POINTED MOUNTAIN

1957

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REPORT ON SURFACE GEOLOGY

POINTED MOUNTAIN AREA

Conducted by

D. W. Martin

(PAN AMERICAN PETROLEUM CORPORATION)

On

NORTHWEST TERRITORIES PERMITS

No. 998 (95B-5)

No. 999 (95C-8)

No. 1000 (95C-8)

No. 1001 (95C-8)

Maps and Cross Sections
in separate folder

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During the period June 1 to July 15, 1956.

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Prepared By

S. A. ANTONIUK
(Surface Geology Supervisor)

May 22, 1957.

Maps and Cross Sections
in Separate Folder

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GEOLOGICAL REPORT #FXD-16

INTRODUCTION

During the summer of 1956, surface geologic investigations were carried out by Pan American geologic parties in the Pointed Mountain Area. The Pointed Mountain anticline was mapped in detail and the surrounding area was worked in a reconnaissance manner.

C. O. Grasdal acted as junior party chief. Assistance was given in the field by W. O. Richmond, W. J. Fulop and F. J. Meyer.

Transportation and aerial reconnaissance were carried on by means of the company-owned, float-equipped, Beaver aircraft, and a Bell Model 47 D-1 helicopter, contracted from Spartan Air Services, Ottawa, Ontario. A river boat, hired from C. Jensen of Fort Nelson, B.C. was combined with the Beaver to transport gasoline, supplies, equipment and personnel. Contact with commercial communications systems was maintained by means of a 50 watt two-way radio.

Extreme weather conditions hampered the operation throughout the field season.

Faunal collections were identified by Dr. C. R. Stelck of the Department of Geology, University of Alberta.

OUTCROPS AND TERRAIN

The area worked lies in foothills and mountainous country west of the Liard River. Relief of up to 5000 feet was encountered in the area. Most of the ridges were devoid of vegetation and offered good landing spots for a helicopter.

Outcrop density was fair to good and a good interpretation from outcrops was usually possible.

NATURE OF WORK

The prime purpose of the work was to obtain a good knowledge of the structures in the area of Pan American's Pointed Mountain acreage. The area surrounding the acreage was mapped to give a better relationship with on-acreage structure. As well, several stratigraphic sections in the general area were measured to give a better knowledge of subsurface beds and attempt to correlate with Great Slave Lake area stratigraphy.

Aerial reconnaissance, to determine the position of camps and any unusual problems to be expected, was done by Beaver just previous to starting the field season. Reconnaissance flights by helicopter to determine traverse routes were made when necessary throughout the summer.

Dips were taken in the field by means of Brunton compasses while vertical control was obtained from pocket altimeters, corrected whenever possible, to the base camp pressure setting. The information gathered was plotted on aerial photographs and transferred to base maps and mosaics in camp.

STRATIGRAPHY

Table of Formations

Period of Epoch	Group or Formation	Approximate Thickness	Lithology
Pleistocene or Recent			Till and Fluvioglacial material
Cretaceous	Wapiti (?)	?	Continental sandstone with some shale and coal.
	Kotaneelee	500'	Marine shale with occasional sandstone and grit beds.
	Fort Nelson	500'-750'	Conglomeratic to coarse grained cross bedded sandstone.
Cretaceous (Lower)	Lepine	1700' ?	Dark grey marine shale.
	Scatter	500' ?	Sandstone, fine grained grey green with black shale, poor porosity.
	Garbutt	800'-1600'	Shale, dark grey marine.

Table of Formations - Cont'd

Period or Epoch	Group or Formation	Approximate Thickness	Lithology
Carboniferous	Upper Member	800'-8000'	Calcareous quartsitic sandstone with shale interbeds. Excellent porosity overlain in south and west by chert. Violent pinchout to S.E.
	Lower Member	0-1000'	Coarse to very fine grained limestone - appears to shale out to west.
Carboniferous - Devonian Undivided	Banff - Fort Creek	3300?-7500?	Shale, dark grey with silty to sandy zones.
Middle Devonian	Slave Point	750'±	Dense to crystalline grey limestone.
	Ramparts	600'±	Coarse to medium crystalline dolomite. Good reef porosity at Bluefish Lake.
Silurian? and Older?		1700'+	Dense banded silty dolomite with quartsitic sandstone and sandy dolomite near base.

