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STATE OF IDAHO
Chas. C. Moore, Governor.

BUREAU OF MINES AND GEOLOGY
Francis A. Thomson, Secretary.

NOTES ON THE GEOLOGY OF EASTERN BEAR LAKE COUNTY, IDAHO, WITH REFERENCE TO OIL POSSIBILITIES.

by

Virgil R. D. Kirkham

In response to repeated requests for data concerning the area in question, the following compilation of the information on file in the Bureau office has been prepared for interested persons. It represents a correlation of available material in the reports of the United States Geological Survey as well as of field observations and other data collected by the State Bureau staff.

The twelve townships covered by these notes are located in Range 45 East, Boise M., extending from 12 South to 16 South, inclusive and in Range 46 East, extending from 10 South to 16 South inclusive. Each township in Range 46 is approximately four and one-half miles wide, being cut-off on the east by the Idaho-Wyoming state line. This group of townships constitutes a strip extending along the Wyoming state line from the southernmost townships described in Bulletin No. 4, to the Utah-Idaho state line. Practically all of the townships are tributary to Montpelier, Idaho, or Cokeville, Wyoming, by wagon road. The main line of the Union Pacific system passes thru Townships 14 and 15 South, Range 46 East. The farthest north township of this group is about 20 miles by wagon road from Montpelier, while the farthest south township is about 30 miles distant. However, most of the townships are within 10 or 15 miles of the above distributing center, with one being as near as three miles.

Topography

The relief, is in general rough and broken. The highest point in the area is Red Mountain, with an altitude of 8799 ft., Bear River Valley traverses the area with an average altitude of 6050 ft. The only agricultural land lies in Bear River valley and the valleys of two of the tributaries known as Thomas Fork and Sheep Creek, and includes approximately one-half of Townships 13 S. and 14S., one-third of Township 12 S. and 46 East, and about one-seventh of Townships 14 and 15 South, Range 45 E. Sheep raising and farming are the chief industries.

Bibliography.

Gale, H. S. and Richards, R. W., Preliminary Report on the Phosphate Deposits in Southeastern Idaho and adjacent parts of Wyoming and Utah. U. S. Geological Survey Bulletin No. 430, pp. 457 - 535, 1909.

Hayden, F. V., Eleventh Annual Report of the Territories, 720 pages, 1879.

Richards, R. W., and Mansfield, G. R., Preliminary Report on a Portion of the Idaho Phosphate Reserve. U. S. Geological Survey Bulletin No. 470, pp. 371 - 439, 1910.

The writer has also had the advantage of several personal conferences with Dr. G. R. Mansfield, whose monumental work on the phosphate areas of Southeastern Idaho, will, it is hoped, shortly be available in the form of a Professional Paper of the U. S. Geological Survey.

General Geology.

The entire area is overlain by an extraordinary thickness of sediments of both marine and continental or fresh water origin. No igneous rocks are known to exist in this particular group of townships.

The formations found here are allotted to the Permian, Triassic, Jurassic, Eocene, Pliocene, and Pleistocene periods of the geologic time scale. The formations exposed, in order of age are the Phosphoria formations of the Permian, the Woodside and Thaynes formations of the Triassic, the Nugget sandstone, the Twin Creek limestone, the Preuss sandstone and the Stump sandstone of the Jurassic and the Wasatch and Salt Lake formations of the Tertiary period.

Permian Formations.

I - The Phosphoria Formation.

This bed is correlated with the upper beds of the Park City formation of other localities by the U. S. Geological Survey, and is a marine formation. It is made up of two members, the (overlying chert" and the "phosphate shales". The former known as the Rex Chert is the conspicuous member of the Phosphoria because of its extreme resistance to erosion. Its ledges form marked topographic features. The shales, quite to the contrary, are the softest formation in the area and are easily removed where exposed.

