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The Oregon Basin Gas and Oil Field

Park County

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The Oregon Basin Gas and Oil Field

INTRODUCTION

Ever since the first discovery of oil in the Bighorn Basin vigorous prospecting for oil structures has been going on. Attention has only lately been directed to the northern and western side of the Basin, the first wells in the Oregon Basin field having been drilled five years ago. No oil was encountered, but a very heavy flow of gas.

Previous Work

No detailed work treating of this district has so far been published. Fisher* in his report on the geology of the Bighorn Basin shows the anticlinal structure in this locality. Washburne† first called attention to its possible economic importance. Hewett‡ has examined in great detail a section of the rock formations exposed along the Shoshone River near Cody, and his descriptions have been found extremely accurate and concise. They have been freely drawn upon by the writer in the compilation of this report.

Field Work

The field data for the following report was collected during the summer of 1916, when the writer, assisted by Messrs. R. W. Gibson, Max T. Hofius, Albert K. Chan, and Walter Storrie, spent part of the month of August at Oregon Basin. The topographic map of the Oregon Basin quadrangle was used as a base map and as a guide for determining elevations throughout; the locating of boundary

*Prof. Paper, U. S. Geol. Surv., No. 53, 1906.
†Bull. 340, U. S. Geol. Surv. 1908, p. 360.
‡Bull. 541c, U. S. Geol. Surv. pp. 43-67.

lines, of oil wells, etc., was done by means of stadia traverses started from the bench marks of the U. S. Geological Survey or from located section corners.

A section of the Cretaceous formations was measured by means of a stadia traverse about 6 miles northwest of Wiley along the west side of Sage Creek, where the end of the anticlinal uplift of Cedar Mountain is exposed. This was the nearest locality to Oregon Basin where a complete section could be obtained. All prominent lithological members were located as stations in the stadia traverse. Thicknesses were calculated from the dip and strike records and from the distances between units after these had been corrected, when necessary, for differences in elevation and for divergences from a bearing in the traverse perpendicular to the strike line. The thicknesses determined for the various formations showed a close agreement with their thicknesses as determined by Hewett* along the Shoshone River near Cody.

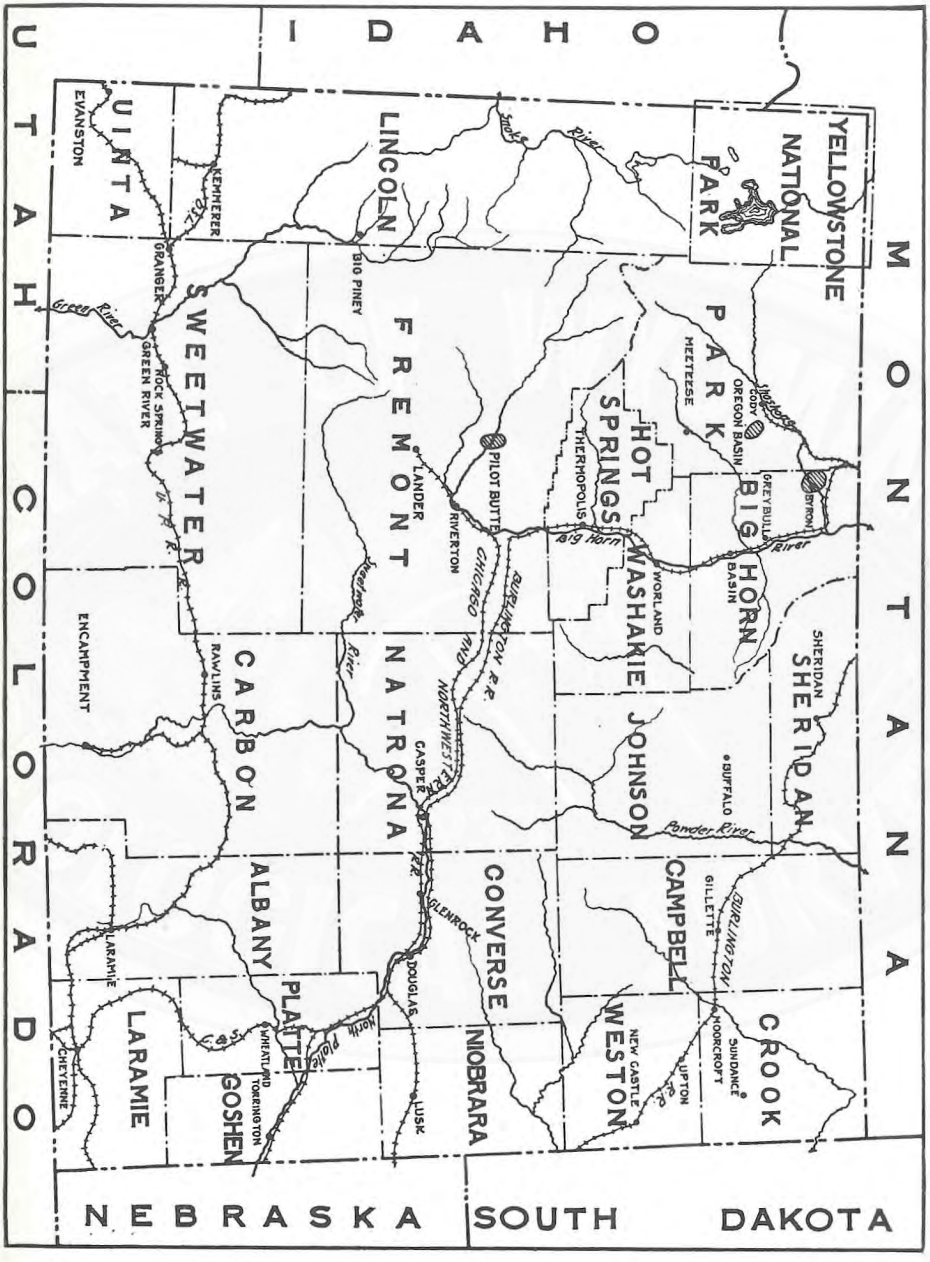
ACKNOWLEDGMENTS

The thanks of the writer are due to his field assistants for painstaking work. Mr. W. D. Waltman kindly furnished several well logs. The report of Hewett, referred to above, was used extensively both in the field and in the compilation of this report; hence a special acknowledgment is considered necessary. The State Geologist, L. W. Trumbull, has given helpful suggestions during the preparation of this report, for which the writer's appreciation is hereby expressed.

LOCATION OF THE FIELD

The Oregon Basin field is located in the northwestern part of the Bighorn Basin in Park County, about 14 miles south and slightly east of Cody, with which it is connected by fair wagon roads. Cody is also the nearest railroad point, being the terminal of a branch line connecting with

*Op. cit.


MONTANA
IDAHO
UTAH
COLORADO
NEBRASKA
SOUTH DAKOTA
YELLOWSTONE NATIONAL PARK
BIG HORN
HOT SPRINGS
WASHAKIE
PARK
MEETEETSE
OREGON BASIN
COODY
GREYBULL
STRONG
Big Horn River
WORLAND
THERMOPOLIS
PILOT BUTTE
RIVERTON
LANDER
FREMONT
LINCOLN
BIG PINEY
SWEETWATER
GRANGER
ROCK SPRINGS
GREEN RIVER
KEMMERER
FOSSIL
UINTA
EVANSTON
Green River
Smiths Fork
Popo Agie River
CHICAGO BURLINGTON & NORTHWESTERN R.R.
CASPER
NATRONA
CARBON
RAWLINS
ENCAMPMENT
ALBANY
LARAMIE
CHEYENNE
PLATTE
GOSHEN
TORRINGTON
WHEATLAND
North Platte River
GLENROCK
DOUGLAS
LUSK
CONVERSE
NIOBRARA
NEW CASTLE
WESTON
CAMPBELL
GILLETTE
BURLINGTON
HOORCROFT
SUNDANCE
LUPTON
CROOK
SHERIDAN
SHERIDAN
JOHNSON
BUFFALO
Powder River

the main line of the Burlington at Frannie. The general location is shown on the accompanying sketch map.

