

TEXACO EXPLORATION COMPANY  
CALGARY, ALBERTA



GEOLOGICAL EVALUATION OF  
LA BICHE PERMITS,  
YUKON AND NORTHWEST TERRITORIES

By

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TEXACO EXPLORATION COMPANY  
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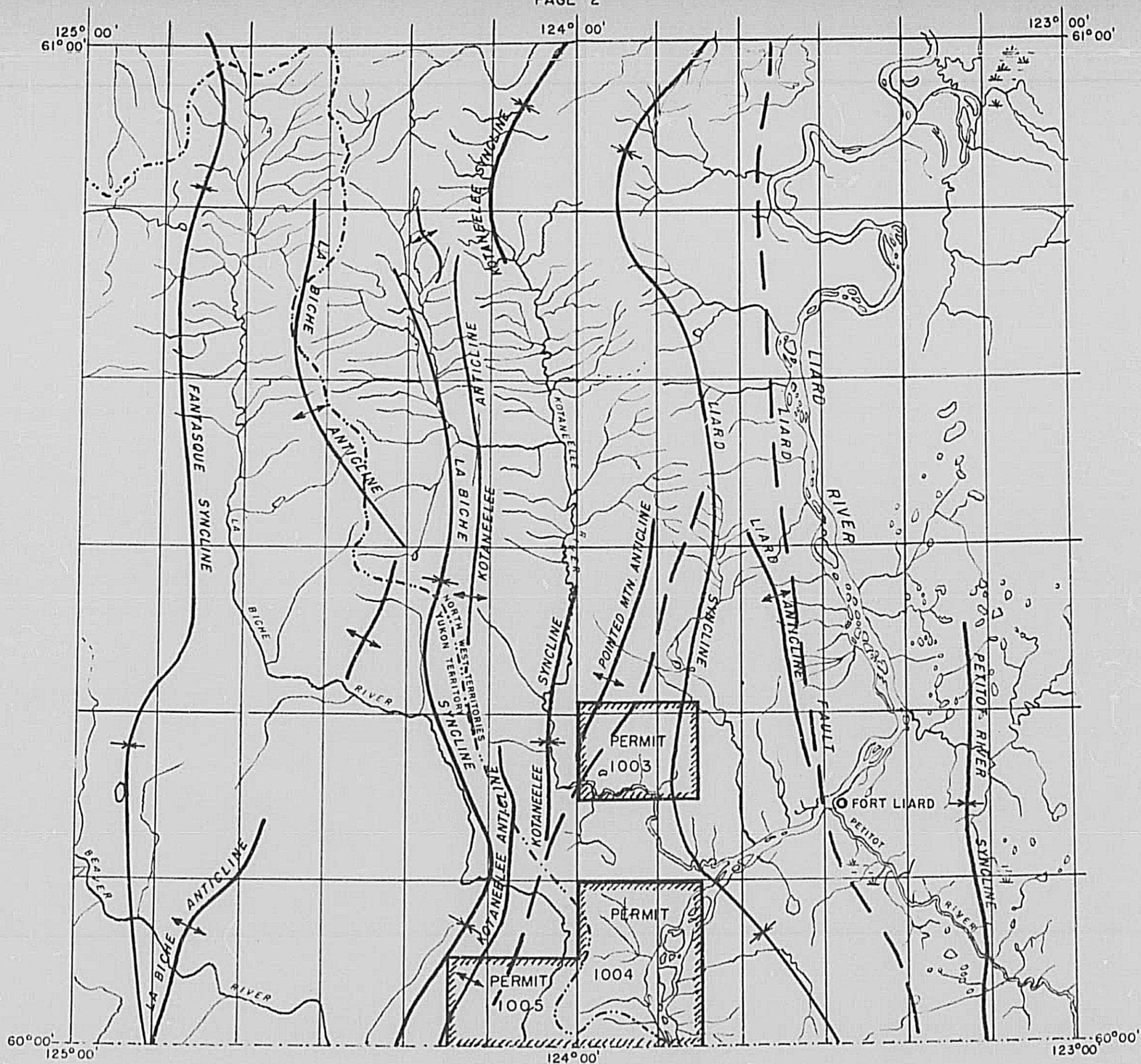
INTRODUCTION

A geological investigation of Texaco Exploration Company's La Biche permits was conducted by Texaco Exploration Company geologists in the latter part of May, 1959. As many field traverses as time allowed were made within the permit area in an attempt to

- (a) evaluate two features, one a known structure (Kotaneelee anticline), the other a photogeologic prospect, thought to be a closed anticline (La Biche prospect); and
- (b) map, if possible, surface expressions of these structures.