This formation bears the rich and immensely valuable phosphate deposits of Southeastern Idaho and its stratigraphy has been thoroughly worked out by Mansfield. The thickness of the two members as exposed in this area is about 600 ft. This formation outcrops in Townships 12 and 13 South, Range 45 E., B. M., of this area, and is being mined by two companies operating near Montpelier.

Triassic Formations.

II - Woodside Formation.

This formation appears to conformably overlie the Phosphoria and is a marine formation. It is chiefly shale, varying from olive green to brown and including abundant lentils of impure fossiliferous limestone; a massive limestone member often appears at the top of the formation. This formation attains a thickness of 1200 ft. where uneroded. It outcrops, at a few places in Townships 12, 13, 14, 15 S. R. 45 E.

III - Thaynes Limestone.

This is a marine formation and is thought to conformably overlie the Woodside formation. It contains massive as well as thinly bedded platy limestones of a bluish-gray color. The weathered surface is generally buff-tan or brown in color. Near the base the formations generally contain a gray clay member which aids in distinquishing the formation from the contiguous Woodside. The limestones are so impure in many places that the weathered surfaces are often mistaken for sandstones. A thickness of 2000 ft. where uneroded has been credited to this formation. It outcrops in Townships 12, 13, 14 and 15 S.R.45E.

Jurassic Formations.

IV - The Nugget Sandstone.

The Nugget Sandstone appears to overlie the Thaynes conformably but its litholigic characteristics and lack of fossil life suggest a fresh water origin. It is generally a deeply colored reddish sandstone containing thin layers of sandy shale. It often has a white, coarse grained phase at its base and a similar member at the top where the upper part is uneroded. The formation being more erosion resistant and highly colored than contiguous beds, is quite easily identified. The thickness in this area is generally under 2000 ft. and is variable from North to South. It outcrops in townships 12, 13, 14, 15 and 16, South, Range 45 E., B. M.

V - The Twin Creek Limestone.

This lies scattered promiscuously over the northernmost townships and is the oldest formation of the area - it lies unconformably on the underlying Nugget sandstone which is the lowest member of the Jurassic series.

The formation is generally quite readily recognized, consisting principally of grayish, yellowish, white limestones, with a notable splintery, platey and shaly occurrence. This formation contains various impure, yellow calcareous sandstones and dark olive, compact limestones that serve as ledge makers throughout the area. Its thickness will average 3500 ft., where it is uneroded. It is a marine formation and outcrops in all the townships in question.

VI - The Preuse Sandstone.

The next member of the Jurassic series above the Twin Creek Limestone is exposed at several places in the area. It is separated from the Twin Creek limestone by a minor unconformity.

The formation is made up of fine and even grained sandstones, variable in color from reddish-gray to deep shades of red. It is shaly in many places and also has calcareous phases. It is about 1300 ft. thick where uneroded, in this group of townships. The Preuss is believed to have had a fresh water origin. It is exposed in most of the townships in Range 46 E., B. M.

VII - The Stump Sandstone.

This member of the Jurassic series has a marine origin and is separated from the underlying Preuss by a minor unconformity. It consists mainly of thin bedded gray, greenish-gray and yellowish-gray fine grained sandstones with occasional calcareous members and grits. Its thickness in this area varies from 300 to 600 feet where uneroded. It outcrops throughout the Townships in Range 46 E., B. M.

Eocene Formations.

VIII - Wasatch Formation.

The Wasatch formation, of fresh water or continental origin, is the oldest member of the Tertiary - being allotted to the Eocene. Its thickness is thought to be about 2000 ft., where uneroded.

This formation is the most prominent rock forming series in the southernmost townships. It is made up of conglomerates, breccias, and grits, along with ash beds, sandstones and gravels.

Pliocene Formations.

IX - The Salt Lake Formation.

This formation is lithologically very similar to the Wasatch and probably a great deal of the area formerly thought to be Wasatch will prove to be Salt Lake as a result of more detailed work. Its occurrence is approximately that of the Wasatch and the thickness is unknown It is non-marine and is a result of ponding, fluvial or continental deposition.