TOPOGRAPHY AND PHYSIOGRAPHY

The field proper occupies a depression about 12 miles long in a north-and-south direction and 7 miles wide along an east-and-west line. It is surmounted in the center by a high gravel-capped mountain rising about 1000 feet above its lowest point and known as Elk Butte. The field is surrounded by a high rugged escarpment of massive sandstones except in the central-western part. The general elevation of this "rim rock" varies from 5200 to 5600 feet. The lowest point of the depression is near the quarter corner common to Sections 20 and 29, Twp. 52 N., R. 100 W. There we have an elliptical basin two by three miles in extent with smooth, gently inward-sloping sides elongated in an east-and-west direction. This is known as Oregon Basin. Its total depth is about 80 feet. Formerly Oregon Basin was the site of a small lake, which, however, at the time of visit had practically disappeared. The whole depression represents a wind-eroded basin. To the south of Oregon Basin proper the area of the field is very rough and hilly and is broken by deep gullies, most prominent of which are Oregon Coulee and its tributaries. The highest point to the south is Elk Butte, 6194 feet high, which is in Sec. 31, Twp. 51 N., R. 100 W. This is a flat-topped mountain covered by a heavy sheet of gravel. Its general elevation is about the same as that of the surface of the "Meeteetse rim", a high table land lying northwest of the Greybull River and south and east of Oregon Basin. This is also covered by heavy gravel sheets. The author is of the opinion that formerly one great sheet of gravel extended over this whole area, representing continental fans derived from the mountain ranges to the west. Subsequent erosion dissected these fans, leaving only a few isolated remnants, such as Elk Butte, or larger highly dissected table lands such as the "Meeteetse rim".

The rim rock forms a high bold escarpment rising 400 to 800 feet above the inner low area except in the central eastern part, where it forms low hills due to greater erosion. In several cases decided breaks occur in the continuity of the ridge marked by offsets of from 100 to several thousand feet. These are the result of oblique normal faults.

The general slope of the whole field is eastward. The western edge is from 500 to 700 feet higher than the eastern. The drainage is eastward and northeastward. There are only two important streams, both intermittent, Oregon Coulee and Dry Creek. Oregon Coulee and its tributaries are subject to heavy floods and hence have very steep, box-like canyons across which it is extremely difficult to maintain roads. East of the field Oregon Coulee empties into Dry Creek. The latter stream rises to the west of Elk Butte and in a semicircular sweep swings due south and east until with a northeast course it cuts across the rim rock in a fault zone located in Sec. 35, Twp. 51 N., R. 100 W. Several of its tributaries coming from the south have cut narrow gaps into the high escarpment.

GEOLOGY

Stratigraphy

In Oregon Basin strata of Cretaceous age only are exposed, and these are restricted to the Benton and Montana series. Thus about Elk Butte, and south of Oregon Basin proper, are two areas exposing the top of the Benton sandstones. These are surrounded by the Cody shale which occupies the floor of the Basin and which is in turn surrounded by the high escarpments of the Gebo sandstones of the Mesaverde formations. Outside of the rim rock proper lie the upper part of the Mesaverde, the Meeteetse formation, followed by the Ilo sandstones at the very top of the Cretaceous, upon which rest unconformably the Tertiary Fort Union and Wasatch.

Table of Formations

System	Series	Formation	Thickness in feet	Characteristics
Tertiary	Eocene	Fort Union	5592	White and buff massive sandstones with conglomerate zone at base. Upper portion more shaly.
		UNCONFORMITY		
Cretaceous	?	Ilo	1790	Buff and yellow sandstones, with minor sandy shale and clay.
Cretaceous	Montana	Meeteetse	1110	Argillaceous sandstones and sandy shales with numerous beds of brown carbonaceous shale and lenticular coal near top.
		Gebo	1000 to 1200	Bright buff-colored massive sandstone beds, 18 to 60 feet thick, with interbedded sandy shale. Workable coal beds near base. High ridges, "rimrock".
		Cody	2000 to 2300	Black shale with many concretions and a Niobrara fauna at base. Sandy near top, and passing into a succession of sandy shales and thin-bedded, ripple-marked sandstones with Montana fauna. Broad valley.
	Colorado	Frontier	500 to 578	Pale buff to white sandstones with conglomeritic streaks carrying small shiny black chert pebbles. Beds of brown carbonaceous shale, with thin and poor coal streaks. Benton fauna.
		Mowry	422	Bluish black sandy shale, hard and fissile, weathering light grey. Minor amounts of thin-bedded sandstone and sandy shale. Many fish scales.
		Thermopolis	415	Black shale with thin beds of bentonite; a few thin-bedded rusty-weathering sandstones at base.
		Cloverly	100 to 150	Thin argillaceous sandstones, beds one foot or less in thickness. Cross-bedded and ripple-marked, central portion dominantly sandy shale.
Comanchean		Morrison	570 to 580	Bright-colored maroon, purple and green clays; sandy shales and sandstones, locally indurated; conglomerate lenses. Many "gastroliths".
Jurassic		Sundance	500 to 600	Highly fossiliferous greenish grey sandy shales, impure sandy limestones, and friable sandstones.
Triassic		Chugwater	1000+	Red colored sandstones and shales; gypsum beds, and thin grey non-fossiliferous limestones.

Description of Formations

No attempt will be made to describe the Chugwater and Sundance formations. These are not exposed in the Oregon Basin field proper, nor have they been penetrated by any of the wells.

COMANCHEAN SYSTEM

Morrison Formations.

Overlying the marine Sundance formation we find a succession of terrestrial clays, usually of light colors among which maroon, purple, green and white are the most common. These alternate with buff sandy shale, thin-bedded argillaceous sandstones, and sandstones with conglomeritic streaks which are locally massive and indurated and hence form a high wooded hogback. In this discussion, the top of the Morrison is placed above the upper maroon clay. A section about six miles northwest of Oregon Basin is as follows:

	FT.
Clays, greenish grey to olive green with maroon streaks near top	184
Sandstone, argillaceous, occasionally conglomeritic and locally indurated	45
Thin bedded argillaceous sandstones and sandy shales	96.5
Clays, olive green, grey and maroon alternating	156.8
Sandy buff shales	85
TOTAL	567.3

Hewett* reports a thickness of 580 feet on the Shoshone River about twelve miles north of this locality. The sandstones are crossbedded and ripple-marked. The conglomerates consist of streaks of pebbles of chert, up to ¼-inch in diameter, subangular and usually polished. Highly polished subangular pebbles up to six inches in diameter are found in the clays. These are usually chert, although quartzites, granite, basalt and even milky and rose quartz occur. They are interpreted as being "stomach stones" or "gastroliths".

Cloverly Formation.

