CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

PAPER 55-14

TWO LAKES, ALBERTA

(Map and Preliminary Report)

By

H. R. Greiner

OTTAWA
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Price, 50 cents

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INTRODUCTION

Location

The Two Lakes area is located in the Foothills belt of west-central Alberta between latitudes 54° 15' and 54° 30' north and longitudes 119° 30' and 120° 00' west. The west border follows the boundary with British Columbia. Mapping on a scale of 1 mile to the inch was completed for the east half of the area, and in the southeast quarter of the west half bounded by Torrens River and Narraway River.

Accessibility

The area may be reached by pack-train from Grande Prairie, Alberta, in the summer months. During the winter, motor vehicles can be driven over a road from Grande Prairie as far as the Jerd well site on Torrens River.

The Grande Prairie-Jasper pack-trail follows along the top of Nose ridge in the northeast corner of the area. Another trail transects the southwest corner of the area and provides communication with Beaverlodge to the northwest.

Previous Work

The only previous study of the Two Lakes area was a reconnaissance survey along parts of Torrens, Stetson, and Nose Creeks by C. S. Evans and J. F. Caley (1929)[1]. They noted the formational contacts in those streams.

Acknowledgments

Field data for the present work were collected during the season of 1954. Able assistance was given by A. R. MacGregor, G. M. Greenwood, and E. H. MacCosham.

Fossils collected were identified by W. L. Fry, J. A. Jeletzky, and E. T. Tozer of the Geological Survey of Canada.

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[1]Dates, etc., in parentheses refer to References, page 9.

PHYSICAL FEATURES

Ridges and valleys in the Two Lakes area trend in a general northwesterly direction, thus reflecting the structural trend. Elevations increase toward the southwest. In the southwest corner of the area, the mountains stand well above timber-line. However, in the part of the area studied, only Grand Mountain ridge and its continuations, Mount Jean to the north and Hat Mountain to the south, lie above the limit of tree growth. Most of the area is heavily wooded with spruce, pine, alder, birch, willow, and minor poplar and balm-of-gilead. Some tamarack grows in the swampy bottom along Gunderson Creek.

Between Grand Mountain ridge and Nose Mountain northwesterly alinement of ridges and valleys is not pronounced. Nose Mountain ridge, however, forms a prominent, northeast-dipping cuesta, with Nose Creek and Shetler Creek alined on its south flank and the headwaters of Cutbank River on the north.

The Cutbank waters, like those of Kakwa River that just crosses the southeast corner of the map-area, flow in a northeasterly direction, eventually to join Smoky River. Nose Creek and the Torrens River-Narraway River system, on the other hand, flow in a more northerly direction to their eventual juncture with Wapiti River. Between Hat Creek and Gunderson Creek are two small lakes.

Stetson Creek, Torrens River, and Narraway River occupy incised, canyon-like valleys, carved largely in dark shales. A well-preserved terrace lies some 400 feet above the valley floor. Nose Creek and Gunderson Creek, in contrast, have wider, non-incised valleys; Gunderson Creek is especially misfit, meandering, and swampy.

Glaciation

The principal valleys were probably once filled with glacial ice that flowed from the high ranges to the southwest onto the plains. Good glacial striae were seen at three locations. Two were found in the west half of the area, one paralleling Torrens River and the other Narraway River, at elevations of 5,400 and 4,100 feet respectively, and a third on Grand Mountain ridge at almost 5,500 feet elevation. This last striae suggests an overflow of ice across the ridge and into the Nose Creek drainage basin to the northeast. The angular, unrounded nature of the higher parts of this ridge suggests that this striation probably lies close to the highest level of glacial ice in the east half of the area.

The deeply incised, youthful valleys of Stetson Creek, Torrens River, and Narraway River, with their pronounced terraces, suggest that the area has been rejuvenated in post-glacial time.

STRATIGRAPHY

Rocks in the area studied are Lower and Upper Cretaceous and possibly Paleocene in age. The stratigraphic nomenclature used herein is that employed in areas to the southeast except for the term "Wapiti group', which is used in preference to 'Brazeau formation' to include beds of possible Paleocene age.

