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A discussion of the geological department of an oil company. Part II. Report on structure north of Ochelata, Washington Co., Okla.

Lawrence Joseph Zoller

A DISCUSSION OF THE GEOLOGICAL DEPARTMENT OF AN OIL COMPANY

by

Lawrence J. Zoller

A

THESIS

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Approved by Garrett A. Muilenburg
Assistant Professor of Geology and Mineralogy
Acting Head of the Department.

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Position and Relation

The position of the department in the general organization of an oil company and its relation to the other departments of the company is shown in the accompanying sketch.

Function and Operation

The function of a geological department in an oil company is to make itself profitable and valuable to the company.

This means, first, the selecting of acreage that is probable or potential oil land; and second, aiding the production department in drilling and operating the company properties.

The acreage may be selected by two courses of action or generally a combination of the two. The department will go into an area and work out the geological conditions so far as possible. Then where the conditions are found to be favorable for the accumulation of oil in commercial quantities, the desirable acreage will be recommended to the land and scout department. With the sanction of the General Manager, the latter department will obtain all or part of the desirable acreage.

On the other hand, the course of action may be just the reverse. That is, the land and scout department will have acreage or production submitted to them, on which they will want the opinion of the geological department. If the area has been covered by the geological department, the report will be made immediately as all the information will be in the files where it can be obtained in a few moments. If the area has not been covered, the submitted acreage will be examined and recommendations will then be made to the land and scout department.

If harmony and co-operation exists between the departments, both courses of action will be used. The company's interests will be furthered by each department feeling that it has the confidence of the other and that an exchange of information will be of mutual advantage.

The geological department may aid the production department in drilling and operating company properties as follows:

In a case where a wildcat test is being drilled, the geological department will furnish the depth at which sands will be encountered, the depths at which the best casing points will be found and, if possible, the depths where caves may be encountered.

In the case of a producing property, the geological department will furnish all available information upon the possibilities of deeper producing horizons, and, when called upon, will make a study of the water, casing and other troubles experienced in operating the property.

Personnel and Organization

The position and relation, the function and operation of the geological department just discussed shows the basis upon which the department is placed; it shows what its work is and how it is accomplished in the general organization.

The questions now are: "Of what is a geological department composed?" and "What is the work required of each individual in the department?"

These questions may be answered by a brief discussion of the personnel and organization of the geological department. Generally, the department will consist of:

A head, an office assistant, and field men or parties.

The head of the department may be known as the Head Geologist, the Resident Geologist, or the Chief Geologist. In the Mid-Continent field, the latter title is the one commonly used.

To be successful, the Chief Geologist should be a man personally familiar with the geology and production in his region; he should have a good sense of values; and he should be a good executive and a diplomat of the first order. He is responsible for the discharge of all company orders concerning his department; he must be forever studying his region with the idea of locating new favorable areas; he must see that all information is filed so that it is instantly available; he must know the prevailing prices for acreage and production so as to be able to compare them with the intrinsic values as based on his geological knowledge; and he must keep his department running smoothly at all times.

The office assistant should be the right-hand man of the chief. He is, in reality, a secretary and stenographer. In addition to knowing his ordinary business of stenography, he must be familiar with land descriptions, legal and geological terms; and he must be capable of filing and keeping departmental information, such as well records and geologic maps.

The surface work and sub-surface work as shown in the sketch may be carried on by the same men, if the company has a small force of geologists; or, if a larger force is maintained, the work may be so divided that one set of men handles the surface geology and another set of men the sub-surface geology.

As implied, the surface geology embraces all geological work which is concerned with the surface formations and structure; and the term, sub-surface geology embraces all geological work concerned with the sub-surface or underground formations and structure.

The field parties consist of one or more men, depending upon the kind of work in which they are engaged, i.e., surface work, including reconnaissance and detail, or sub-surface.

The surface geology consists of mapping the structure of an area by taking observations on some datum of the outcropping formations. In mapping a given area, a reconnaissance geologist makes a complete examination and outlines the acreage he thinks should be detailed. A detail party then makes a detail survey of the acreage outlined.

In outlining the acreage which is to be detailed, the reconnaissance geologist has a difficult task. This work requires not only that he be familiar with the general geology of the area and that he know the normal regional dip, but also that he be able to see instantly any changes that may have taken place in the relative position and dip of the formations. This does not mean that he should be able to detect reverse dips only, but that he must be able to detect any change in strike or dip of the beds.

The instruments a reconnaissance geologist uses are: an aneroid barometer, a hand level and a Brunton compass. He is also equipped with production plats and topographic maps of the area if they are available.

