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TAY RIVER MAP-AREA, ALBERTA

(Summary Account)

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CONTENTS

	Page
Introduction	1
Stratigraphy	1
Devonian	1
Mississippian	1
Banff formation	1
Mississippian and (?) Pennsylvanian	2
Rundle formation	2
Jurassic	2
Fernie group	2
Lower Cretaceous	2
Blairmore group	2
Upper Cretaceous	3
Blackstone formation	3
Bighorn formation	3
Wapiabi formation	3
Brazeau and Edmonton formations	3
Structural geology	4
Oil possibilities	4

Illustration

Preliminary map - Tay River, Alberta.

TAY RIVER MAP-AREA, ALBERTA

INTRODUCTION

Tay River map-area lies between longitudes 115°15' and 115°30' and latitudes 52°00' and 52°15' in the Foothills Belt of central Alberta, 60 miles west of Innisfail. A graded road from Innisfail or Rocky Mountain House extends to within 8 miles of the southeastern corner of the area. Wagon roads branch from the graded road northwest to Ram No. 2 oil well on Prairie Creek and west along Clearwater River to two abandoned oil wells 2 miles south of the map-area. Forestry trails from these roads follow the main stream valleys and provide easy access to most parts of the area.

The map-area has a maximum relief of about 2,500 feet, ranging from 3,900 feet above sea-level at its northeast corner to 6,380 feet on Idlewilde Mountain. The topography is controlled by the structure and character of the bedrock formations. Thus, anticlinal structures with cores of resistant Palaeozoic limestone form prominent ranges of hills such as Idlewilde and Corkscrew Mountains. Synclinal areas between the major anticlines, underlain by the less resistant sandstones and shales of Mesozoic age, are of lower relief. Nearly horizontal Mesozoic sandstones form the lowlands in the northeastern part of the map-area.

With the exception of the higher ranges of hills, most of the area is drift covered and rock exposures are small and scattered. No continuous section of any of the formations was found in the map-area.

STRATIGRAPHY

The rock formations of the map-area are all sedimentary and range in age from Devonian to Upper Cretaceous.

Devonian

Devonian (1)[1] strata are exposed along the crests of

[1] Numbers in brackets refer to map-unit numbers on the accompanying map and map-legend.

Prairie and Idlewilde anticlines. They consist, mainly, of thick-bedded, massive, dark blue-grey limestone and dolomite with some interbedded calcareous shale.

Mississippian

Banff Formation. The Banff formation(2) is estimated to be 600 to 700 feet thick. It is composed of buff weathering, platy, dark blue-grey limestone, shaly limestone, black calcareous shales, and occasional thick beds of light weathering blue-grey limestone.

Mississippian and (?) Pennsylvanian

Rundle Formation. The Rundle formation(3) is exposed along the crests and flanks of the major anticlines, where it forms the highest and most rugged ranges of hills. It consists mainly of white weathering, thick-bedded, light grey, coarse-grained limestone with some interbedded, light grey, fine-grained limestone, platy limestone, and chert. Its thickness is estimated to be 700 to 800 feet.

An outcrop of pink weathering quartzite containing much iron oxide was observed on the northeast flank of Tay anticline 1 mile southeast of Prairie Creek. It lies apparently between the Rundle and Fernie formations, and though too small to map may represent the Pennsylvanian, Rocky Mountain formation.

Jurassic

Fernie Group. The Fernie group is here divisible into two parts. The lower part(4) consists of 100 to 150 feet of thin-bedded, fine-grained, platy, black limestone, with much interbedded chert. The beds weather buff to grey with a hackly surface and form conspicuous cliffs and dip slopes on the flanks of Prairie and Tay anticlines. On Tay anticline, south of Tay River, a bed of fine-grained, dark, phosphatic limestone at or near the contact with the overlying shale contains fossils that have been identified, tentatively, as Lower Jurassic by F.H. McLearn of the Geological Survey. Apart from this phosphatic bed at or near the top, no fossils were found in this part of the group and some of it may be of Triassic age.

The upper part of the Fernie group(5) consists of poorly exposed, fissile, black shale and sandstone. In the southern part of the map-area the shale rests on the underlying limestone. To the northwest, however, on the southwest flank of Prairie anticline, 60 feet or more of clean, fine-grained, white to buff weathering sandstone or quartzite overlies the limestone. This, in turn, is succeeded by 50 feet or more of black, fissile shale. The passage from Fernie shale to overlying Blairmore conglomerate is abrupt in the southern part of the map-area, but to the northwest sandstone is interbedded with the shale near the contact and may represent an occurrence of Nikanassin (Lower Cretaceous) beds.

