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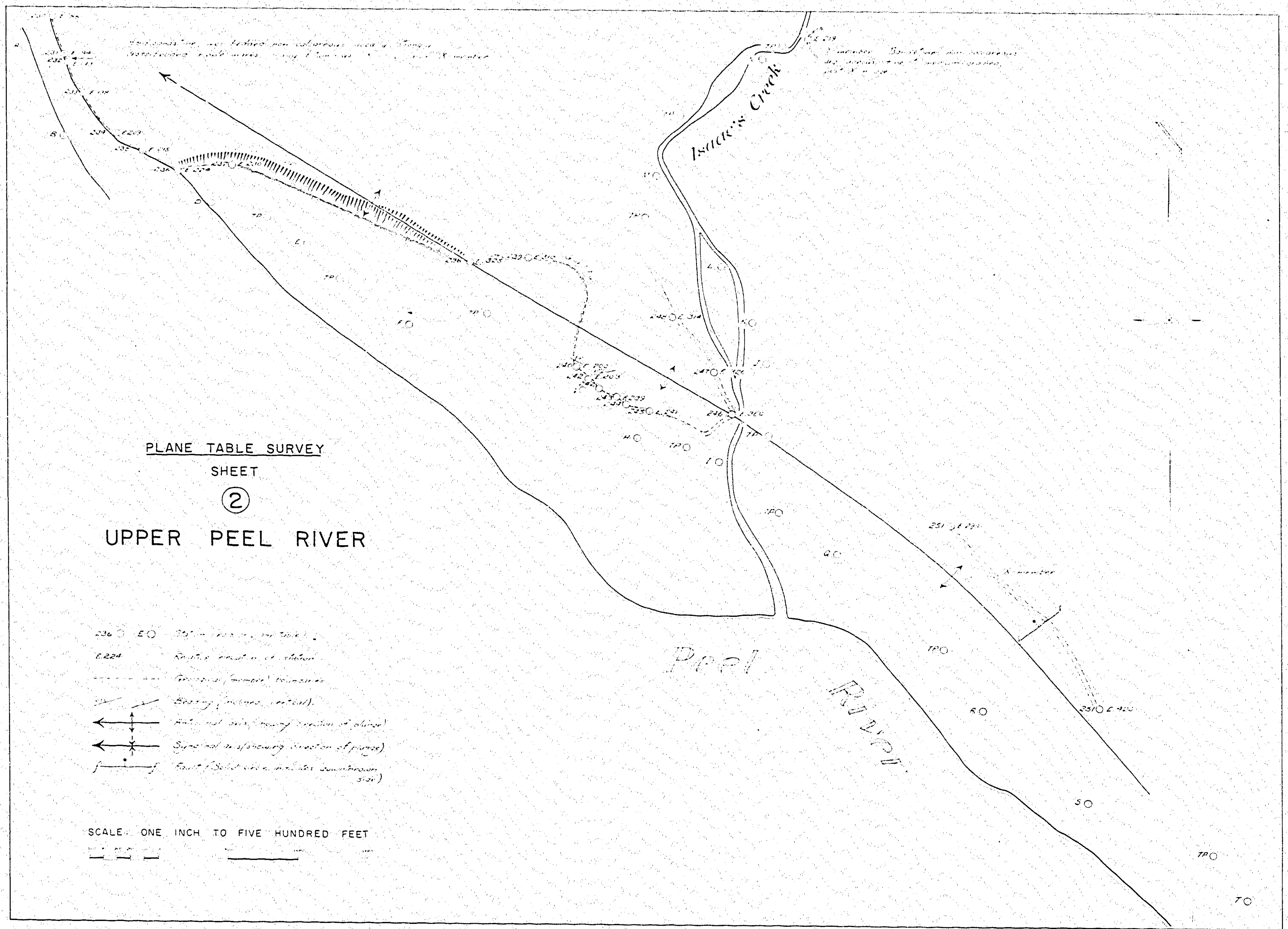

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PETROLEUM GEOLOGISTS

Geology by R.D. Hughes, 1957

PRELIMINARY GEOLOGIC REPORT

PERMITS 692 & 693

PEEL RIVER AREA

YUKON TERRITORY

JANUARY 1958

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INTRODUCTION

This report is about the geology of two Territorial Oil and Gas Permits located in the upper Peel River area.