In working the area which has been assigned to him, the reconnaissance geologist makes a complete study of the general geology by learning the normal succession of the outcropping beds, their lithologic character, thickness and appearance, and the manner in which they weather. He then picks out one or more good datums upon which to base his structural observations. When this is accomplished and he has the direction and amount of normal dip firmly in mind, he is prepared to start his search for favorable structures. Simply stated, he takes dip and strike observations whenever possible. This he may do with or without the aid of any of his instruments. Upon noting any changes in dip or strike, he follows the beds in every direction until they again assume their normal position. In doing this he outlines any structural deformation which may be present. The area is then reported to the chief who has a detail survey made.

The good reconnaissance geologist is rare, because there are few men who have the mental characteristics which the work demands. The work as just outlined requires the reconnaissance geologist to have a rapid, accurate power of observation, high ability in reasoning, a well developed visuality and a natural sense of location and direction.

As stated before, the reconnaissance geologist reports any favorable structural disturbance he finds and the chief has a detail survey made of the area outlined. This is done by a detail geologist and an instrument man.

These man have the description of the area outlined by the reconnaissance geologist, and production and topographic maps on the area if they are available. The instruments which they use are a plane table outfit consisting of a telescopic alidade, a plane table and tripod, and a stadia rod. In addition to this, the geologist will have a Brunton compass, hand level and probably an aneroid barometer. The work of this party is to make an accurate contoured structural map of the area by taking elevations on the top or bottom of a persistent bed, or beds and referring them to a common datum.

The geologist familiarizes himself with the details of the general geology of the area and chooses the bed upon which he will base his structural observations as discussed in connection with the reconnaissance geologist. The instrument man makes his set up at a given starting point. The geologist then places his rod on the outcrop and the instrument man takes the readings on his instrument from which he computes the location and elevation of the point given him by the detail geologist. The geologist continues to follow the outcrops and the instrument man continues his work until the survey has been completed. By this time, all elevations, traverse lines and lines of outcrops are complete on the plane table sheet. The geologist then contours the map of the area, generally using ten foot contours. This map is the final word concerning the structure in the area. Therefore, it is imperative that the instrument man be mechanically accurate in his part of the work and it is necessary that the geologist be sure every minute that he is correct in following his outcrops and has made no mistake in his correlations.

The work of a detail geologist requires that he be painstaking, patient and accurate. He must be a good observer and honest enough to show the structure as it actually is and not as he thinks it is, because his work recommends or rejects the area surveyed.

The work of the instrument man requires that he have the ability of a good surveyor and draftsman. If he intends to become a geologist, he does everything he can to help his geologist and pays as close attention to the geologist's work as he does his own.

Just as surface geology is concerned with the surface formations and structure, the sub-surface geology is concerned with the underground formations and structure.

Sub-surface geology may be divided into two parts. First, the taking of the elevations of the wells; and second, the office work consisting of: putting the well records in graphic form, correlation and reduction of the elevation markers to a common datum, the making of a production plat, and finally, the contouring. At the same time a study is made of the sand conditions.

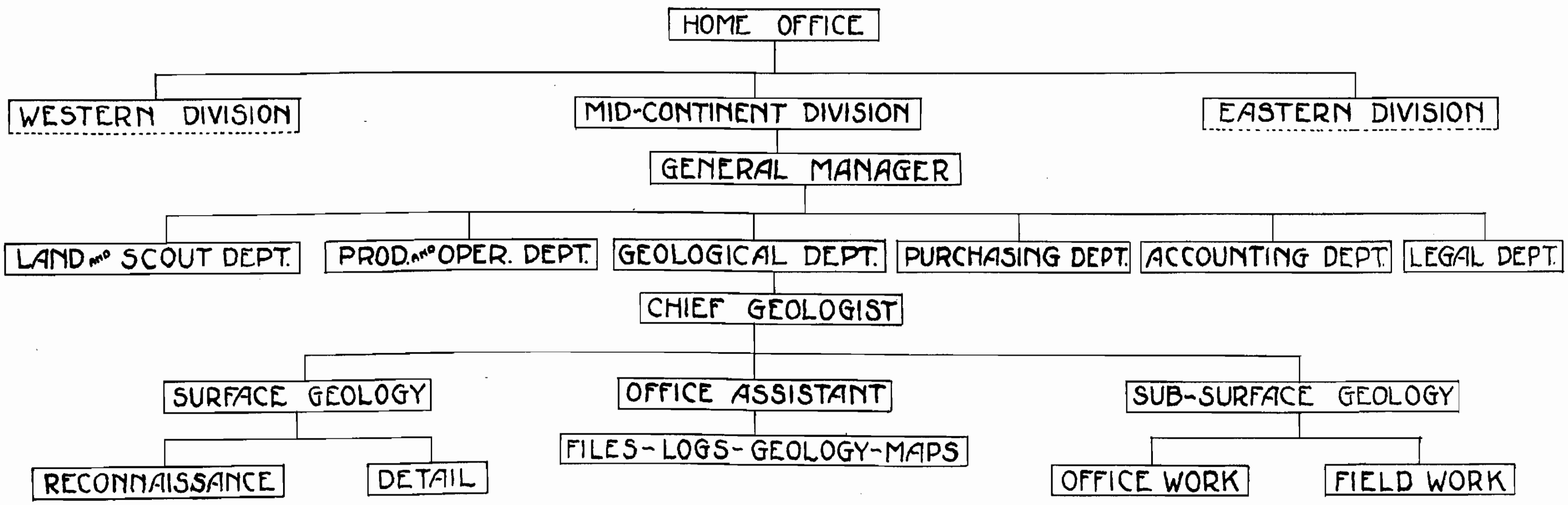
The first part of the work, i.e., taking the elevations, is done by an instrument man and a rodman, who may or may not be a geologist.