The Cloverly formation is not as characteristically

*Bull. 541, U. S. Geol. Survey.

developed at Oregon Basin as in the southern part of the Bighorn Basin. It consists of thin sandstones, buff to rusty in color, well indurated, and usually crossbedded and ripple-marked. The beds are a foot or less in thickness and are separated by grey sandy shale partings. The shale is most abundant in the middle of the formation. Hewett* reports a buff massive sandstone at the base, 25 feet thick, which directly overlies the top maroon clays of the Morrison. This massive sandstone seems to be only locally developed, as it was not found at a locality four miles northwest of Wiley Ranch and about twelve miles south of the Shoshone River section. Here a succession of thin-bedded buff sandstones, grading into sandy shales near the top, formed the base of the Cloverly. The total thickness measured is 150.2 feet.

CRETACEOUS SYSTEM

Hewett* in his description of the Shoshone River section near Cody describes the whole lower part of the Cretaceous system under the name Colorado formation, and although he makes a three-fold division into a lower, middle and upper member, he does not apply any formation names. The writer follows Lupton's† suggestion as to formation names and uses the terms as indicated below.

Hewett, Bull. 541 U. S. G. S.		Present Paper	
Colorado	Upper Member	Cody Shale	Pierre Shale
			Niobrara Shale (Basin)
	Middle Member	Frontier Sandstone	
	Lower Member	Mowry Shale	
		Thermopolis Shale	

The chief difference in interpretation of the writer's classification as compared with those of Hewett and Lupton is the two-fold division of the upper shale member or Cody

*Op. cit.
†Bull. 621-I, U. S. Geol. Survey, p. 166.

into Pierre and Niobrara shale due to the fact that the lower part carries fossils of Colorado age, while near the top an undoubted Pierre fauna occurs. This is also brought out by the work of Hintze* in the Basin oil field and is also recognized by Lupton†.

Thermopolis Shale.

This formation consists of a black soft adobe shale with occasional thin bentonite seams. Near the base occur a few thin sandstone beds, grey in color, poorly cemented, ripple-marked, and usually weather rusty. Near the center is a massive sandstone bed, buff colored and crossbedded. Four miles northwest of Wiley Ranch the total thickness of the Thermopolis is 415 feet. At the base occur phosphatic concretions about 1½ inch in diameter and spherical in shape. The "Rusty Beds", which are so characteristically developed in the southern part of the Bighorn Basin, are here reduced to very minor importance, only a few thin sandstones representing the 200 feet or more farther south.

Mowry Shale.

Above the soft black shale of the Thermopolis is a formation essentially made up of hard, fissile, grey shale with few thin, interbedded, hard sandstones. The shales split into very thin flakes which carry fish scales in profusion, and on this account, as well as their characteristic lithological appearance, form an ideal horizon marker. The formation, because of its superior resistance to weathering, usually forms a prominent ridge. The total thickness of the fish scale beds with their thin interbedded sandstones was determined to be 422.5 feet.

Frontier Sandstones.

Resting upon the Mowry shales and usually forming several minor ridges on the dip slope of the Mowry hogback, occurs a succession of sandstones here included under the name Frontier. The name Frontier was first applied by

*Wyo. State Geol. Sur. Bull. 10.
†Op. cit. p. 172.

W. C. Knight* to the coal-bearing sandstones of Benton age in southwestern Wyoming. It was subsequently applied by Veatch† to the Colorado sandstones of south central Wyoming. Later, Lupton‡, assuming the correlation of the Colorado sands of the Bighorn Basin with those of the southern part of the State, applied the term Frontier to all sands of Benton age in the Basin oil field. This is the sense in which the term is used in this report.

These sandstones occur in three prominent benches, one at the top 50 to 70 feet thick, one 170 feet below, 20 to 40 feet thick, and one at the base, 30 feet thick. These benches are separated by buff, sandy shale, alternating with thin irregularly bedded sandstones. Near the top brownish black carbonaceous shales occur which occasionally carry streaks so rich in organic matter as to suggest coal. Very characteristic is the occurrence of small chert pebbles in the sandstone layers, and especially in the upper and lower benches. These pebbles are black highly polished chert. They average one-quarter to three-eighths of an inch in diameter, although a few up to two inches were found. They occur in such profusion in the upper bench that the surface of the ground becomes thickly covered with them. Where outcrops are not available, they serve as a valuable guide to the underlying formations.

The total thickness as measured by the writer is 499.5 feet. It corresponds to the middle member of the Colorado series which, according to Hewett, is 494 feet thick on the Shoshone River.

Cody Shale.

The Cody Shale is in many respects similar to the upper Cretaceous shales found in the Bighorn Basin west of Big Sheep Mountain and Little Sheep Mountain, and at Byron. The basal part is a succession of bluish black shales 200 to 300 feet thick. It carries very few fossils, usually in sphaerosiderite concretions. Near the top occur thin red shale streaks. This black shale is succeeded by several

*W. C. Knight, Bull. Geol. Soc. Amer., Vol. 13, p. 542.
†A. C. Veatch, Prof. Paper 56, U. S. Geol. Surv.
‡C. T. Lupton, Bull. 621-I, U. S. Geol. Surv.

hundred feet of dark green shale which gets lighter in color near the top, due to increasing sandiness, and which carries occasional thin deep green glauconitic sandstones. Concretions are common. They are usually sphaerosiderite, are non-fossiliferous and up to a foot in diameter. Occasional beds of shales are practically a mass of small concretions averaging the size of a baseball.

There are also calcareous concretions, which are fossiliferous. In these, *Baculites* are especially abundant. Some of the sandy streaks are characterized by an abundance of fossils and are very persistent. One such especially could be traced more or less intermittently around the whole field and was hence used as a datum horizon. Layers of cone-in-cone structure are also very persistent at certain horizons.

The upper part of the Cody is a succession of sandy shales and thin argillaceous sandstones, buff in color. The sandstones are ripple-marked and crossbedded. Near the top there are a few ledges of massive sandstone two to three feet thick, forming transitional beds into the overlying Mesaverde.

The following fossils were collected from the lower black shales:

Baculites
Inoceramus
Fusus
Gyroides
Turritella
Scaphites
Lucina
Dentalium

Mesaverde Formation.

Overlying the Cody shale is a succession of massive sandstones and sandy shales with coal seams which represent the Mesaverde formation. Here as elsewhere in the Bighorn Basin this formation can be divided into an upper and lower member as suggested by Hewett*, to which the names Gebo and Meeteetse are applied.

Gebo Sandstone.

The Gebo forms the inner high escarpment which completely surrounds the Oregon Basin field except in the

*Op. cit. p. 54.

western part where it follows the limbs of the Cedar Mountain anticline in a general northwest direction. In all characteristics the Gebo is essentially like that to the south and east in the Bighorn Basin. It is essentially a succession of massive sandstones, buff in color, fine and uniform in texture, and crossbedded. The individual beds are from 18 to 65 feet thick. The sandstones are interbedded with buff sandy shales and brown carbonaceous shales which carry coal seams near the base. At Oregon Basin several of these seams have been opened up and mined on a small scale.

No measurements of this formation were made, nor was any detailed study of it attempted, because it has no direct bearing on the oil and gas accumulations. According to Hewett the total thickness of the Gebo on the Shoshone River is 1120 feet. The Gebo usually forms high prominent ridges.

Meeteetse Formation.

This formation is made up of a succession of poorly indurated, argillaceous sandstones and carbonaceous shales with poor lenticular coal seams. No attempt was made to study this formation in detail.

Ilo Formation.

Overlying the Meeteetse is a group of massive buff-colored sandstones alternating with sandy shale and clays. The whole formation is characterized by a lack of induration and the absence of coal seams. According to Hewett the thickness varies from 810 to 850 feet.

TERTIARY SYSTEM

Fort Union.

Overlying the poorly indurated beds of the Ilo formation is a succession of well indurated sandstones, conglomerates and clays with the latter more abundant near the top. A total thickness of 5400 feet has been measured by Hewett and on the basis of fossil plants has been referred to the Fort Union.