The acreage is accessible from either Dawson City, Y.T., or Fort McPherson, N.W.T. by winter tractor train. Heavy equipment, such as a rotary drilling rig, might be moved by barge in the spring from Fort McPherson to the permits, however, this would be a difficult and even risky method of transportation. Small boats can be used on the Peel River which is navigable as far as the mouth of Wind River for craft drawing not over one foot. Float planes can land on several straight stretches of the Peel River close to and within the acreage under permit.

The nature of the work carried out in 1957 comprised three projects:

(1) stratigraphic studies of Palaeozoic beds exposed on Margery Hill.

(2) stratigraphic studies of the Paleozoic section exposed along Peel River canyon.

(3) plane-tabling of Peel River anticlinal structure.

The writer arrived in Fort McPherson on June 20, 1957, where he was met by his field assistants Eugene

Estabrooks and Tom Williams who had preceded him there. The period from June 20 to June 27 was spent mainly in Fort McPherson arranging for transportation and outfitting. June 27 to June 30 were spent travelling by boat to a camp site immediately above the mouth of Snake River on the Peel River. On July 2 camp was moved by helicopter to a site on Tom Williams Creek. Stratigraphic studies were carried out with plane table control on Tom Williams Creek and Margery Hill until July 30. On that and the next day camp was moved to the south bank of Peel River at the lower end of Peel River canyon. The well-exposed Paleozoic section of Peel River canyon was measured by plane-table survey between August 1 and August 15. Plane-table mapping of Peel River anticlinal structure commenced on August 17 and continued until September 7. On September 8 the writer and Estabrooks were flown to Norman Wells.

Personnel on the project included the following:

Mr. R.D.Hughes, P.Eng., consulting geologist, who was engaged on this program from June 19, 1957 to January 15, 1958.

Mr. E.Estabrooks, assistant geologist, who was on the project between the middle of June and mid-September, 1957.

Mr. T. Williams, junior field assistant, who was employed on the program between mid-June and July 30, 1957.

Mr. I. Kunnizi, cook, was engaged on the project between June 26, 1957 and September 9, 1957.

Mr. J. Charlie, river guide, was engaged on the project from August 6 to September 9, 1957.

Mr. E. Cronan, helicopter pilot, was engaged on the project on July 2, 1957.

Mr. B. Akins, helicopter engineer, was engaged on the project on July 2, 1957.

Dr. V.J. Okulitch, consulting paleontologist, studied the fossils collected during the field season between mid-August and December 20, 1957.

Mr. J.C. Benlow, draughtsman, was employed on the project from December 24, 1957 to January 15, 1958.

The help and hospitality shown the party by Mr. Ian McGee of the Hudson Bay Company, Mr. Mike Krutko, and Miss Phyllis Geran of Fort McPherson, N.W.T., is much appreciated. Mr. J.L. Tillman reviewed the structural geology of the mapped area with the writer and contributed much to the preparation of the geologic map. The logistics and supply problems were undertaken by Mr. D.B. Bullock whose co-operation made possible the project's success.

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STRATIGRAPHY

Strata of Cretaceous, Devonian, Silurian, Ordovician, and Cambrian age are exposed in the mapped area. Formational names have been assigned to only a few of the rock units occurring in this region. Two member names are given in this report to thin discontinuous rock units in Margery Hill area for ease in discussion. A brief review of the sections studied follows in this chapter. Detailed studies of thin sections made from specimens obtained near Margery Hill will add considerable new data which will be of value in the diagnosis of the environment of deposition of the beds and show whether they are reef, reef talus or basin rocks.

Margery Hill Section A

A section exposed on the west side of Margery Hill was found to consist of 754 feet of Middle Silurian beds. The section is topped by a reef which we will term the Margery Hill member. This member comprises 72 feet of dolomite in which local porosity is present, however, porosity is sparse in the section. The reef overlies a reef talus conglomerate of dolomite which measures 52 feet in thickness. The talus in turn is underlain by a well-

bedded basinal cherty limestone and dolomite sequence within which three reefs occur. Below the talus and at the top of the basinal sequence an eight foot dolomite reef is present. A second dolomitized reef, eleven feet in thickness, was found one third of the distance below the top of the basinal carbonates. Lastly a limestone reef, 25 feet in depth, is located one third of the distance above the base of the basin sequence.