Table of Formations

Period or Epoch	Formations or group and approximate thickness in feet		Lithology
Paleocene?	Wapiti 6,000		Sandstone, shale, conglomerate; coal (non-marine)
		Solomon member 60-80	Sandstone (marine and non-marine?)
Upper Cretaceous	Wapiabi 1,400		Shale, siltstone, sandstone (marine)
	Bighorn 400-500		Quartzose sandstone, shale, conglomerate (marine and non-marine)
	Blackstone 2,000		Shale; minor siltstone (marine)
	Dunvegan 350-400		Quartzose sandstone, shale, siltstone; coal (non-marine and marine)
Lower Cretaceous	'Fort St. John' 500+		Shale, siltstone (marine)

Lower Cretaceous

'Fort St. John' Group

The oldest rocks in the part of the area mapped are in the 'Fort St. John' group, which is exposed along Torrens River. No lower contact was seen. A thickness of 450 to 500 feet was obtained by Thorsteinsson (1952) in the Grande Cache area to the southeast. The 'Fort St. John' group is presumed to thicken to the northwest, hence a thickness of 500+ feet is given for the Two Lakes area. The upper contact with the Dunvegan formation on Torrens River was placed at the base of a series of ledge-forming, lenticular, non-marine sandstones and siltstones. These beds, however, may grade into greenish grey mudstones and shales, but are readily dis-distinguishable from the underlying 'Fort St. John' group, which is composed of dark grey, fissile shale and silty shale with siltstone beds up to 6 inches thick. The upper 40 feet contains marcasite concretions, and the remainder thin, rusty weathering calcitic bands and concretions.

Neogastroplites ex. gr. cornutus (Whiteaves), found low in the section on Torrens Creek, suggests correlation of that part of the 'Fort St. John' group with the Goodrich formation of the Peace River area.

Upper Cretaceous

Dunvegan Formation

The Dunvegan formation is conformably underlain by the 'Fort St. John' group and overlain by the Blackstone formation. It is composed predominantly of sandstone with interbedded shales. The sandstone outcrops on the hilltops between Torrens River and Stetson Creek. Good exposures occur along Torrens River, where a thickness of 350 to 400 feet was measured. On Torrens River a massive, resistant, 4-foot sandstone bed marks the top.

Cross-laminated, ripple-marked, lenticular, micaceous, medium-grained, grey sandstone beds up to 4 feet thick form at least three cliff-forming units within the Dunvegan. Intercalated with the sandstones, and also forming more or less distinct units, are greenish grey, fissile, micaceous shales and siltstones. Thin, shaly coal bands and partings occur in some parts of the sequence. Plant fragments were the principal fossils found in the non-marine sandstones. Beds of marine origin, but poorly fossiliferous, are probably also present.

Blackstone Formation

Approximately 2,000 feet of dark, fissile shale, silty shale, and siltstone make up the marine Blackstone formation, but intense folding, crenulation, and minor faulting make estimates of thickness difficult. A zone of resistant siltstone lies some 40 feet above the base. Numerous thin, rusty weathering, calcareous beds, about 1 inch to 6 inches thick, occur mainly in the middle part. Ripple-marks and worm tubes are common in the siltstones. The rather sparse marine fauna includes Inoceramus labiatus (Schlotheim), found in the lower and middle parts of the formation, Watinoceras sp. indet. in the mid-section, and Prionocyclus (Collignoniceras) sp. indet. near the top.

Bighorn Formation

The resistant sandstone units of the Bighorn formation outcrop on the top of Hat Mountain and on its flanks, and on Grand Mountain ridge. They were traced to the northwest as far as Narraway River. The contact with the underlying Blackstone shale is conformable and has been placed at the base of the first thick sandstone bed. The upper contact with the Wapiabi formation also appears to be conformable. The formation is composed of lower and upper sandstones separated by some 200 feet of dark, fissile shale, the whole being 400 to 500 feet thick. Only the lower sandstone and the shale are commonly well exposed. The lower sandstone thins from about 115 feet at Hat Mountain to some 90 feet just north of Grand Mountain, the basal part grading into light grey weathering siltstone. The upper sandstone measured about 120 feet thick 1 1/2 miles southwest of Mount Jean. In the east half of the map-area only some 50 feet of the upper sandstone is preserved at the top of Grand Mountain. It appears, therefore, that the northward thinning of the Bighorn takes place through gradual loss of the lower and upper sandstone units.