QUATERNARY SYSTEM

The high terrace gravels found in the Oregon Basin field on top of Elk Butte and developed extensively in the areas surrounding, are considered to be Quaternary. The gravels are characterized by coarseness. Boulders, usually subangular, one to three feet in diameter, are common. All kinds of rocks are represented, with crystalline gneisses and schists dominant, although sedimentaries, such as hard sandstones and limestones, are not rare.

GEOLOGIC HISTORY

The Oregon Basin field of necessity has had the same geologic history as the rest of the Bighorn Basin. This extends practically through the entire Paleozoic and Mesozoic eras into Eocene time. No attempt will be made to trace this history out completely. Attention will simply be called to the events characterizing the history since Comanchean time.

Comanchean Time

The Morrison formation was deposited in shallow lagoons and probably fresh-water marshes and swamps along a low coast, with occasional periods of deposition by strong currents such as we find along the flood plains of rivers. During Cloverly time such deposition was especially common. Locally conditions of deposition ceased, and more or less of the Cloverly was removed by erosion.

Cretaceous Time

The Cretaceous period was inaugurated by an advance of the sea over the area of the Basin. Thus in the shallow water we find deposited, as the basal part of the marine transgressive series, the "Rusty Beds". These, therefore, lie upon the Cloverly disconformably, and in some cases rest directly upon the Morrison clays. The gradual deepening of the sea is indicated by the greater portion of the

Thermopolis and the Mowry formations, both of which were deposited in quiet but shallow waters. A decided shallowing of the sea and a return to deposition in disturbed waters is indicated by the Frontier sandstones. As a matter of fact deposition probably took place so fast as to raise portions of the area of the Basin above sea level, and hence cause the development of coastal swamps and marshes which supplied the conditions necessary for the interbedded carbonaceous shales and poor coals.

A period of more rapid subsidence followed and in comparatively shallow and quiet water the clay shales at the base of the Cody accumulated. Subsidence and accumulation of sediments kept pace at such a rate that about 2200 feet of shallow water sediments were formed. There was a decided shallowing near the close of the Cody, perhaps due to slower subsidence or perhaps accelerated deposition, so that disturbed water conditions with accompanying strong currents and vigorous wave action, again predominate. Thus the late Cretaceous deposits are the result of continental deposition upon an area characterized by many fresh water swamps and ponds, in which the vegetation made a rank growth, and accumulating afforded us the many coal beds of the Mesaverde formation. Fluviatile conditions are indicated by the thick interbedded sandstones.

The close of the Cretaceous was marked by great crustal disturbances, resulting in the intense folding of all the sedimentaries and the formation of the various mountain ranges. This period of folding was accompanied by faulting, locally quite intense, as for example at Hart Mountain near Cody. At Oregon Basin the dome folds were formed and a number of normal faults took place at this time.

Tertiary Time

Tertiary time was inaugurated by a vigorous period of erosion and a practical peneplanation of the older rocks over large areas. Upon the flat plains so developed, there were deposited a thick succession of sandstones, conglomerates and clays, representing continental deposition of

terrestrial and fluviatile type. At Oregon Basin these are represented by the Fort Union formation.

Quaternary Time

In late Tertiary or early Quaternary time there were developed huge continental fans and aprons about the higher mountain ranges, which are now represented by the high gravels such as those on the Meeteetse rim and on Elk Butte. Subsequent to their deposition, perhaps as a result of uplift due to warping, or perhaps as a result of the lowering of the drainage outlet resulting from the cutting of the Wind River Canyon at Thermopolis, the present erosion cycle was begun. The high terrace gravels were dissected, leaving only a few remnants, and the Tertiary formations were removed over much of the area, again exposing to erosion the underlying Mesozoic and Paleozoic rocks.

STRUCTURAL GEOLOGY

The large anticlinal uplift which results in Rattlesnake and Cedar Mountains extends in a general southwest direction about 15 miles beyond Cody. The southward plunging end, showing the various Cretaceous formations extending with steep dips, is well exposed west of the northern end of the Oregon Basin field. There it forms the divide between the valley of Sage Creek to the east and Sulphur Creek to the west. Sage Creek flows in a synclinal basin in the Gebo sandstones. This syncline plunges northward and separates the north end of Oregon Basin fold from the Cedar Mountain anticline. Wiley Ranch is located at the southern end of this syncline. To the south and southwest the Gebo and overlying formations form the so-called Frost Ridge syncline, which plunges southeastward and rises to the surface immediately to the west of the southern extremity of the Cedar Mountain anticline. Toward the east the Gebo sandstones pass underneath the younger formation and quickly assume

horizontality. Thus it is apparent that the Oregon Basin dome has a close relationship to the large anticline of Cedar Mountain and the Rattlesnake Mountains, and is a fold in line with the above.

The axis of the Cedar Mountain anticline comes from the northwest into the Oregon Basin field as shown by the dips in the Cody shale in the central western part. The axis passes roughly through the center of Sec. 22, Twp. 51 N., R. 101 W., indicating a structural ridge which is arched up into a small dome fold on the east side of Elk Butte. At the top of this dome there are exposed the Frontier sandstones. For the sake of convenience this dome will be spoken of as Elk Butte dome. The dome is slightly elongated in a north-and-south direction and sends out towards the north a narrow anticlinal spur from 400 to 650 feet lower than the crest of the dome. This anticlinal fold extends to the center of Section 5, Twp. 51 N., R. 100 W., where it is truncated by a normal fault with a general east-and-west strike. The north side of the fault is the upthrown side, hence here is exposed another small area of Frontier sandstone. This is anticlinal in structure and plunges northward. For convenience this will be spoken of as the Wiley anticline, since Wiley postoffice is located on its west limb.

Elk Butte Dome

Elk Butte dome is a nearly ideal dome with its apex located near the quarter corner common to Sections 31 and 32, Twp. 51 N., R. 100 W. At the apex of the dome the Cody shales are eroded and there are exposed the upper sandstone benches of the Frontier formation. The irregular and rugged outlines of this area are due to the downstream travel of the contact line because of its very low dips, upon crossing the gullies and intervening ridges. At least nine wells have been drilled upon this dome, several of which have penetrated into the Morrison Red Beds as indicated by the red clays found in abundance in the sumps. Gas only has been encountered in quantity and in several wells under great pressure.

PLATE I.

A.—North End of Cedar Mountain Anticline.

Cloverly sandstone at left, covered with scrub pine. Morrison clays in center. Massive bench of sandstone in Morrison at right.

B.—Mowry Hogback in foregrcund. Gebo Hogback in backgrcund.

Looking east from Cedar Mountain anticline toward Oregon Basin.


STATE OF WYOMING
1933
GEOLOGICAL SURVEY

The Wiley Anticline

On the apex of the Wiley anticline, which as already stated represents the up-faulted end of the northward extension of the anticlinal spur sent out from the Elk Butte dome, the Frontier sandstones are again exposed. The exact area of outcrop is difficult to define because of the thick covering of soil and wash. This is especially true of its northward extension. The contact is drawn on the basis of the gravel float which consists essentially of the small, black chert pebbles that have been mentioned under the description of the Frontier formation. In the southern part of the area, near the center of Section 5, the sandstones form several low ridges. Two wells are located upon this anticline. One to the south of the fault has penetrated to the Morrison. It formed a flowing artesian well and also gave a showing of oil and gas. A second well was being drilled on the north side of the fault at the time of the writer's visit. The heavy soil and wash on the south of this anticline obscure the fault plane. It is located on the map on the basis of the offsets shown by a highly fossiliferous sandstone layer in the Cody shale, 403 feet above the top of the Frontier. This sandstone flanks both sides of the structural ridge coming north from the Elk Butte dome to Sections 5 and 4. Here, however, the western outcrop shows a strong westward heave, while the eastern outcrop shows a lesser heave eastward. There are two prominent faults shown by the Gebo sandstones, east and northeast of Section 5, either one or both of which may represent a continuation of the fault here mentioned.