SILURIAN? AND OLDER?

These beds consist of 1400' of dense, very fine grained, grey silty dolomite underlain by 300' of sandstone and silty to sandy varicolored dolomite. The upper unit is tight while the lower unit has scattered good to very poor porosity. On the basis of lithology the lower unit may be tentatively correlated in part with what has been termed "Redbeds" in the Great Slave Lake region.

MIDDLE DEVONIAN

The Middle Devonian is the major drilling objective of the Pointed Mountain area. Surface and subsurface data in the area shows the Ramparts to contain reefal porosity. In the Great Slave Lake region these beds gave many encouraging

oil shows although no commercial production was found. Porosity developed at the unconformity between the Ramparts and Slave Point formations yielded gas at rates up to 1 Mmcf/d. at J.B. White-Lloyd-Briggs Rabbit Lake #1 (60°55' 32.97" N. Lat., 118°48'04.2" W.Long.).

Ramparts Formation

At Bluefish Lake (123°22' W.Long. 61°11' N.Lat.) the Ramparts formation consists mainly of coarse to medium crystalline reefal dolomite. Here the formation is 600' thick. Eight miles south of Bluefish Lake at Nahanni Butte 602' of badly mineralized and smashed up Ramparts is exposed, of which only 180' is reefal dolomite. The rest of the section is made up of limestone and dense to fine crystalline dolomite. At Central Leduc Toad River Joint Venture #1 (124°59' W.Long., 59°21' N.Lat.) the unit is composed of limestone. An unconformity, marked in subsurface by the Watt Mountain shale, separates the Ramparts and Slave Point formations.

Slave Point Formation

The Slave Point Formation consists of 500' to 750' of grey, dense to medium crystalline limestone with occasional crystalline dolomite bands. At Bluefish Lake no porosity was observed in these limestone beds.

UPPER DEVONIAN - MISSISSIPPIAN UNDIVIDED

In this area the Banff (Mississippian) shales directly overly the Fort Creek (Upper Devonian) shales. Both shales are dark grey to black with silty to sandy zones. They cannot be separated except by fauna and so are grouped together as one rock unit for this report . At Nahanni Butte, after determining the elevation, location and strike and dip of the top and bottom of the unit, a thickness of 6500' was determined geometrically. This thickness assumes that across the shale occupied valley there was no wrinkling or repetition of beds.

As this is almost impossible for shale in a deformed belt the thickness is undoubtedly high, but as this was the closest figure available it was used as the unit thickness when drawing up cross-sections in the area. At Central Leduc Toad River Joint Venture #1 (124°59' W.Long. 59°21' N.Lat.) approximately 130 miles to the southwest, the unit was 2530' thick. At British Columbia Oil Lands Bekumi Lake #1 (123°06' W.Long., 59°30'24" N.Lat.) it consisted mainly of green limy shales measuring 2510' in thickness with the base not reached.

The basal portion of the black shales is probably a euxinic basin deposit with green shales and limestonebeing a shelf facies to the east. Reefing, equivalent in age to the Kee Scarp reef at Norman Wells, may be anticipated in this shelf facies.

CARBONIFEROUS

For mapping purposes, the Carboniferous has been divided into a lower limestone and shale unit and an upper sandstone and shale unit. This division is based strictly on lithology with no regard as to age of the beds.

Lower Unit of the Carboniferous

This lower unit, of Mississippian age, consists of 0'-1000' of coarse organic and fine crystalline grey limestone, with occasional shale interbeds. The unit may be lithologically correlated with the Rundle formation of the Banff area, although agewise it is probably equivalent to the Upper Banff formation. Most workers in the area term the unit "Rundle". It becomes more clastic toward the west shaling out to leave only limestone stringers by the time the Labiche Range is reached. To the east of the Pointed Mountain area the Rundle has good potential as a reservoir rock. Up to 100' of shale separates the limestone from the Upper unit of the Carboniferous. Fossils collected include Deltodus, bone fragment, and Productus Sp.