Lower Cretaceous

Blairmore Group. The base of the Blairmore group(6) is marked by a massive chert and quartzite pebble-conglomerate 35 to 45 feet thick. The conglomerate is overlain by coarse-grained quartzitic sandstones, crossbedded dark brown sandstones, and brown carbonaceous shales. These in turn are overlain by coarse- and fine-grained, greenish grey, crossbedded sandstones and olive-green crumbly shales. A massive, chert-pebble conglomerate up to 30 feet thick occurs near the top. It is somewhat similar to the basal conglomerate, but the pebbles are smaller and much less firmly cemented in a lighter grey, finer grained, and more siliceous matrix. The thickness of the Blairmore group is estimated to be at least 1,500 feet.

Upper Cretaceous

Upper Cretaceous strata comprise a lower marine group that includes the Blackstone, Bighorn, and Wapiabi formations, and an upper non-marine group that includes the Brazeau and Edmonton formations. The Blackstone and Bighorn formations lie in an open syncline in the southwestern part of the area, and are also exposed along the northeast flank of Teepee-Pole and Tay anticlines.

Blackstone Formation. The Blackstone formation (7) consists largely of black marine shale, sandy shale, and some thin beds of fine-grained sandstone. The formation is poorly exposed and no reliable data on its thickness were obtained, but it is estimated to be between 1,000 and 1,300 feet thick.

Bighorn Formation. The Bighorn formation (8) is between 280 and 320 feet thick. It consists of two sandstone members separated by a middle member of grey sandy shale. The lower sandstone consists of 10 to 20 feet of poorly bedded, reddish weathering, rubbly, impure sandstone at the base overlain by 40 to 60 feet of platy, hard, fine-grained, pure, quartzitic, pink to cream weathering sandstone. It is characterized by worm tracks or root markings and abundant Inoceramus capulus in certain beds. The middle member is predominantly grey shale with thinly bedded shaly sandstone and thin ironstone bands. The upper member consists of 25 to 30 feet of hard, platy, quartzitic sandstone very similar to the lower sandstone. It is more thinly bedded and contains fewer worm tracks, but its only characteristic feature is an abundance of Cardium pauperculum. The sandstone members are resistant to erosion, and form mesa-like topography where nearly horizontal, and conspicuous ridges where they dip at steeper angles.

Wapiabi Formation. The Wapiabi formation (9) of marine shale lies above the Bighorn along the northeast flank of Teepee-Pole and Tay anticlines. Only one exposure was observed, on the bank of Tay River, and the thickness of the formation is not known, but in the adjoining Marble Mountain map-area, to the southeast, the Wapiabi is estimated[1] to be between 1,490 and 1,840 feet thick.

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1 Beach, H. H.: Geol. Surv., Canada, Paper 42-3.

Brazeau and Edmonton Formations. The non-marine Brazeau and Edmonton formations (10) underlie the northeastern half of the map-area. They are composed of interbedded sandstone, shale, and conglomerate. The Brazeau sandstones are mainly yellowish green, brown weathering, crossbedded, medium- to coarse-grained, arkosic rocks. Beds and lenses of chert-pebble conglomerate are interbedded with the sandstone and are most abundant near the base of the formation. Dark green sandy shales are also common. About 3,500 feet northeast of the Wapiabi-Brazeau contact the sandstone changes from yellow or brownish green to light grey, and becomes more thickly bedded. Conglomerate beds are rare or lacking. This change in lithology may mark the approximate boundary between the Brazeau and Edmonton formations, but it is not sufficiently well defined to map. No reliable estimate of the combined thickness of the Brazeau and Edmonton can be made as the structure in the area underlain by these formations is not known.

STRUCTURAL GEOLOGY

Tay River map-area may be divided into three structural units. From southwest to northeast these are: (1) the Idlewilde Mountain thrust block, bounded on the northeast by the fault northeast of Idlewilde Mountain; (2) the Sevenmile Creek thrust block, bounded on the southwest by the Idlewilde fault and extending 6 miles northeast to the zone of thrust faulting along the northeast flank of Tay and Teepee-Pole anticlines; and (3) the lowlands of the northeastern half of the map-area, underlain by Brazeau and Edmonton formations.

Only a small part of the Idlewilde thrust block is in the map-area. It comprises an asymmetric anticline of Palaeozoic strata that dip 25 to 30 degrees on the southwest limb and nearly vertically on the faulted northeast limb.