Faults

As indicated on the accompanying map there are a number of faults shown by the encircling Gebo ridges. These are apparently all normal faults oblique or roughly parallel to the dip. Several of these show large heaves on the surface. Thus a fault in Sections 2 and 3, Twp. 50 N., R. 99 W., shows a total heave of 1200 feet. The total displacement is probably far less than that distance, as

the characteristics of the fault and its steep dip (75° S.) suggest that it is a hinge fault probably formed by slipping at the time of folding. Considering the flat dips of the Gebo at this point (10°-20° E.), it will be apparent that a very slight hinge-like fault would have a very large horizontal component, so that a small angular displacement would result in a large total heave. As would naturally be expected this fault dies out quickly in the underlying Cody shales and in the eastern line of Sec. 3 no evidence of it is shown.

Another large fault partly masked by heavy wash is shown in Sections 28, 27 and 22, Twp. 52 N., R. 100 W. This has a general northeast strike and a total heave of practically 5000 feet on the surface. The dips of the Gebo here are steeper (30°-42°); consequently the total displacement of this fault must be large and it must affect the Cody shales for a considerable distance. No direct evidence is available to prove this, but the fault plane strikes directly for the fault at the south end of the Wiley anticline, suggesting the probability that the latter is an extension of it.

A fault of smaller displacement is shown in Sec. 34, Twp. 52 N., R. 100 W., which also strikes directly towards the fault in Sec. 5. The fault in Sec. 34 lines up directly with the two displacements shown by the fossil layer referred to above, and for this reason is drawn so as to connect all three of these displacements.

In the case of both of these faults the side north of the fault plane represents the upthrow block. The fault in Sec. 34 shows a hinge-like displacement with maximum motion on the west end. Thus the displacement in the Gebo to the east is the smallest, the displacement of the east limb of the fossil layer is intermediate, and the displacement of the west limb of the fossil layer is greatest.

Other faults are shown, one in Sections 20 and 16 and another in Secs. 17 and 16, Twp. 52 N., R. 100 W. These two fault planes converge rapidly in a northeasterly direction and the greater part of Sec. 16 represents a fault block included between them.

PLATE II.

A.—Fault, Southeast Side Oregon Basin Field.
Gebo ridge in left foreground is the same as the one in hogback at right in background.

B.—Same Fault as above. Close-up view.


STATE OF WYOMING
1933
GEOLOGICAL SURVEY

Summary of Structure

In the Oregon Basin field we have a prominent, nearly ideal, dome which centers on the southeast flank of Elk Butte and which we hence call the "Elk Butte Dome". This dome sends out toward the northwest a structural ridge which represents an extension of the large anticline of Cedar Mountain. The crest of this structural ridge is approximately 800 feet below the highest point of the dome. A second structural ridge extends from the Elk Butte dome due north for about six miles where it is cut by a transverse fault that has raised the northern part of the anticline about 300 to 350 feet with respect to the southern. The northern end of this structural ridge about the fault is named the "Wiley Anticline". A number of other faults are noted in the "rim rock" but they are not believed to be sufficiently extensive to affect the oil and gas horizons.

OCCURRENCE OF OIL AND GAS

Two wells have been drilled on the Wiley anticline, for both of which complete well logs are available. Nine wells have been drilled on the Elk Butte dome, for three of which detailed logs and information are at hand. The logs show that there are four prominent horizons that carry oil and gas. These are as follows:

1. Various sands in the Frontier formation.
2. Sandy zones near the center and base of the Thermopolis shale.
3. The Cloverly sandstones, and
4. A sand near the top of the Morrison formation.

Gas only has been struck in large quantities, oil occurrences being confined practically to "showings". Of the above horizons only 2 and 3 are of importance, but nevertheless a brief description of each horizon will be given.

1. Frontier Formation.

Both on the Elk Butte dome and on the Wiley anticline

the upper sandstones of the Frontier formation are exposed. While this includes the more important oil horizons of the State, it will be evident that at Oregon Basin there can be retained only traces of the oil and gas which this formation originally contained. It is of interest to note that all wells drilled through the Frontier gave showings of oil and gas in the middle and lower sands. Probabilities of commercial accumulation and future production are practically precluded by the shallowness of the sands and the lack of shale cover.

2. Thermopolis Shale.

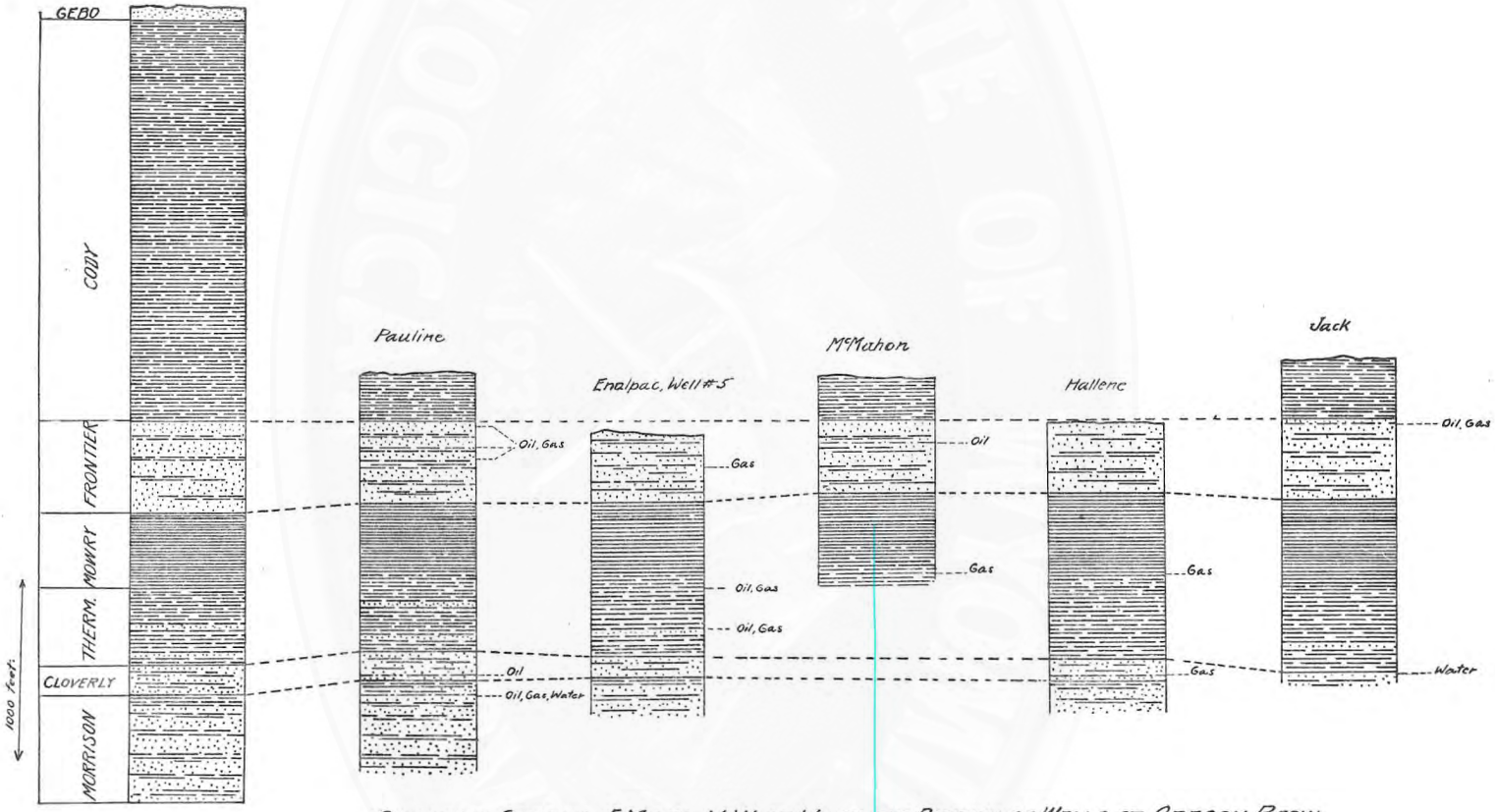
In the description of the Thermopolis shale attention has been called to several sandstones and sandy zones which occur interbedded with the soft black adobe shales that make up the major part of the formation. These occur near the center and in the lower half of the Thermopolis. As would be expected they form good reservoirs and in several of the wells, gas under great pressure was encountered in these sands. None yielded more than a showing of oil.