The sandstones of the Bighorn formation are generally massive, light grey, and fine- to medium-grained rocks. Locally they are cross-laminated, and the well-cemented sand grains are mainly of quartz. Conglomerate is locally present in the lower sandstone member. The pebbles are well-rounded quartz and dark grey chert. Contacts of the sandstones with the median shale unit are gradational. In general, the shale is dark grey and fissile, with rusty weathering concretionary bands, and contains thin interbeds of shale and siltstone with shaly coal seams and plant leaves, indicative of a non-marine origin. However, an oyster coquina lies near the base of this median shale in the Grand Mountain vicinity, and Scaphites ex. gr. ventricosus (Meek and Hayden) is also present. Hence, at least part of the shale is of marine origin.

Wapiabi Formation

Approximately 1,400 feet of dark, concretionary, marine shale, mudstone, siltstone, and sandstone comprise the Wapiabi formation. It is conformable with and overlies the Bighorn formation. The lower 700 feet consists of shale, silty shale, and siltstone, all containing concretionary limestone bands and nodules, and a marine fauna. Some 65 feet of fine-grained, in places cross-laminated, grey sandstone beds up to 5 feet thick lie above the shales and siltstone, succeeded by about 175 feet of mudstone and shale, in turn overlain by another 50 feet of sandstone. The uppermost 400 feet are interbedded shale and sandstone containing Inoceramus ex. gr. lobatus (Goldfuss).

Upper Cretaceous and (?) Paleocene

Wapiti Group

The entire northeastern half of the map-area is underlain by the Wapiti group, all but the base of which is non-marine.

About 70 feet of unfossiliferous, light to greenish grey, hard, platy, medium- to fine-grained sandstone beds conformably and gradationally overlie the Wapiabi formation. These beds are believed marine in origin and are mapped separately as the Solomon sandstone member. They outcrop sporadically in a narrow belt from North Adams northwestward to Mount Jean. On North Adams ridge, the Solomon is overlain by a cliff-forming conglomerate 65 feet thick, which forms the base of the non-marine part of the Wapiti group.

The lower 500 to 1,000 feet of the Wapiti consists of beds of greenish grey to buff, medium- to coarse-grained sandstone, conglomerate, and siltstone, with grey shale and mudstone interbeds. The conglomerates are made up of well-rounded dark chert and quartzite pebbles up to 2 inches in diameter. This part of the section is commonly easily eroded. The succeeding 2,000 feet consist largely of dark, carbonaceous, silty shale and mudstone with thin, buff-coloured sandstone interbeds, the latter reaching as much as 50 feet in thickness. Rare conglomerate and thin coal seams are present, together with some bentonitic clay shales. Resistant and thick sandstone beds, with dark shales and mudstones and a few coal seams, comprise the overlying 3,000 feet. Bentonitic clay shales are again present. The uppermost 500 feet or so of the group contain abundant coal seams and coaly shale. Some of the sandstones are loosely cemented, friable, and light buff coloured. The entire succession totals about 6,000 feet in thickness.

Pleistocene and Recent

Poorly stratified sands and gravels underlie the terraces along Stetson Creek and Torrens River, and are generally well exposed at the mouths of small tributaries of those streams. This material, which probably is reworked glacial till and outwash gravel, may attain 50 to 100 feet in thickness.

STRUCTURAL GEOLOGY

Strata of the Wapiti group in the northeast part of the map-area are folded into two large anticlines and synclines. The northeasternmost anticline has average dips of 10 to 15 degrees on the northeast flank, and somewhat less on its southwest limb. An amplitude of 2,000 to 3,000 feet seems not unlikely for the anticline. The Union Oil Company Nose Creek No. 1 well, on Gunderson Creek, is on the crest of this anticline.