Texaco Exploration Company's La Biche permits lie immediately north of the British Columbia - Northwest Territories boundary and straddles the Yukon - Northwest Territories border (see Location Map, Figure 1). Specifically, they are comprised of Permit 1004 ( $123^{\circ}45'$  to  $124^{\circ}00'$ W,  $60^{\circ}00'$  to  $60^{\circ}10'$ N) and Permit 1005 ( $124^{\circ}45'$  to  $124^{\circ}15'$ W,  $60^{\circ}00'$  to  $60^{\circ}05'$ N) totalling 95,810 acres.

A field party, including seven Texaco Exploration Company geologists, boarded a river boat and barge at Fort Nelson, British Columbia on May 17, 1959, and arrived at the mouth of the



TEXACO ACREAGE

## FIGURE

LOCATION MAP OF TEXACO ACREAGE AND  
MAJOR STRUCTURAL FEATURES, LA BICHE  
RIVER AREA N.W.T.

Kotaneelee River two days later. Here, a base camp was established and, following the arrival of a G-2 helicopter, field work began May 20. The party terminated field work on the La Biche project May 31.

Two senior members of the party, accompanied by the helicopter, returned to the La Biche area for two days, August 8 and 9, in an unsuccessful second attempt to find and examine rock outcrop in the northern part of the La Biche prospect.

The dense, very heavy tree cover in the area made the evaluation extremely difficult. Much time was spent clearing helicopter landing spots and making difficult, and usually unrewarding, traverses through the dense bush in search of outcrop.

#### STRATIGRAPHY

Most of the stratigraphy presented here is taken from Douglas and Norris (1959). This is necessary in that many of the formations present are not exposed in the report area. Stratigraphy is summarized in Table 1.

Surface rocks in the La Biche permits are Upper and Lower Cretaceous. Immediately north of Permit 1005, in the core of the Kotaneelee anticline, beds as old as Carboniferous are exposed.

Oldest beds examined by the field party are Permian cherts, sandstone and siltstone, exposed immediately north of

# TABLE OF FORMATIONS

(After DOUGLAS and NORRIS, 1959.)

ERA	PERIOD or EPOCH	GROUP, FORMATION	LITHOLOGY	THICKNESS FEET	
CENO-ZOIC	PLEISTOCENE and RECENT		ALLUVIAL SANDS AND SILTS	—	
UNCONFORMITY					
MEZOZOIC	UPPER CRETACEOUS	WAPITI	SANDSTONE; COAL	25 +	
		KOTANEELEE	CONCRETIONARY SHALE; MUDSTONE; SANDSTONE	525	
		FORT NELSON	CONGLOMERATE; SANDSTONE; MUDSTONE; COAL	500	
	LOWER CRETACEOUS	FORT ST. JOHN GROUP	UPPER SIKANNA	CONCRETIONARY, FISSILE AND GYPSIFEROUS SHALE	1500
			LOWER	FINE GRAINED SANDSTONE; SHALE; SILTSTONE	300
		BUCKINGHORSE	UPPER	CONCRETIONARY SHALE	1700
			MIDDLE	FINE GRAINED SANDSTONE	200
		BUCKINGHORSE	LOWER	CONCRETIONARY SHALE; BENTONITE; SANDSTONE; CONGLOMERATE	900
				SHALE; SANDSTONE; UNKNOWN LITHOLOGY (MAY INCLUDE PRE-CRETACEOUS STRATA)	?
UNCONFORMITY					
PALEOZOIC	?PERMIAN?		CHERT; SANDSTONE; MUDSTONE	300'	
	UNCONFORMITY ?				
	CARBONIFEROUS and PERMIAN	MATTSON	UPPER	CALCAREOUS SANDSTONE; LIMESTONE; SHALE	1176-1740
			MIDDLE	SANDSTONE, MASSIVE AND THICK BEDDED	752-1574-
			LOWER	SANDSTONE, THIN BEDDED; SHALE; COAL.	1164-1732

Permit 1005 in the Kotaneelee anticline. In the report area thickness is approximately 300 feet, with chert in the lower part and sandstone predominant in the upper beds. It unconformably overlies the underlying Carboniferous Mattson formation and is itself truncated by pre-Cretaceous erosion.