3. The Cloverly Sandstones.

In the Cloverly sandstones also only a showing of oil was obtained. Gas, however, was encountered in large quantities and under great pressure. As a gas horizon these sandstones are more important than those of the Thermopolis described above. The capacity of well No. 5 of the Enalpac Oil and Gas Co., located on the Wiley anticline, was estimated at 25,000,000 cu. ft. per day, the yield coming from both the Cloverly and the Thermopolis in the ratio of perhaps 4 to 1. Several wells on the Elk Butte dome also encountered very heavy flows of gas in the Cloverly. No exact estimates as to yield are, however, available.

4. The Morrison Formation.

The Morrison as previously described consists essentially of a series of variegated clays and sands. Several



COLUMNAR SECTION. 5 MILES N.W. OF WILEY AND POSITION OF WELLS AT OREGON BASIN.

of the sands in the upper part gave "showings" of oil, both the common, pale green, paraffin base oil and, in one well at least, also a heavy black oil. The sands also yielded "showings" and weak flows of gas. The upper sandstones are saturated with water and in the case of the Pauline well the pressure of the water was great enough to form a flowing artesian well.

DESCRIPTION OF WELLS

Eleven wells are known to have been drilled on the Oregon Basin field. These are located on the accompanying map. Well logs are available for five of the wells which have been put at the writer's disposal by Mr. W. D. Waltman. Such data as are available for the other wells are summarized directly on the map. This includes elevation of well, and whether it is a "dry", "gas" or "water" well.

WELL LOGS

1. PAULINE WELL. (No. 2 on Map)

Property of Enalpac Oil and Gas Co. Located in SE. ¼ Sec. 5, Twp. 51 N., R. 100 W. Elevation of well 5212 feet. Well completed January 21, 1913.

The following detailed log was furnished by Mr. W. D. Waltman:

LOG OF PAULINE WELL

		THICKNESS OF STRATA	DEPTH
	Soil	48 feet	48 feet
	Shale	112 "	160 "
Cody	Sandy shale	10 "	170 "
	Sand	5 "	175 "
	Shale, light	65 "	240 "
	Sand	20 "	260 "
	Some oil and gas at 250 feet		
	Shale, brown and grey	120 "	380 "
	Sand	20 "	400 "
	Shale, sandy	20 "	420 "
Frontier	Sand	27 "	447 "

More gas at 430 ft. Water filled well at 427 ft. and ran over the top.

	Shale	2 feet	449 feet
	Lime	2 "	451 "
	Shale	9 "	460 "
	Sand	5 "	465 "
	Sandy shale	15 "	480 "
	Sand	3 "	483 "
	Shale, black	12 "	495 "
	Lime	3 "	498 "
	Sand	37 "	535 "
	Showing gas at 510 feet; showing oil at 530 feet		
	Shale	15 "	550 "
	Bentonite shale, white	3 "	553 "
	Sand	7 "	560 "
	Bentonite shale	1 "	561 "
	Sand and shale	29 "	590 "
	Shale	4 "	594 "
	Sand (fine black)	17 "	611 "
	Bentonite shale	4 "	615 "
	Sand	1 "	616 "
	Shale	67 "	683 "
	Sand, fine black	22 "	705 "
	(Water in this sand came over the top of the casing)		
	Bentonite shale	4 "	709 "
	Shale, black	6 "	715 "
	Sand, black	27 "	742 "
Mowry	Shale, black	16 "	758 "
and	Sand, black	8 "	766 "
Thermopolis	Shale, black	39 "	805 "
	Sand, black	4 "	809 "
	Shale	77 "	886 "
	Sand, dark (with little gas)	5 "	891 "
	Shale, black to grey	439 "	1330 "
	Sand	45 "	1375 "
	Shale	150 "	1525 "
Cloverly	Sand, broken, with shale	87 "	1612 "
	Sand, making water (oil showing)	58 "	1670 "
	Lime, red	24 "	1694 "
	Clay, red	2 "	1696 "
	Lime, red and hard	5 "	1701 "
	Clay	9 "	1710 "
	Sand	76 "	1786 "
	Gas appeared immediately; water at 1735 feet, which came over top of casing at 1755; oil showed at 1765 feet.		
Morrison	Shale	44 "	1830 "
	Sand	17 "	1847 "
	Shale, red	53 "	1900 "
	Shale, grey	92 "	1992 "
	Sand	76 "	2068 "
	Shale, grey (some water)	92 "	2160 "

2. WELL No. 5 (No. 1 on Map)

Property of the Enalpac Oil Co. Located in SE. ¼ of NW. ¼ of Sec. 5, Twp. 51 N., R. 100 W. Well begun June 14, 1916, completed December 3, 1916. The following log was furnished by Mr. W. D. Waltman:

LOG OF ENALPAC OIL & GAS COMPANY WELL NO. 5
Well spudded in June 14, 1916

	0– 40	Sandstone and dark shale
	40– 50	Dark shale
	50– 70	Greenish sand
	70– 82	Sandy shale
	82– 100	Dark shale
	100– 115	Grey shale
	115– 125	Water sand. Making about 10 bailers per hour.
	125– 140	Light sandy shale
	140– 163	Dark colored shale
	163– 185	White sand. Making water at 163 ft. and showing oil and gas
Frontier	185– 192	Muddy sand
	192– 208	White muddy sand
	208– 237	Dark shale
	237– 261	Grey sand. Hole full of water at 240 ft.
	261– 277	Dark shale
	277– 285	Water sand. Making 3 bailers of water per hour.
	285– 288	Bentonite
	288– 290	Peculiar coarse light gravelly green formation
	290– 295	Firm dark sand. Showing gas
	295– 320	Dark shale
	320– 328	Dark sandy shale
	328– 350	Sandy shale. Water increasing. Hole filled and ran over
	350– 370	Dark grey shale
	370– 374	Dark sand. Oil and gas
	374– 385	Light sandy shale
	385– 397	Dark shale
	397– 415	Light shale. Water
	415– 419	Hard lime and sand
	419– 430	Black shale
	430– 433	Bentonite
	433– 436	Hard black lime and sand
Mowry	436– 454	Sandy lime and shale
and	454– 466	Grey sandy shale
Thermopolis	466– 507	Grey sandy shale
	507– 514	Black shale showing gas. Making 3 bailers of water per hour, 508 ft.
	514– 540	Dark shale. 3 bailers of water per hour, 515 ft.
	540– 570	Dark sandy shale
	570– 582	Dark lime
	582– 585	Bentonite
	585– 595	Light limey shale
	595– 621	Light sandy shale
	621– 630	Hard black sand
	630– 648	Light shale