Upper Unit of the Carboniferous

Sandstones and shales with occasional limestone stringers make up the main portion of this unit. In the southern portion of the area the sandstone beds are overlain by up to 500' of chert and hard black very siliceous shale. The sandstones are generally light grey to brown, well sorted and rounded, fine to medium grained and are calcareous to quartzitic. Porosity is fair to excellent. Abundant carbonaceous material and plant fragments indicate proximity to the Western shoreline of the Mississippian seaway. Patton (M. Sc. thesis, University of Alberta) reports a 4' coal seam near the base of the unit at Jackfish River.

Within the area it thins from close to 8000' thick in the west on the Labiche Range to 750' in the East on Sawmill Mountain. This thinning is probably due both to rafting in of the sands from the West, and to the post-Carboniferous unconformity. Being overlain and underlain by shale, this wedge edge, in an updip position, will probably form one of the most promising traps on the Western portion of the Bekami Lake acreage. A test of the formation at British Columbia Oil Lands Bekami Lake #1 yielded 970' of salt water.

The age of this unit is probably Upper Mississippian (i.e. Upper Rundle) and possibly Pennsylvanian. To the south at Mt. Merrill, on top of the chert bed, a sandstone of similar lithology yielded fossils indentified as Permian. Fossils collected include Trepostoma?, Deltopecten, Productid, Straparollus, Martinia of glabra (about Meramec), Echinoconchus, Productis sp., Allerisma sp., Composita sp., Chonetes, Cherothyridina and Dictyoclostus of. parvus (Lower Chester).

CRETACEOUS

Garbutt Formation

Overlying the Upper Unit of the Carboniferous is a shale, believed to be of Lower Cretaceous age, called the Garbutt formation. Calculated to vary from

800' to 1100' in thickness within the Pointed Mountain area, it consists of dark grey fissile to crumbly shale and silty shale with abundant ironclaystone nodular bands. Except by stratigraphic position it is very difficult to distinguish from the Lepine shale.

Scatter Formation

Overlying the Garbutt in this area is a grey-green, glauconitic, very fine grained, tight sandstone with some shale, termed the Scatter formation. Here only one member was observed which has an estimated thickness of 400'-500'. The formation's tightness and amount of exposure make it unfavorable as a potential producing horizon in this area. However, its resistive properties and characteristic color made it very useful for mapping purposes.

Lepine Formation

Measuring approximately 1200' thick at the mouth of the Petitot River the Lepine consists of fissile to crumbly dark grey shale with abundant ironclaystone nodular bands. It is quite fossiliferous, containing ammonites, pelecypods, and a fish scale zone which is taken to mark the Upper Cretaceous-Lower Cretaceous boundary.

The Garbutt, Scatter and Lepine formations may all be correlated with the Buckinghorse formation to the south.

Fort Nelson Formation

Chert-quartz conglomerates and cross-bedded coarse sandstone measuring approximately 500' make up the Fort Nelson Formation. These ridge-forming beds may be correlated with the Dunvegan formation farther south.

Kotaneelee Formation

An estimated 500' of marine dark grey shales with a few sandstone and grit beds make up the Kotaneelee formation. It is believed to correlate with all or part of the Smoky River shale series.

Wapiti Formation

A medium grained sandstone grading to grit with some coal, indicating a non-marine origin, overlies the Kotaneelee formation. Tentative correlation with the non-marine beds overlying the Smoky River shales has led to use of the name "Wapiti" for these beds.

STRUCTURE

GENERAL STATEMENT

The Pointed Mountain area is characterized by extremely large simple elongate anticlinal and closed basinal structures. Except in the easterly portion there is a noticeable absence of much wrinkling associated with the large folds and faults. The curved shape of the structures coupled with the change in thickness of the "Upper Unit of the Carboniferous" suggests more than one period of orogeny. Some warping was probably taking place while this upper sand unit was being deposited, however, closely associated dips in Cretaceous beds suggest a more extensive Laramide orogeny. Folding appears to have taken place before any faulting.