Upper Tom Williams Creek Section B

An important though discontinuous stratigraphic section was measured on the low hill immediately west of Tom Williams Creek and southwest of Section A. The age-dating of the rock units exposed in this section was disappointing as a result of only sporadic and rare occurrence of identifiable diagnostic fossils. The youngest beds of Section B comprise 83 feet of Upper Devonian age. These are sub-divided into the upper Tom Williams member which is a talus apron measuring 33 feet in thickness, and underlying beds which are obscured except for a basal section containing reworked Middle Devonian fossils. The Upper Devonian sequence is in turn underlain by an obscured section measuring 85 feet which is tentatively termed Middle Devonian? The Middle Devonian? beds are underlain by a mostly obscured section of 310 feet which

is assigned a Silurian and/or Middle Devonian age. The oldest beds in Section B are Middle Silurian in age. The Middle Silurian is divisible into an upper dolomite section measuring 600 feet thick, and a lower cherty dolomite and limestone sequence which is 726 feet in thickness. The upper 600 feet of beds which includes several thin reefs are two thirds obscured, however a tentative identification of the Margery Hill member in this section is shown on the accompanying graphic log. The lower cherty sequence is mostly well-bedded basin rocks.

Lower Tom Williams Creek Section C

An excellent continuous sequence of beds ranging in age from Silurian to Upper Devonian occur along the lower part of Tom Williams Creek. Upper Devonian beds measure 400 feet plus and include the Tom Williams member which is a talus apron here as well as in Section B. It measures 42 feet and is overlain and underlain by Upper Devonian basin type strata. This sequence is underlain by 196 feet of basinal type beds to which is assigned a Middle and/or Upper Devonian age. Middle Devonian beds which are reef-derivatives in part and measure 29½ feet are the next oldest in the sequence. A thickness of 356 feet of Silurian and/or Middle Devonian beds follow downwards. These comprise mostly basinal sediments, however

some reef talus and local thin reefs are present. Twelve feet of Silurian beds occur at the base of the section. These comprise limestone and siltstone and appear to be basinal in origin.

Peel River Canyon Section

The Peel River canyon section is excellently exposed and apparently relatively unfaulted. Our study of this section is not yet complete. Tentative age assignments are shown for the section in the accompanying graphic log. In general there is a lack of good porosity throughout the examined section and dolomitization is nearly absent. Dr. C.E. Decker has studied a suite of fossils from Peel River canyon and identified three Upper Ordovician graptolites in addition to Lower Ordovician and Silurian forms. No Upper Ordovician forms were identified by Dr. V.J. Okulitch during the present study. This faunal omission will be rectified in our final report.

STRUCTURAL GEOLOGY

Peel River anticlinal structure was mapped by plane table survey along Peel River. Continuous key horizons that might have been mapped throughout the uplifted area were lacking therefore local horizons were mapped only so far as they could be positively identified.

It is the writer's opinion, based on the past field season's work, that Peel River anticlinal structure is genetically related to Margery domal uplift which in turn is related to a major fault to the east. There is no geologic evidence that Peel River anticlinal structure is associated with drape over a reef. In fact the pattern of associated thrust faults suggests an orogenic origin for the structure.

Several air photos of the area were examined and the resulting photogeological interpretations were added to the accompanying geologic map. D.B. Bullock's reconnaissance geologic map provided an excellent regional map on which to base the present study. The present map therefore includes Bullock's reconnaissance geology, photogeological studies, and observations made during the past field season.

Peel River anticlinal structure extends for

about eleven miles in a northwestward direction across the permits under study. It plunges to the northwestward and is closed on both flanks, however, there is no evidence to show whether closure is obtained by plunge out in a southeastward direction on the surface. Fort Creek beds on John Charlis Creek are badly distorted and a suggestion is present that the anticlinal axis of Peel River anticlinal structure is slightly deflected as it crosses the valley. A structural saddle is present on the north flank of Margery domal structure which separates it from a low anticlinal structure to the north in the core of which Middle Devonian beds are exposed on Peel River. This saddle or depression, if it extends to the west, will result in the closure of Peel River anticlinal structure by southeastward plunge. It is probable that this does occur, however the amount of surface closure obtained this way will be relatively small. The west flank of Peel River anticlinal structure ranges up to 4½ miles in width and the east flank exceeds more than five miles locally. Faulting associated with Peel River anticlinal structure along Peel River is minor in degree although both normal and thrust faulting are present.