The second part of the work is under the supervision of a geologist. After the mechanical details of putting the logs in graphic form, and platting the wells is completed, the geologist commences the difficult part of the task.

First, he studies the logs in order to pick out the most persistent and continuous marker. This he does by placing the graphic logs side by side for comparison. When he has selected a marker, he computes the elevation of it in each well, which is generally equivalent to its depth below sea level. Then the result obtained for each well is marked at the location of the well on his production plat. The last step is to contour the map on the computed elevation of the marker in each well.

After the contour map is completed, cross-sections are made of the area showing the relative position and thickness of the principal producing sands and more prominent limestones. This phase of the work is important in showing the character, position and thickness of stray and lenticular sands.

ORGANIZATION PLAN



PART II

REPORT

ON

STRUCTURE NORTH OF OCHELATA,

WASHINGTON CO., OKLA.

by

Lawrence J. Zoller,

September 1919.

Candidate for degree of

Engineer of Mines

Approved by

Garrett A. Muilenburg

LOCATION

The area surveyed is located one mile north of Ochelata, Washington County, Oklahoma. It embraces Sections 24 and 25, Township 25 North, Range 12 East; and Sections 19 and 20, Township 25 North, Range 13 East.

TOPOGRAPHY AND DRAINAGE

The area is drained by two small branches which form what is known as Keeler Creek. Keeler Creek flows north into Caney River, which is the major stream of Washington County.

The southern branch of Keeler Creek flows from north to south on the west side of Sections 30 and 19. The western branch flows from the southwest corner of Section 25 due north to the center of the northwest quarter of Section 24. Then it flows slightly northeast and joints the southern branch of Keeler Creek on the section line between Sections 18 and 19.

The southern branch flows through a U-shaped valley about one-half mile wide. The valley is bordered on each side by a low bluff about twenty feet high on the west side and thirty feet high on the east side. East of the southern branch, the topography is a rolling plain dissected by small washes. West of the branch, the surface is a plain which slopes to the westward and is cut by the north-south extension of the western branch of

Keeler Creek so as to form small bluffs along its banks.

The plain continues west across the west line of the area in question for about one-half mile. At this point, the topography changes and the Osage hills are encountered; they rise one hundred to one hundred fifty feet above the west side of the area surveyed.