The Lower Cretaceous strata form the Fort St. John group. The lower formation is the Buckinghorse, which in turn is divided into four map units, and has an average total thickness of approximately 3000 feet.

The lower beds of the Buckinghorse consist of a few feet of shales, exact thickness of which is unknown in the report area. This unit could not be recognized in all parts of the La Biche map area and is sometimes included in the undivided Buckinghorse formation by Douglas and Norris. This map unit does not occur within the La Biche permits, but is present immediately north of Permit 1005.

Second map unit of the Buckinghorse is approximately 900 feet of rusty-weathering shales containing glauconitic sandstone in its lower beds. Fine-grained, greenish sandstone with some rusty-weathering shales form the third unit. Averaging 200 feet in thickness, it forms low topographic knolls along each side of the Kotaneelee anticline in the report area.

The uppermost unit of the Buckinghorse consist of approximately 1700 feet of rubbly, rusty-weathering shale. Contact is gradational into the overlying Sikanni formation.

The Sikanni formation consists of a lower sandstone, 300 feet thick, which is composed of fine-grained sandstones, argillaceous siltstone and some shale; and an upper member, approximately 1500 feet thick, consisting of dark grey shales.

Upper Cretaceous rocks make up the Fort Nelson, Kotaneelee and Wapiti formations. Where it is exposed east of Permit 1004, the Fort Nelson formation is about 500 feet thick. It consists of massive, coarse-grained sandstones with mudstone and conglomerate lenses in its upper beds. Several outcrops of this formation are present along the crest of a topographic ridge near the southwest side of the La Biche prospect. Its lower contact is gradational into the underlying Sikanni formation.

The Kotaneelee formation consists of about 525 feet of sandy mudstones, sandstones and shales. Shale forms the upper half of the formation and grades upward into the massive sandstone of the Wapiti formation.

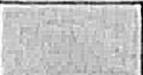
The Wapiti formation is present as remnants capping some hills in the eastern side of the permit. It is about 25 feet thick and consists of coarse-grained, buff sandstones.

#### STRUCTURAL GEOLOGY

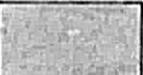
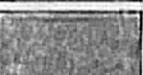
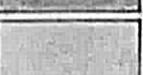
The La Biche permits are located on the southeast edge of the Liard Plateau, on the eastern side of the Cordillera. Bedrock in this region is deformed into characteristically

## LEGEND TO FIGURES 2 AND 3

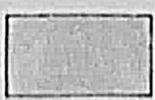
## UPPER CRETACEOUS

-  WAPITI FORMATION
-  KOTANEELEE FORMATION
-  FORT NELSON FORMATION

## LOWER CRETACEOUS

-  UPPER } SIKANNI FORMATION
-  LOWER }
-  UPPER }
-  MIDDLE }
-  LOWER }
-  UNNAMED }

## PERMIAN (?)



## PERMIAN AND CARBONIFEROUS

-  MATTSON FORMATION

GEOLOGICAL BOUNDARY (approximate, assumed)

BEDDING (measured, photogeological)

THRUST FAULT (approximate)

ANTICLINE

SYNCLINE

LIMITS OF TEXACOS LABICHE GROUP OF PERMITS

PROVINCIAL BOUNDARY

LINE OF SECTION A-A'

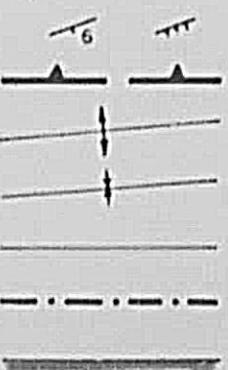


FIGURE 2

GEOLOGIC MAP OF NORTHWEST TERRITORIES PERMITS 1004 AND 1005

LEGEND. See page 7 (In part after Douglas and Norris 1959)