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OIL POSSIBILITIES

Gas seepages are unknown in the area under study, however bituminous dikes or fossil oil seeps are distributed in fractures related to Peel River anticlinal structure. These dikes are shown on the accompanying maps along with brief notes on each individual occurrence.

The bituminous or asphalt material is black, hard to friable, and resembles coal. Dr. R.M. Thompson of the Geological Department of the University of British Columbia studied samples of the material. He reported:

October 1953

"The following tests were made on the sample in question:

(1) Specific gravity - 1.274

(2) Radioactivity - negligible.

Sample count 30 per minute

Background count 26 per minute

(3) Water and neutral fumes given off in a closed tube.

(4) Non-soluble in turpentine but this promotes disintegration.

(5) Gives only one diffuse line on an X-ray powder pattern indicating that it is practically amorphous.

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The reasons I have for not considering this material albertite or mineral pitch are: lack of pitchy lustre, concloidal fracture and too high a specific gravity. Albertite is given as 1.097 but mineral pitch is 1 to 1.8. Most varieties of pitch are soluble in turpentine."

December 1952

"I have completed work on the sample from Peel River and the results are as follows:

This sample was ashed along with a number of other coals from various localities and it was conspicuous by having a very low ash content as compared to the other samples.

A spectrographic analysis on the ash shows the following elements:

Major	Minor	Trace	Absent
Mg	V	Be	In
Si	Ni	B	Ge
Al	Ca	Mn	As
Fe		Cu	Mo
		Zn	Ir
			Sn
			Au
			Ag

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As I said before the material does not resemble any albertite we have or any described albertite. The low ash content does suggest that it may be a distillate of some kind. However, it is well known that coal does flow in faults and fractures and this possibility cannot be discarded entirely although it is unlikely considering the age of the rocks."

Despite Thompson's hedging there seems to be no doubt about the petroleum origin of the bituminous material. Similar asphaltic material was found during the past summer in beds of Middle Silurian age in the section measured near upper Tom Williams Creek. Rounded elliptical pebbles of tar ranging up to two inches in one dimension occurred in a brecciated dolomite at this locality. There must have been a breaching of petroliferous reservoirs in this area at least twice. The earlier breaching occurred in Middle Silurian time and the later in post-Imperial formation time. Interstitial dried oil was observed in beds of the Imperial formation near Calamites Creek and also in Middle Silurian beds exposed near Tom Williams Creek.

The stratigraphic sequence of Peel River area contains source beds for petroleum, reservoir beds, and cap rocks.

CONCLUSIONS AND RECOMMENDATIONS

The structural and stratigraphic conditions observed in the area mapped during the past summer are favourable for the commercial accumulation of petroleum. It is recommended that a bore-hole be located on the north bank of Peel River close to the surface axis of Peel River anticlinal structure to test the stratigraphic sequence to the top of the chert member of the Silurian system. This will be encountered at an estimated depth of from 3600 feet to 4000 feet. The well should have as its targets Upper Devonian, Middle Devonian and Silurian reefs which are expected to provide fair to good reservoir beds in this area.

Attention should be given to the excellent closed elongate domal structure which crosses the Peel River 1½ miles west of the fault contact with Lower Cretaceous beds. Structurally this uplift ranks second to the Peel River anticlinal structure, however it should be acquired by the operators of Peel River anticlinal structure for protective purposes if available.

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Richard D. Hughes

per Richard D.Hughes, Ph.D., P.Eng.

