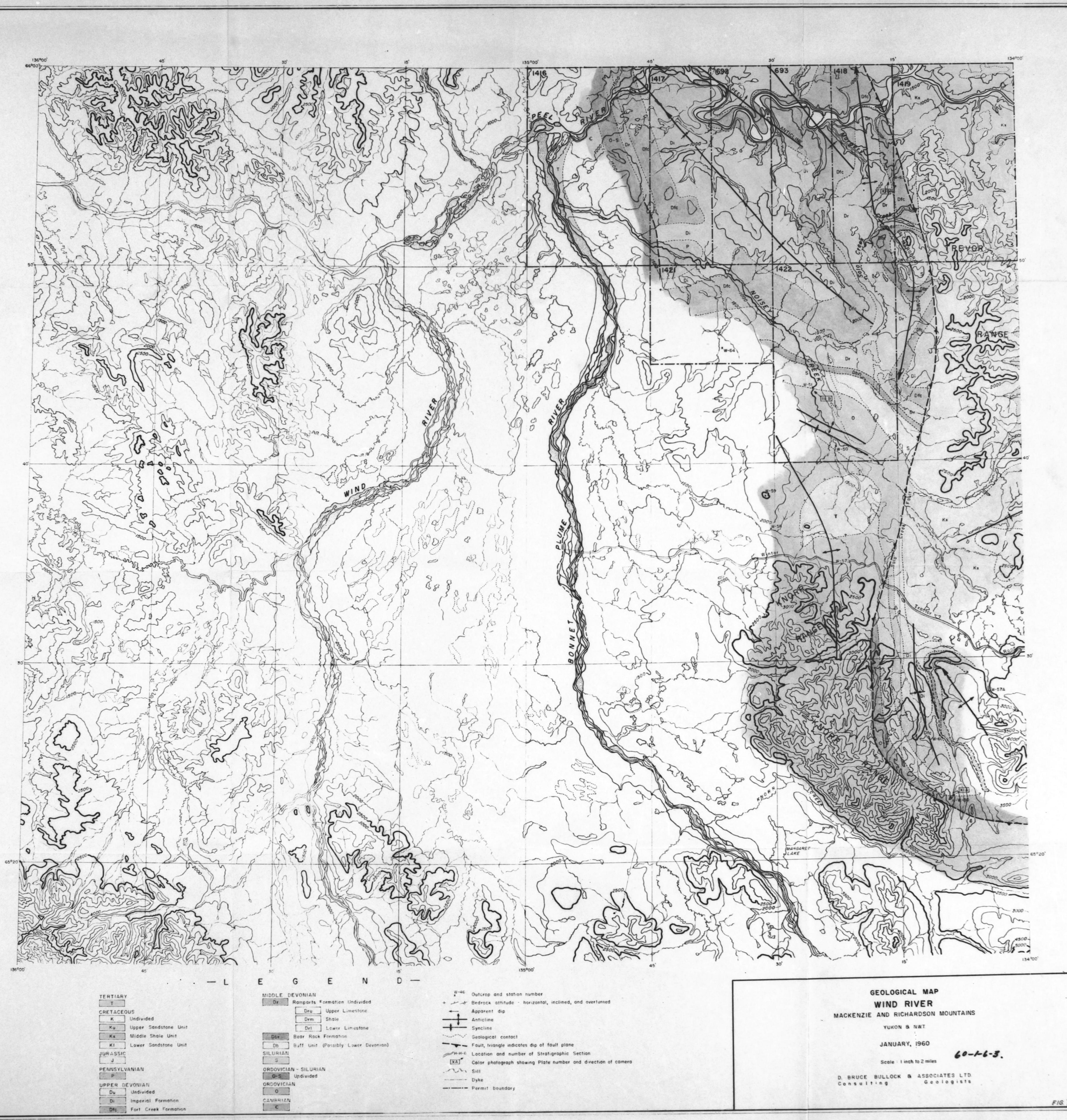
JANUARY, 1960

Scale 1 inch to 2 miles

60-1-6-5.