SCALE. MILES

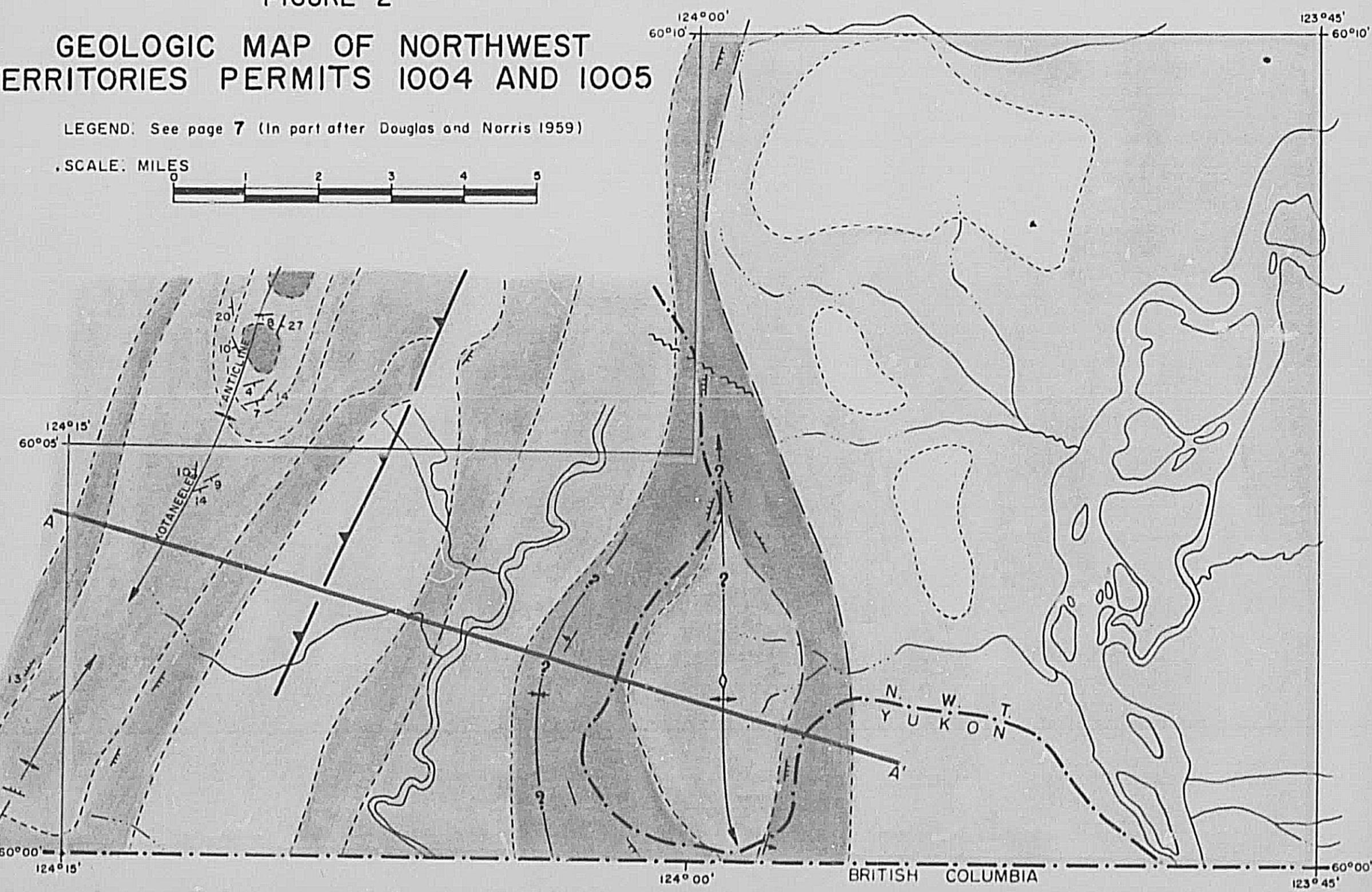
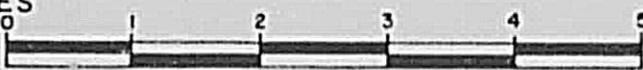
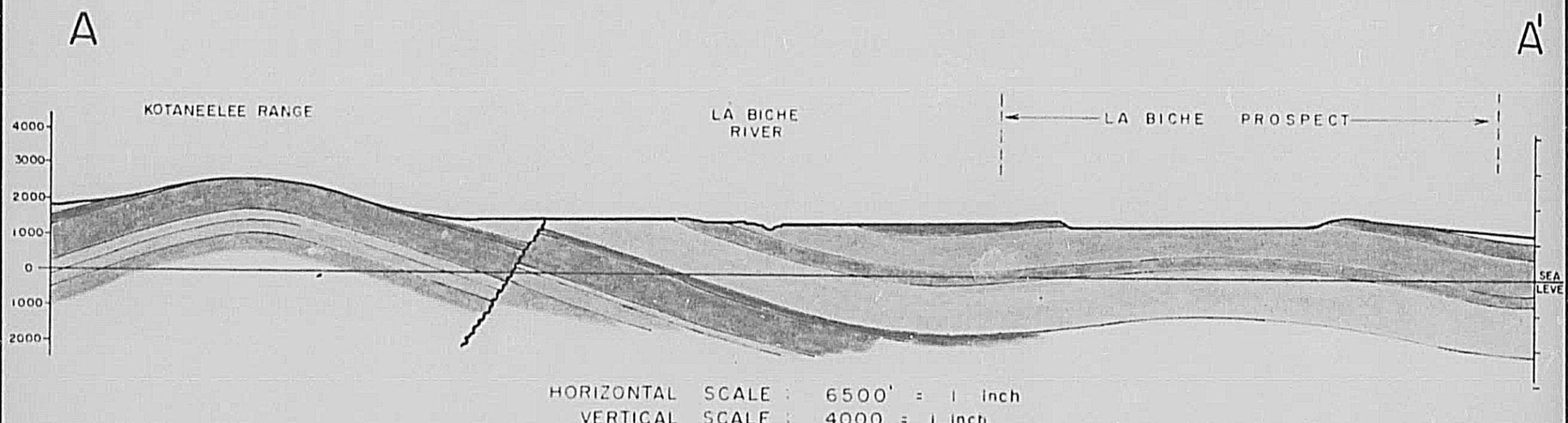