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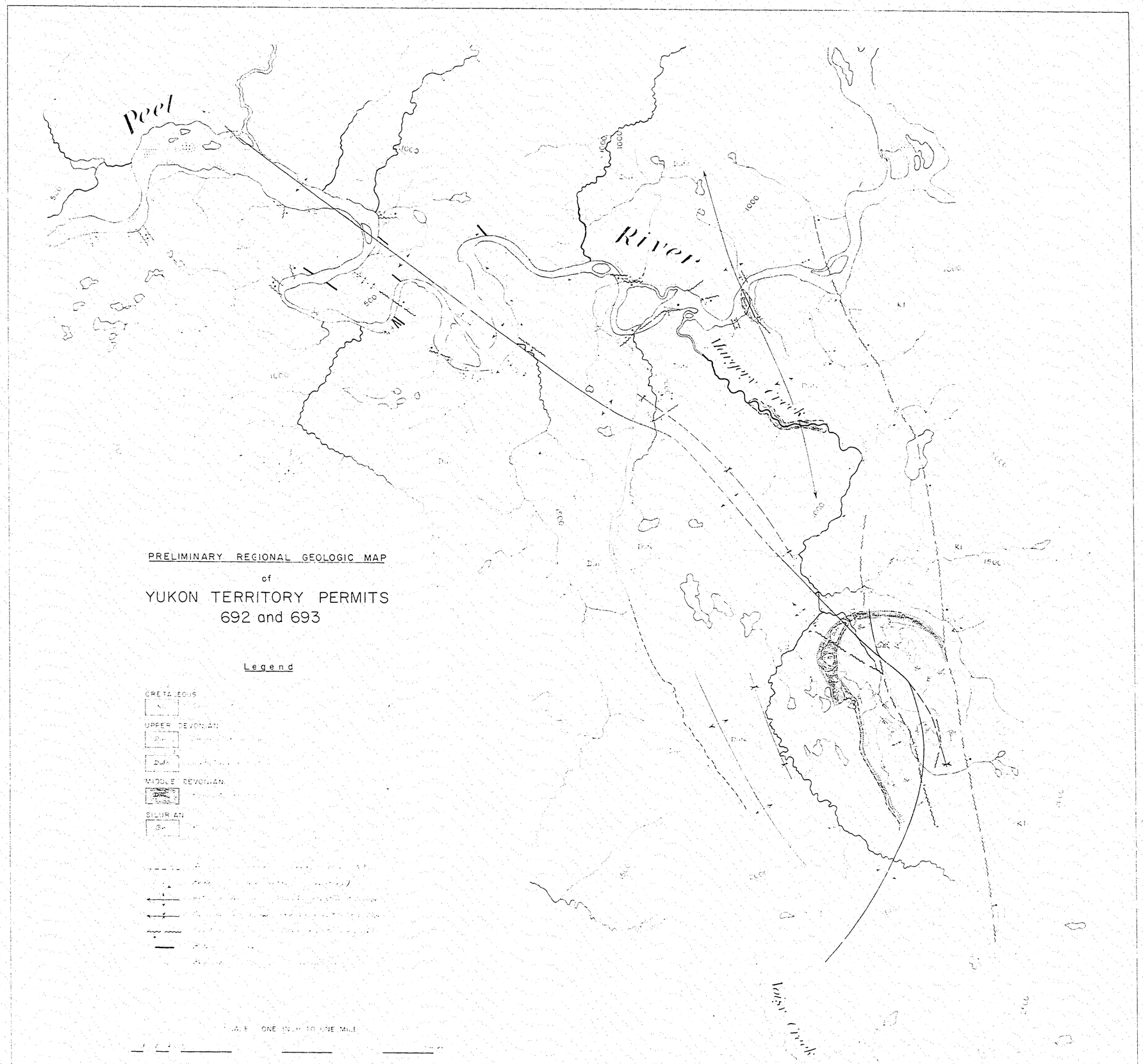