A broad syncline, with a minor anticline and syncline on its northeast limb, separates the anticline just mentioned from the next to the southwest. This anticline is asymmetrical, dips on the northeast flank averaging about 65 degrees and those on the southwest flank being as low as 6 degrees. At North Adams Mountain, the crest is broken by a minor fault. The adjacent syncline lies less than a mile to the southwest. The last two folds mentioned have a southeast plunge of 3 or 4 degrees for 5 miles south of Narraway River, thus bringing Wapiabi, Bighorn, and Blackstone formations to the surface.

The west flank of the above syncline is broken by a thrust fault believed to be continuous with the northeasternmost fault in Copton Creek map-area to the southeast (Irish, 1952). This steeply dipping fault can be fairly well traced southwest from the junction of Narraway and Torrens Rivers to where it cuts across the ridge 4 miles north of Grand Mountain. It is largely concealed by overburden on the northeast slopes of Grand Mountain and Hat Mountain ridges. Stratigraphic displacement on this fault is about 2,000 feet in the southeast, bringing the Blackstone and Bighorn formations against the Wapiti, but decreases to the north. Just north of Grand Mountain the fault apparently splits, the western subsidiary fault transecting the Bighorn and Blackstone formations on the ridge. It could not be traced through the Blackstone shales just to the west.

Close folds and minor faults characterize the belt of Blackstone shale, especially in a zone adjacent to the above fault.

A second major fault, probably less steeply dipping, parallels the lower part of Stetson Creek, and thrusts the Dunvegan formation over the Blackstone. However, on Stetson Creek to the

southeast it passes entirely into the Blackstone formation. It is concealed farther to the southeast, but probably joins the fault thrusting Blackstone over Wapiabi strata in the Copton Creek area (Irish, 1952).

Closely spaced folds occur in the Dunvegan formation in the south-central part of the map-area, and the partial erosion of these folds has yielded an outcrop pattern of long, narrow bands and tongues of Dunvegan sandstones forming ridges between Blackstone shale. Two small thrust faults with displacements of the order of a few hundreds of feet are also present. These faults, like the other major faults, have northwesterly trends. They cut strata of the Dunvegan formation and the 'Fort St. John' group. Jerd No. 1 well on Torrens River is on the crest of an anticline in the 'Fort St. John' shale.

ECONOMIC GEOLOGY

Coal

Several coal seams were observed in the Wapiti group, in that part of the area mapped. They are thicker and more abundant in the upper parts of the group. On the west face of Nose Mountain through 200 feet of strata a total of 20 feet of coal may be encountered, the seams ranging from a few inches to 5 feet in thickness. In most seams the coal contains interbedded shale bands and partings. None of the seams is persistent and none was correlated with certainty from one stream section to another along Nose ridge.

Oil and Gas

Two wells are being drilled in the Two Lakes area. Jerd No. 1 on Torrens River, in l.s. 13, sec. 14, tp. 61, rge. 13, W. 6th mer., commenced drilling on February 3, 1954, and was suspended at a depth of 616 feet on March 18, 1954. Drilling was resumed about January 31, 1955. The Union Oil Company Nose Creek No. 1 well, in l.s. 14, sec. 7, tp. 63, rge. 11, W. 6th mer., on Gunderson Creek started drilling January 13, 1955, and had reached a depth of 4,300 feet at time of writing. No significant data are available from these wells as yet.

References

Evans, C. S., and Caley, J. F.: Reconnaissance Survey of Foothill Area in Wapiti River Basin, Alberta; Geol. Surv., Canada, Sum. Rept. 1929, pt. B, pp. 36-39.

Irish, E. J. W.: Copton Creek Map-area, Alberta; Geol. Surv., Canada, Prel. Paper 52-7, 1952.

Thorsteinsson, R.: Grande Cache Map-area, Alberta; Geol. Surv., Canada, Prel. Paper 52-26, 1952.