	648– 662	Dark broken lime
	662– 680	Dark shale
	680– 682	Sandy shell
	682– 720	Dark shale
	720– 730	Dark shaly sand. Shows green oil and gas at 723 ft.
	730– 777	Dark shale
	777– 797	Black sand
	797– 830	Dark shale, showing green oil and some gas at 784 ft.
	830– 907	Dark shale
	907– 917	Light muddy sand
	917–1039	Dark shale
	1039–1043	Broken sand. Gas showing at 1039 ft. Sand seemed to be thin strata interspersed with strata of shale.
	1043–1069	Dark shale. 2 bailers of water at 1069 ft.
	1069–1077	Dark limey sand
	1077–1086	Light shaly sand
	1086–1170	Light shale
	1170–1230	Blue shale
	1230–1232	Extremely hard grey sand shell
	1232–1240	Blue shale
	1240–1250	Blue shale
	1250–1290	Broken white sand. Apparently strata of sand interspersed with strata of shale showing gas.
	1290–1300	Sand with shale interspersed. Gas estimated at from 3 to 5 million feet per day at 1300 ft.
Cloverly	1300–1310	Broken sand. 1310 ft. of 8¼-in. casing, landed on bottom
	1310–1320	Broken sand. Hole crooked at 1320 ft., filled up with boulders
	1320–1328	Broken sand. Gas increasing
	1328–1335	Hard white sand. Gas increasing in volume. Estimated well making 25 million cubic feet gas.
	1335–1340	White sand. More gas.
	1340–1345	Red sandy shale
	1345–1350	Pink shale
	1350–1357	Red shale
	1357–1361	Hard black sand. Considerable showing of gas and black oil at 1360 ft.
	1361–1380	Pink shale. Gas and oil sand only 4 ft. thick
	1380–1400	Variegated shales
	1400–1410	Variegated shale
	1410–1420	Pink shale
Morrison	1420–1430	Variegated shale
	1430–1445	Shale with white, pink and chocolate colored particles, hard shell, 1438 ft., white and hard like granite
	1445–1450	Grey shale
	1450–1455	White shale
	1455–1460	Grey shale
	1460–1470	Red shale
	1470–1475	Red lime
	1475–1477	Very hard red lime
	1477–1478	Hard pink, sandy lime
	1478–1480	Hard red sand

1480–1495	Broken pink lime or gypsum, sandy
1495–1498	Red shale
1498–1500	Hard pink sand
1500–1506	Hard red sandy lime
1506–1512	Red shale
1512–1517	Hard red lime
1517–1519	Red sandy lime
1519–1524	Sharp white sand
1524–1530	Hard purple sand
1530–1535	Coarse white sand
1535–1540	White sand

3. McMahan Well (No. 10 on Map)

Property of the Enalpac Oil Co. Located in the SW. ¼ of Sec. 32, Twp. 51 N., R. 100 W. Well was spudded in July 15, 1912; completed August 24, 1912. Elevation of well 5567 feet. The following log was kindly furnished by Mr. W. D. Waltman:

LOG OF McMAHAN WELL (BUTTE)

		THICKNESS OF STRATA	DEPTH
	Soil	2 feet	2 feet
Cody	Surface wash	58 "	60 "
	Shale	221 "	281 "
	Sand (oil, gas and water)	39 "	320 "
	Shale	50 "	370 "
	Sand	10 "	380 "
	Shale	70 "	450 "
Frontier	Sand containing oil	5 "	455 "
	Shale	30 "	485 "
	Shale, bentonite	20 "	505 "
	Shale	41 "	546 "
	Sand carrying water	39 "	585 "
	Shale	20 "	605 "
	Sand carrying water	40 "	645 "
	Lime, grey	10 "	655 "
	Sand, dark (making considerable water)	4 "	659 "
	Shale, black	141 "	800 "
	Shale, light grey	90 "	890 "
	Shale, black	105 "	995 "
	Shale, broken	10 "	1005 "
	Sand carrying gas in quantity	10 "	1015 "
	Shale	205 "	1220 "
	Sand, broken with shale	55 "	1275 "
	Sand, hard and solid	11 "	1286 "
	Sand, containing gas	19 "	1305 "

When well was cased 1 month later, at 1322 feet, it was making a large number of million feet of gas.

4. HALLENE WELL (No. 6 on Map)

Property of the Enalpac Oil Co. Located in the SW. ¼ of Sec. 29, Twp. 51 N., R. 100 W. Elevation of well 5559 feet. Well was spudded in October 6, 1913; completed April 25, 1914. The following log was furnished by Mr. W. D. Waltman:

LOG OF HALLENE WELL

		DEPTH OF FORMATION	DEPTH OF WELL	
	Clay	12 feet	12 feet	
	Sand	8 "	20 "	
	Dark shale	65 "	85 "	
	Sand	5 "	90 "	
	Dark shale	55 "	145 "	
	Sand	5 "	150 "	
	Dark and light shale	90 "	240 "	
	Broken sand	15 "	255 "	
	Light shale	15 "	270 "	
Frontier	Coarse sand	15 "	285 "	
	Light shale	5 "	290 "	
	Coarse sand	10 "	300 "	with oil
	Light fine sand	5 "	305 "	colors some
	Light shale	25 "	330 "	water
	Coarse sand	20 "	350 "	
	Light and black shale	20 "	370 "	
	Limestone	10 "	380 "	water
	Dark coarse sand	20 "	400 "	
	Sand and shale	5 "	405 "	
	Shale	5 "	410 "	
	Sand and shale	5 "	415 "	
	Coarse sand	5 "	420 "	
	Black shale	40 "	460 "	
	Light shale	10 "	470 "	
	Dark hard shale	10 "	480 "	
	Black shale	30 "	510 "	
	Dark hard shale	80 "	590 "	Bentonite 575 ft. also 585 ft. to 590 ft.
Mowry and Thermopolis	Coarse sand	10 "	600 "	
	Black shale	70 "	670 "	
	Black sand	10 "	680 "	
	Bentonite (?)	5 "	685 "	
	Dark shale	40 "	725 "	
	Bentonite (?)	10 "	735 "	
	Dark shale	15 "	750 "	
	Sand	10 "	760 "	
	Black and light shale	370 "	1130 "	caving; not sure of exact thickness; gas in sand
	Shell sand	7 "	1137 "	
	Shale	48 "	1185 "	
	Black shale	150 "	1335 "	

	Sandy shale (?)	15 feet	1350 feet	
	Black shale	10 "	1360 "	
Cloverly	Mixed shale and sand	8 "	1368 "	
	Mixed shale and sand	57 "	1425 "	More gas
	Sand	30 "	1455 "	
	Red mud	45 "	1500 "	
	Red mud	23 "	1523 "	
	Red mud	10 "	1533 "	
	Sand shell	2 "	1535 "	
	Red shale	25 "	1560 "	
	Lime shell	10 "	1570 "	
	Lime and red shell	15 "	1585 "	
	Lime	15 "	1600 "	
	Lime shell	10 "	1610 "	
	Lime shell and shale	10 "	1620 "	water
	Bottom of hole		1632 "	

The well is located near the apex of the Elk Butte dome on the 5100 foot contour. It struck gas under considerable pressure in the sandstone of the Cloverly formation.