PRELIMINARY REGIONAL GEOLOGIC MAP

of

YUKON TERRITORY PERMITS 692 and 693

Legend

CRETACEOUS

UPPER DEVONIAN

MIDDLE DEVONIAN

SILURIAN

SCALE ONE INCH TO ONE MILE

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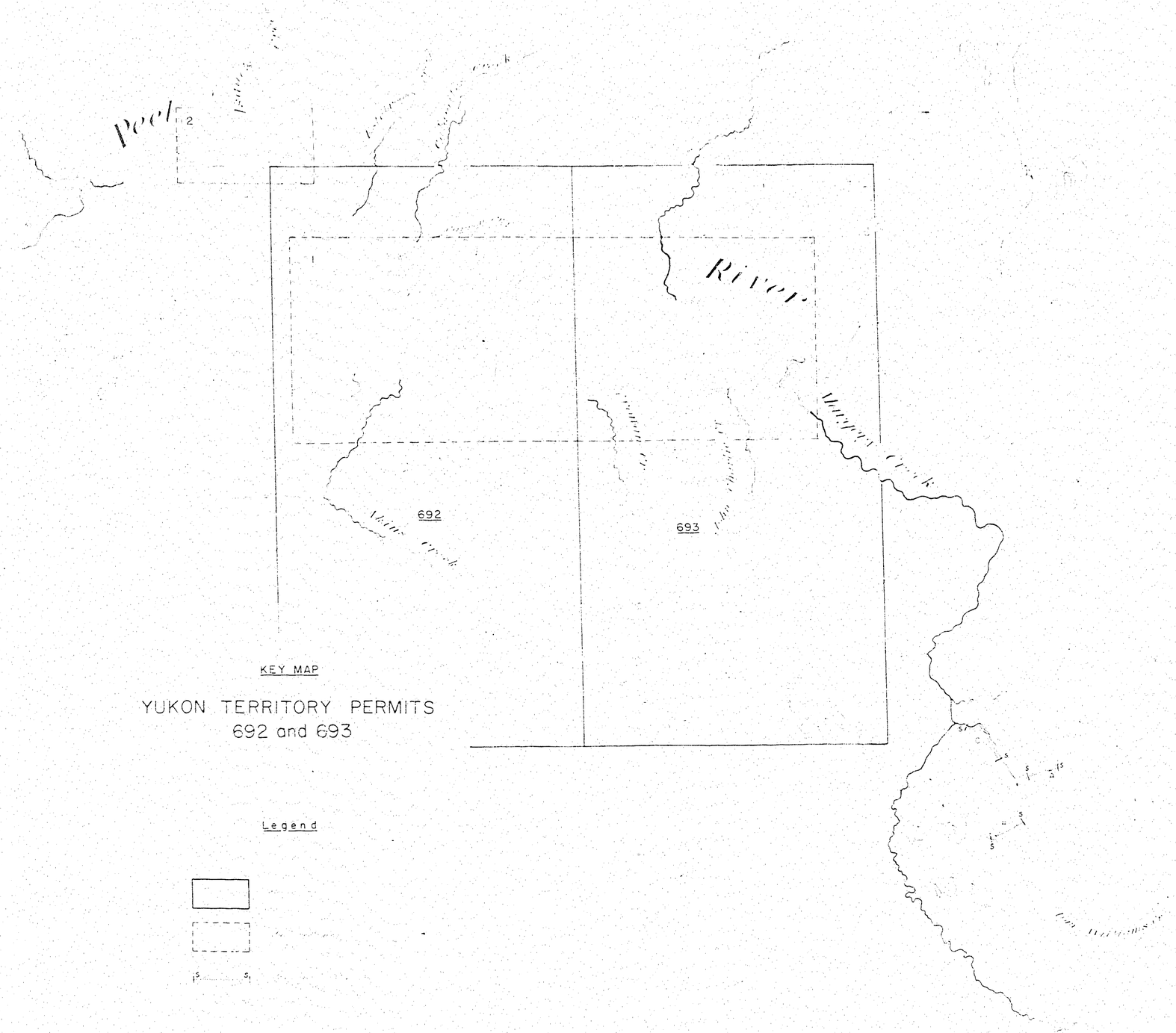