The Sevenmile Creek thrust block adjoins Idlewilde block to the northeast. It consists, from southwest to northeast, of: (1) a broad open synclinal structure of Blackstone and Bighorn formations with minor anticlinal and synclinal flexures on the limbs; (2) the nearly symmetrical Clearwater and Prairie anticlines; (3) a second syncline; and (4) the highly compressed Tay and, in the south, Teepee-Pole anticlines. Blairmore strata on the northeast flanks of Tay and Teepee-Pole anticlines have been thrust northeastward, partly overturned, and faulted over younger formations. In the southeast the fault along the northeast flank of Teepee-Pole anticline seems to die out; a parallel fault replaces it in the syncline between Teepee-Pole and Clearwater anticlines. This fault zone extends to the northwest boundary of the map-area, in which direction the displacement increases so that Tay River anticline is thrust over the northwesterly extension of Teepee-Pole anticline.

The third unit comprises the lowlands of the northeast half of the map-area, underlain by Brazeau and Edmonton sandstones and shales. In the area between the Wapiabi-Brazeau contact and a parallel line 4 miles to the northeast scattered small exposures exhibit marked changes in the angle and direction of dip. The pronounced fault zone that crosses Prairie Creek about ½ mile northeast of the Wapiabi-Brazeau contact may be the northwesterly continuation of the fault crossing Tay River 1 mile from the eastern border of the map-area. In this part of the area there are insufficient exposures to determine the structure, but the attitude of the beds in observed outcrops indicates that the formations are folded and faulted. Farther northeast, to the borders of the map-area, exposures along Prairie and Dry Creeks indicate that the strata have a constant northwesterly strike and dip northeast at 4 to 5 degrees; they probably form part of the western rim of the Alberta syncline.

OIL POSSIBILITIES

The larger anticlinal structures are possible sources of petroleum and natural gas. In Idlewilde, Prairie, and Tay anticlines interest must centre on finding oil in the Devonian and older formations as all younger strata are exposed in the cores of the folds.

Clearwater and Teepee-Pole anticlines plunge northwest and the Palaeozoic formations forming their cores

disappear beneath a cover of Mesozoic strata. Southeast of Clearwater River, in Marble Mountain map-area, the plunge of these structures changes to southeast. Altoba Clearwater No. 1 well has been drilled on this structure on the south side of Clearwater River about 3 miles south and 1 mile west of the southeast corner of the area. Some oil and gas shows were encountered in Devonian limestone and dolomite at drilling depths of between 1,185 and 1,284 feet, some 900 to 1,000 feet below the top of the Devonian. No encouraging indications were reported from pre-Devonian strata penetrated below 2,721 feet[1].

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[1] Beach, H.H.: Geol. Surv., Canada, Paper 42-3.

Prairie and Tay anticlines may be regarded as the northwesterly extension of Clearwater anticline. Prairie anticline is a nearly symmetrical structure, followed to the northeast by a narrow syncline and the tightly compressed Tay anticline, which is faulted along its northeast limb. These structures plunge northwest north of Prairie Creek and southeast south of the Creek. About 300 to 400 feet of Devonian strata are exposed in the core of the structure on Prairie Creek. Ram No. 2 well has been drilled on this anticline where it crosses Prairie Creek. The well penetrated Devonian limestones and dolomites, dipping at 10 to 20 degrees, for about 2,360 feet. At that drilling depth a fault was intersected and below it the well passed into steeply dipping, in places contorted and sheared, dark grey to black, fine-grained limestones, and continued in these to a drilling depth of 4,140 feet. A medium- to fine-grained, grey to reddish quartzite, dipping at 35 to 40 degrees, was intersected from 4,140 to 4,185 feet. Below this, to 4,330 feet, the well encountered fine-grained, dark, limy argillites and platy limestones. The quartzite and underlying argillite and limestone seem similar to beds between drilling depths of 2,721 and 2,795 feet in Altoba Clearwater No. 1 well, which were considered pre-Devonian by Beach[2].

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[2] Beach, H.H.: Op. cit.

Some oil has been obtained from Ram No. 2 well and another well (Ram No. 3) is being drilled nearby on the same structure.

The Brazeau and Edmonton formations for 4 miles northeast of the Wapiabi-Brazeau contact are folded and faulted, but owing to lack of exposures the structure is not known and the oil possibilities of this part of the map-area cannot be assessed.