5. JACK WELL. (Was not located in field)

Property of Enalpac Oil and Gas Co. Located in E. ½ of NW. ¼ of Sec. 30, Twp. 51 N., R. 100 W. Spudded in July 20, 1914. Completed October 7, 1914. The following log was furnished by Mr. W. D. Waltman:

LOG OF JACK WELL

	0– 45	Clay
	45– 330	Black shale (water at 105 ft. about 1 bailer per hr.)
	330– 350	Sand (330–335. Light showing of oil and gas)
	350– 360	Light shale
	360– 490	Black shale
	490– 500	Limestone
	500– 508	Sandstone
	508– 575	Black shale
	575– 580	Limestone
	580– 590	Black shale
	590– 614	Sand
	614– 618	Light shale
	618– 625	Sand (enough water for drilling)
	625– 645	Bentonite
	645– 655	Dark grey sand
Frontier	655– 665	Bentonite
	665– 690	Fine grey sand (water about 6 bailers per hr.)
	690– 695	Sand and shale (mixed)
	695– 702	Bentonite
	702– 705	Dark sand
	705– 708	Black shale
	708– 712	White bentonite
	712– 725	Light shale
	725– 732	Sand

	732– 742	Black shale
	742– 750	Sand (very hard)
	750– 755	Black shale
	755– 785	Sand
	785– 830	Black shale and lime shell
	830– 850	Brown shale
	850– 870	Slate
	870– 880	Brown shale and lime shell
	880–1018	Black shale (water at 920 ft. about 4 bailers per hr.)
	1018–1028	Lime shell
Mowry	1028–1080	Black shale
and	1080–1115	Sand and black shale (mixed)
Thermopolis	1115–1160	Black shale
	1160–1170	Sand
	1170–1190	Brown shale and lime shell
	1190–1235	Black shale (hard shell at 1195 ft.)
	1235–1240	Lime shell (very hard)
	1240–1280	Black shale
	1280–1295	Brown shale
	1295–1375	Black shale
	1375–1385	Light shale
	1385–1515	Black shale
	1515–1518	Sand
	1518–1530	Brown shale
	1530–1760	Black shale
Cloverly	1760–1826	Broken sand and sand (water at 1822 ft.)

Discussion of Well Logs

Of the wells for which detailed logs are available two are located on the Wiley anticline and three on the Elk Butte dome. Of the wells located on the Wiley anticline, one (the Pauline Well), is located immediately to the south of the fault previously discussed, and the other (Well No. 5 of the Enalpac Oil and Gas Co.), is located immediately to the north of the fault. The position of both wells appears to be unfavorable, because of the pronounced displacements shown by the fault on the surface. As closely as can be determined the displacement, as measured in vertical plane, is approximately 350 feet, *i. e.*, the north side of the fault has moved up almost 350 feet with respect to the south side. The effect of such a displacement on both sides of the fault can readily be determined.

Thus, carrying in mind the fact that the northern block represents the upthrow side, it will be apparent that the Cloverly on this side will be brought up until it rests against the clay shales of the upper part of the Thermopolis in the

south block; and the Cloverly on the downthrow side, will be brought to rest against the lower half of the Morrison in the north block. In both parts of the fault the Cloverly forms a sharp anticlinal ridge plunging northward, and in such a plunging fold migration of gas, oil and water will be southward. The Thermopolis adobe shale will form a very efficient bar to southward migration in the Cloverly, and will therefore, prevent the loss of gas and oil by seepage along the fault plane; in other words, it maintains an efficient trap in the Cloverly on the north side of the fault. In the downthrow block, Cloverly and Morrison are resting against each other and both, because of the porous character of their sands, are inefficient in checking lateral migration, which, therefore, can take place uninterruptedly across and up the fault plane until held in by overlying shales. As far as the Cloverly is concerned an efficient trap is formed on the north side of the fault by the sealing action of the clay shale of the Thermopolis, and the northward plunge of the anticline.

This reasoning is borne out by the results of the two wells drilled here. The well on the south side of the fault brought in only a showing of gas, while the well on the north side of the fault yielded gas under great pressure from the Cloverly sandstones.

The Pauline Well is also interesting in that it is the farthest down dip, being located on the 4500-foot contour. The failure of this well to give oil or gas in quantity, as well as the heavy artesian water flow it yields, indicate the probability of the shallowness of the reservoir of the Oregon Basin field.

Of the three wells located on the Elk Butte dome, the Hallene is nearest the top, being located on the 5100-foot contour of the north limb. The McMahan well is located on the south limb between the 4900-foot and 5000-foot contours; while the Jack Well is on the north limb between the 4600-foot and 4700-foot contours. The first two wells yielded gas under great pressure; the Jack Well was unsuccessful. All three wells furnished showings of oil from the Frontier. The McMahan well penetrated to the top of the

Thermopolis and its heavy gas flow came from sands at the top of this formation. The Hallene Well gave a flow of gas from sands near the middle of the Thermopolis; but its more important flow came from the Cloverly. The Jack Well penetrated into the Cloverly a distance of 66 feet but only water was encountered. This last fact is quite significant because of its bearing on the size of the reservoir in the Cloverly on Elk Butte dome. Thus the wells near the top of the dome encounter gas in the Cloverly down to the 5100-foot contour, while approximately at 4650 feet the Cloverly yields water and no show of gas. If there is any oil in this structure it should be present as a layer between the gas and the water; therefore, between the 5100- and the 4650-foot contours.

PRODUCTION

There has been no commercial production of oil or gas from the Oregon Basin field. Gas from the earlier wells has, however, been used as a source of power in later exploratory work.

FUTURE DEVELOPMENT

The most promising horizons at Oregon Basin are the Cloverly sandstones and to a lesser extent sands in the Thermopolis, from both of which a moderate production of oil may be realized, especially in the Elk Butte dome. This conclusion was derived from a balancing of the following points:

FAVORABLE:

1. There are two favorable geological structures at Oregon Basin;
   a. an ideal dome—at Elk Butte, and
   b. a fault trap—east of Wiley.
2. The wells so far drilled have yielded gas under considerable pressure.
3. The gas is moist and oil condenses at the well heads.

4. The wells drilled on Elk Butte dome are located too near the top of the dome.

UNFAVORABLE:

1. While the geologic structure is favorable in that two traps are present, both are shallow. The Elk Butte dome is limited in height to 800 feet by the structural ridge connecting it with the Cedar Mountain anticline.

2. Drilling has demonstrated the presence of gas under great pressure, but not the presence of any noticeable quantity of oil. Thus drilling results are tabulated below:

WELL	HEIGHT ON DOME	RESULT	SOURCE
Pauline	4500 contour	Water	Cloverly
Jack	4650+ "	"	Thermopolis and Cloverly
McMahan	4950 "	Gas	Thermopolis. Did not penetrate to Cloverly
Hallene	5100 "	"	Thermopolis and Cloverly

Apparently then, the possible producing part of the dome must be above the 4650-foot contour. Thus there remain 300 feet of territory in the dome for which no data is available. It is of interest to note that two wells drilled north of Elk Butte on the 4850-foot contour are said to have been unsuccessful.

The most promising location for drilling is considered to be the south side of the Elk Butte dome between the 4700-and 4900-foot contours, as indicated on the map. Until this territory has been drilled and proven unproductive, the chances of striking oil in Elk Butte dome must be considered fair. The shallowness of the dome itself and the limitation of the possible oil reservoir, as shown by the wells so far drilled, indicate that moderate production only is to be expected.