KEY MAP

YUKON TERRITORY PERMITS
692 and 693

Legend

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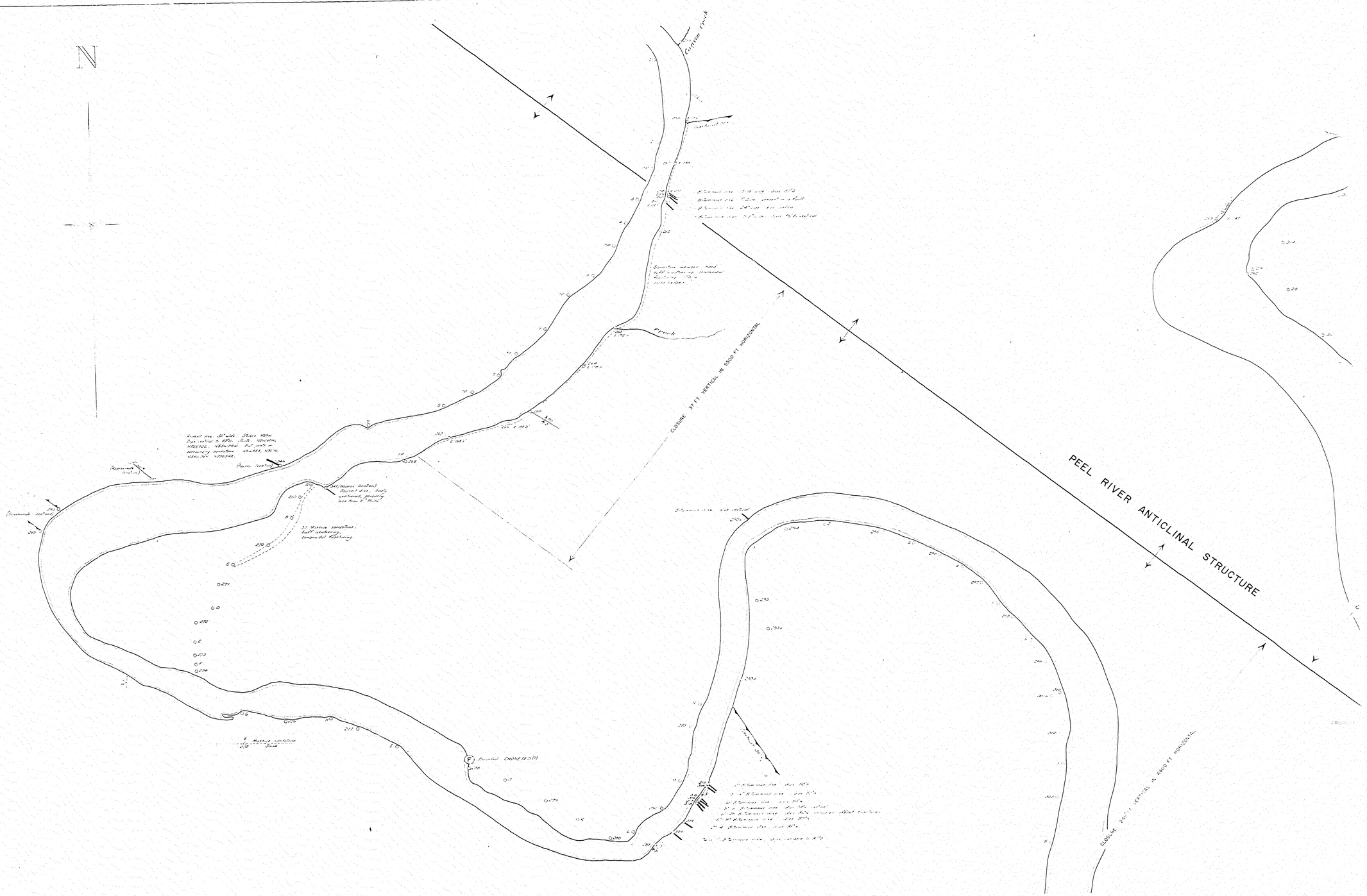
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PEEL RIVER ANTICLINAL STRUCTURE
CLOSURE 37 FT VERTICAL IN 5500 FT HORIZONTAL
CLOSURE 200 FT VERTICAL IN 4400 FT HORIZONTAL