FIGURE 3.  
STRUCTURE SECTION ACROSS  
KOTANEELEE ANTICLINE AND LA BICHE PROSPECT  
( FOR LEGEND SEE PAGE 7 )



broad, gentle synclines and faulted anticlines, forming a relatively subdued platform between the Rocky Mountains to the south and the Mackenzie Mountains to the north.

The north-trending Kotaneelee Range, approximately 65 miles long, is formed mainly of Mattson strata and is essentially anticlinal in structure. The anticline is multiple and is divided into several en echelon segments. It is the southern segment which plunges gently southwestward through Permit 1005 (see Figure 1).

In the report area, the eastern flank of the Kotaneelee anticline dips eastward toward the trough of the Liard syncline. Farther north, these two features are separated by several intervening structures.

Within the La Biche permits a relatively small anticline is developed on the eastern flank of the Kotaneelee anticline. This feature is known as the La Biche prospect (see Figure 2).

#### Kotaneelee Anticline

Within the report area, the southern segment of the Kotaneelee anticline plunges southward, on trend with the gas-bearing Beaver River anticline. The Beaver River structure lies immediately south of Permit 1005, and is separated from the Kotaneelee anticline by a structural saddle in the western portion of the Permit. Inasmuch as this structural saddle is indicated by surface geology to be a low point on the crest of

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the Kotaneelee - Beaver River structural trend, it is considered less prospective than the structurally higher portions of both anticlines.

The lower beds of the Buckinghorse formation are exposed along the crest of the anticline in Permit 1005. Northward, successively older beds crop out and strata as old as the carboniferous Mattson formation are exposed.

#### La Biche Prospect

The La Biche prospect is almost completely surrounded by topographic ridges formed of Fort Nelson formation sandstones. It was these ridges, recognizable on aerial photographs, which first lead Texaco Exploration Company photogeologists to suggest the presence of an anticlinal structure.

Straddling Permits 1004 and 1005, the La Biche prospect is approximately eight miles long and four miles wide, and strikes north-south (see Figure 3). The prospect is thought to be an anticline, but as yet northern plunge of the prospect has not been proved. Southern plunge is reasonably certain. Northern plunge is suggested from a study of aerial photographs, but a field traverse over the topographic ridges failed to yield any outcrops which could prove or disprove northern plunge. In addition to the field traverse, low level helicopter reconnaissance indicated no outcrops within the northern half of the La Biche prospect.

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### CONCLUSIONS

The Kotaneelee anticline is less prospective within the La Biche permits than it is immediately to the north or south of the permit boundaries. The structural saddle which separates the Kotaneelee and Beaver River anticlines lies in the western portion of Permit 1005.

The photogeologic La Biche prospect is either a closed anticline or a south plunging structural nose. Southern plunge is indicated by field work and photogeology, but northern plunge cannot be established by geological surface work.

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