All major structures in the area are probably influenced by basement control. However, whether the basement folds up or faults up under structures such as the Pointed Mountain anticline is of little consequence provided closure of some description does exist.

The Pointed Mountain anticline has approximately 2500' of north closure. It has an area about 2.2 miles wide and 14 miles long under closure at the surface. A broad flat valley breaches the structure close to the crest. The top of the Slave Point formation is estimated to be at a depth of 5,500'. The Silurian should be topped at a depth of 7100'.

THE POINTED MOUNTAIN ANTICLINE

Centered at 60°24' N.Lat., and 123°55' W.Long., this simple doubly plunging anticline is approximately 20 miles long and 8 1/3 miles wide. Approximately 3000' of Mississippian sandstone and shale is exposed in the core while at the south end an additional 500' of chert and siliceous shale preserve the anticlinal form. At the south and east end the flanks have 7000 feet of structural relief. To the west there is 4000' of structural relief between the anticline and the Kotaneelee syncline.

The structure lies en echelon to the southward plunge of the Liard Range Anticline. There is probably a small amount of tear faulting between the two structures. Closure between the two anticlines is probably in the order of 2500' although lack of good outcrop has made exact evaluation difficult.

Structural similarities make the Pointed Mountain Anticline appear to have originally been a part of the Liard Range anticline with a saddle between the two. Subsequent movement has relatively pushed the Liard Range to the south and east, resulting in the en echelon relationships.

A broad flat bottomed valley cuts across the anticline running in a northwesterly direction. As it is close to the crest it makes the anticline easily accessible for drilling purposes. From this position 3000' of Carboniferous sands and shales which are exposed would not have to be drilled. By averaging the combined Banff-Fort Creek shale thickness at Nahanni Butte and Central Leduc Toad River Joint Venture #1 it is estimated that the Shale thickness at Pointed Mountain is probably close to 4500'. This would place the top of the Slave Point formation at approximately 5500'. In building cross-sections in the area the closest known shale thickness was used, i.e. 6500' from South Nahanni.

THE LIARD RANGE

Bounded on the east by the Flett Creek Basin and on the west by the Kotaneelee syncline, the Liard Range is basically an anticline with a thrust back limb. The anticlinal axis, swings from a northwest strike in the south to a northeast strike at the north end forming a long gradual arc. The Liard Range thrust, trending N 25° W and dipping west is generally much straighter. Going north the anticlinal axis runs under the plane of the fault and emerges again after approximately 10 miles. The east limb of the anticline is preserved under the fault plane throughout this distance. At no place was crumpling or brecciation observed in conjunction with the fault. The fault appears to be completely independent of the anticline and probably was formed in a more recent orogeny.

On the upthrown side of the fault the Carboniferous sand-shale unit measures up to 5500' while on the east side of the fault it is only 1000' thick. The average rate of thinning between the Labiche Range and Sawmill Mountain is 460 feet per mile. At this rate a dip slip of 6.5 miles is required for the fault. The suddenness with which the fault dies out toward the south indicates that this is not so. It is suggested that gentle anticlinal structures were present during the end of and shortly after deposition of the Carboniferous sands. Post Mississippian erosion removed much of the sandstone from the higher land. During Laramide time the thick sandstone section present in the basin to the west was faulted up over the thinner sandstone section on the highland.

The portion of the Liard Range as defined by Hage, extending south from a point opposite the north end of Pointed Mountain anticline to Fort Liard, on the east side of the Liard syncline, is not structurally a part of the true Liard Range. This separate range is actually a large faulted anticline separated

from the Liard Range by the Flett Creek Basin - Liard syncline trend and structurally ties in with the Flett Mountain and Sawmill Mountain fault block.

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Respectfully submitted,

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SAA/vb

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