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PLANE TABLE SURVEY

SHEET

1

UPPER PEEL RIVER

PEEL RIVER ANTICLINAL STRUCTURE

PROPOSED

CLOSURE 2681' VERTICAL IN 6600 FT HORIZONTAL

CLOSURE 37 FT VERTICAL IN 3300 FT HORIZONTAL

30x

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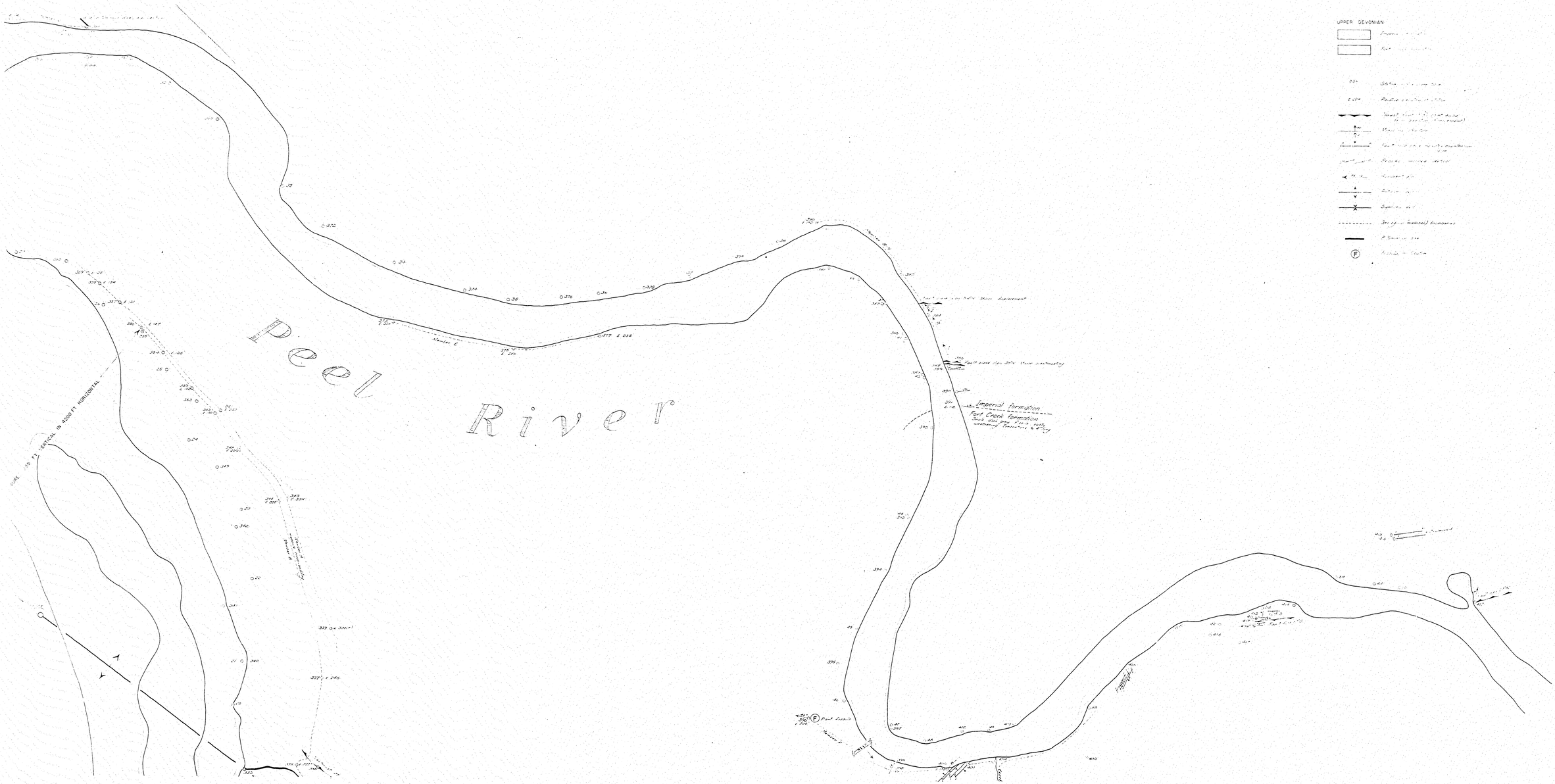
Peel River
LEGEND
UPPER DEVONIAN
Imperial formation
Fort Creek formation


Peel River
Cronan Creek
WELL SITE
CLOSURE 255 FT VERTICAL IN 4200 FT HORIZONTAL
Imperial formation
Fort Creek formation
SCALE ONE INCH TO FIVE HUNDRED FEET
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