Pleistocene Formations.

The Pleistocene formations are hill wash, terrace gravels, and alluvial deposits, such as cones and fans. They are scattered promiscuously throughout the valleys of Bear River, Thomas Fork and Sheep Creek.

Alluvium covers the valleys of the above mentioned streams and is of recent date.

Structure of the Area.

Little is known about the location of structures in this region, although it is known that the Jurassic and Eocene rocks are tilted and folded into anticlines and synclines. Insufficient work in the area will not permit actual locations to be suggested.

The writer has observed an anticline in T. 10, S., R. 46 E., B. M., which enters the township in the north and western part and extends south easterly for an undetermined distance.

Three anticlines, one in the Nugget and two in the Twin Creek, enter the northern part of T. 12 S., R. 45 E., B. M. Their general trend is north and south but their extent and amount of closure is not known.

Two sharp assymetrical anticlines in the Thaynes have been noted in the southern part of T. 14 S., R. 45 E., and the northern part of T. 15 S., Other tilted strata have been observed throughout the area but no attempt has been made by the writer to work out the relationships.

Oil Possibilities.

A careful examination of the structures of sedimentary rocks and their relations to concentrations of gas and petroleum in many widely separated oil fields of the world, has resulted in certain essential conditions being recognized by geologists as controlling the accumulation of oil and gas in rocks. These may be stated briefly:

1 - A source or origin for the oil (in marine sediments).
2 - A reservoir or containing rock.
3 - An impervious capping rock.
4 - A suitable structure for trapping oil or gas.
5 - A high water saturation in the reservoir rock.
6 - A sufficient gathering ground for commercial concentration.

Correlation of formations with oil and gas producing formations of other States.

The Phosphoria formation is believed by some authoritative geologists to be equivalent to some part of the Embar of Wyoming, which produces oil in Big Horn Basin and central Wyoming.

The Woodside, Thaynes and Nugget formations taken together are tentatively correlated as the equivalent of the Chugwater of Wyoming which produces oil and natural gas in the above mentioned localities.

The Twin Creek formation of this area has been tentatively correlated by the writer with the Sundance formation of Wyoming because of age relationship, position in the geologic column and lithologic similarities. The Sundance formation produces commercial oil and natural gas in Central Wyoming. The Ellis formation of Montana has been correlated with the Sundance and is credited with producing the commercial oil of the Kevin-Sunburst field, and much of the oil in the Cat Creek field of Montana.

The Stump and Preuss formations together have been correlated with the Beckwith of Wyoming and this in turn has been correlated by many geologists, with the Morrison formation of Wyoming. The Morrison formation produces commercial oil and natural gas in Shoshone River Basin, Big Horn Basin and Central Wyoming.

The Tertiary beds are not correlated with oil producing beds since they are unconformable to the underlying Jurassic formations.

Conclusions

Comparatively little can be definitely said concerning oil possibilities in this area.

Carbonaceous shales are known to occur in the exposed column as shown in the Phosphoria. Some of these from nearby areas have yielded petroleum when subjected to destructive distillation, and the Twin Cree limestone is fairly full of fossil life, indicating a possible source for oil. Sandstones for reservoir rocks are contained in the Stump and Preuss formations, and shales for capping rocks are also present. Good sturctures for trapping oil may or may not be present, although the writer is prone to suspect the latter conclusion. Nothing is known about the amount of water saturation or drainage since a study of the area for petroleum possibilities has never been made.

The most favorable conclusion that can be drawn is simply this: Some of the rocks exposed in the area are marine sedimentaries of approximately the same age and showing similar lithologic characteristics as oil bearing formations in other Rocky Mountain states such as Wyoming and Montana

Further detailed geologic work in the area would be necessary to a more complete discussion of the structural and other pertinent facts.