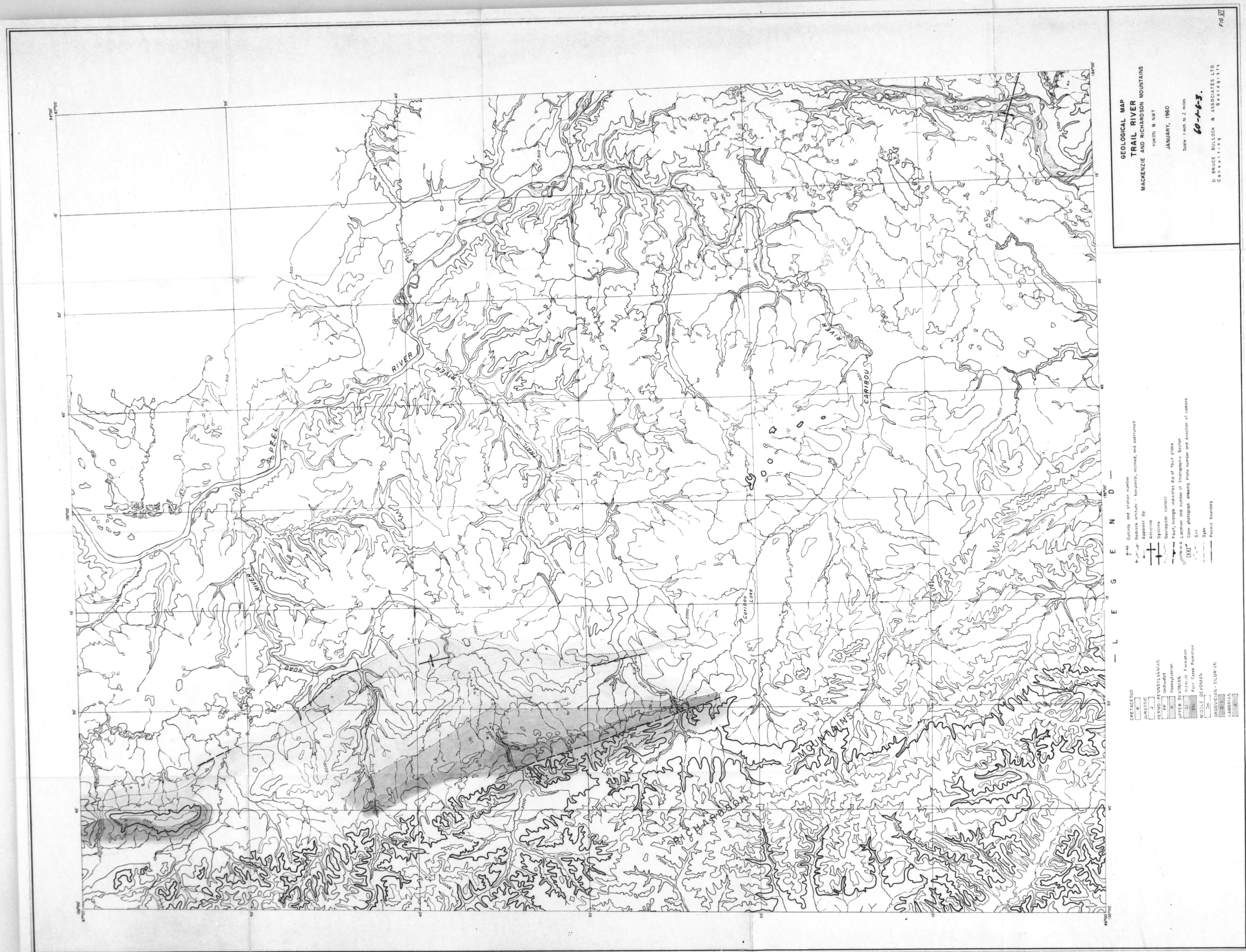
D BRUCE BULLOCK & ASSOCIATES LTD
Consulting Geologists





A ruler scale from 1 to 35 inches. The numbers are in a bold, sans-serif font. Below the numbers, there are smaller tick marks for each quarter inch. The ruler is oriented horizontally across the page.

30x



30 x

West Canadian Graphic Industries Ltd.



30x