GENERAL GEOLOGY

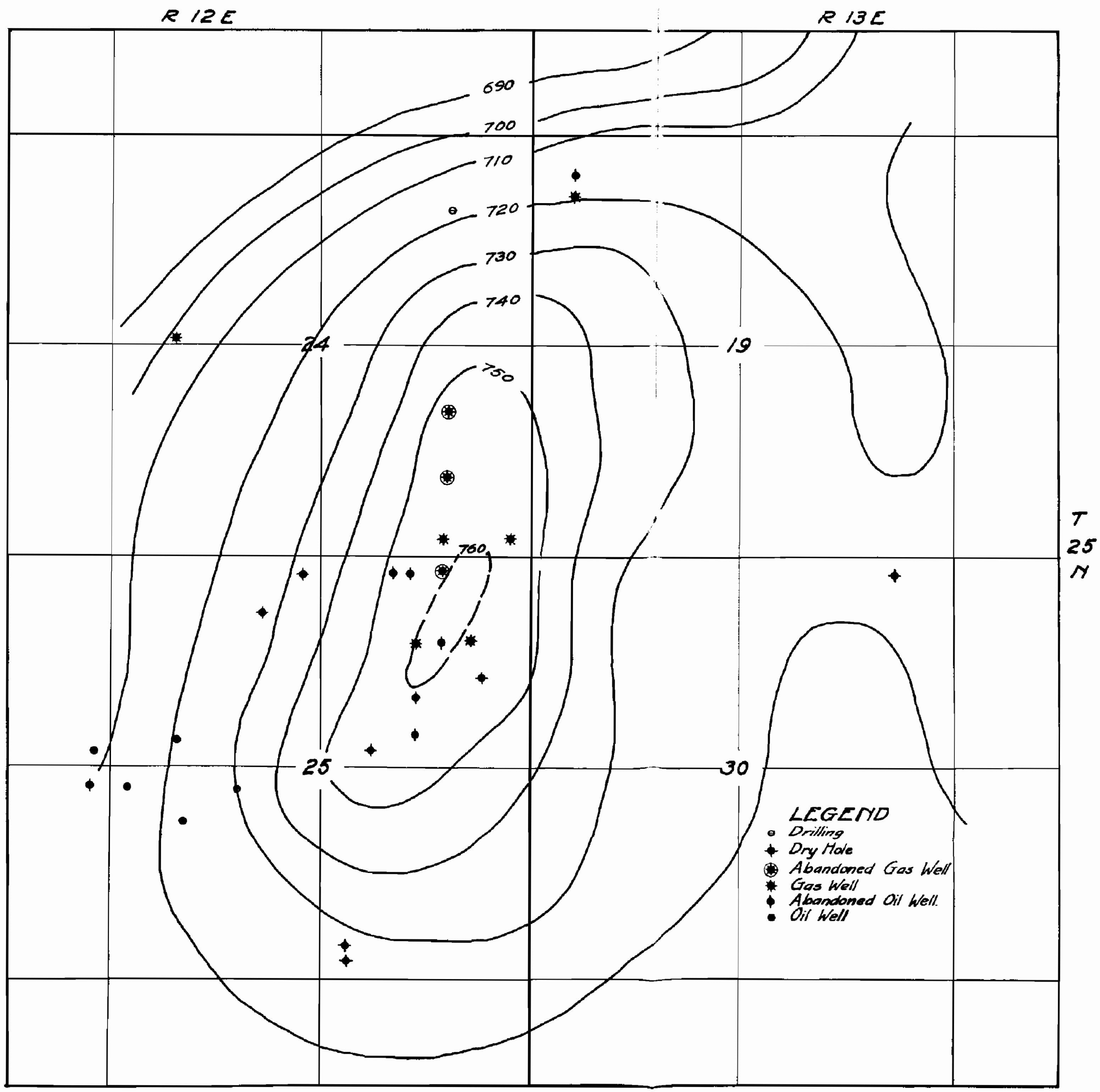
The rock formations exposed in the area examined belong to the Skiatook and Romona formations of the Pennsylvanian series of the Carboniferous system.

The upper part of Skiatook formation, the oldest formation exposed in this area, consists of brown and greyish-brown shales. Only a small thickness of the upper part of the formation is exposed. The best exposures are in the faces of the escarpments along the valley of Keeler Creek, underlying the limestone which caps the escarpments.

The limestone which caps the escarpments and overlies the Skiatook formation is the Dewey Limestone. It is the lowest and oldest member of the Romona formation. It is a heavy-bedded, massive, resistent white limestone approximately eight (8) to ten (10) feet thick.

Overlying the Dewey lime on the north, west and south sides of the area are some brown shales belonging to the Ochelata

STRUCTURE
NORTH of OCHELATA
WASHINGTON CO. OKLA.



member of the Romona formation. Only a few feet of the basal part of the formation are exposed in the area surveyed.

STRUCTURE

The attitude of the rock strata in this area was determined by careful observations on the Dewey limestone. Careful observations on this horizon disclose the formations to be folded in the form of an anticline. The general configuration of the fold is shown on the accompanying structural plat. The sharpest dip of the strata occurs in the north limb of the fold, where the beds are depressed a vertical distance of sixty feet in a lateral distance of about three-fourths mile.

DEVELOPMENT

Old Development:

The major portion of the holes shown on the accompanying plat were drilled in 1913 and 1914. During this period of development a number of gas wells were obtained in the southeast quarter of Section 24 and the northeast quarter of Section 25. The gas was encountered in the Peru sand at an average depth of approximately seven hundred (700) feet. The Peru sand in this area obtains a thickness of twenty feet and during the period of development, and for two or three years subsequent thereto, produced gas only.

About 1917, however, several of the wells in the northeast quarter of Section 25 started to make oil and have produced oil intermittently since that time. The oil is accompanied by considerable salt water.

Of the various gas wells obtained in this area, only two are at present productive. One well is located near the center of the south line of the southeast quarter of Section 24; the other is located near the southwest corner of the northeast quarter of the northeast quarter of Section 25. The present capacity of these wells is unknown, but it is doubtless very small. The wells are producing sufficient gas, however, to hold the leases upon which they are located.

At some time during 1913 or 1914, the Empire Gas and Fuel Company drilled a test near the southwest corner of the northeast quarter of Section 25. This test was drilled to a total depth of 2368 feet and was bottomed according to the driller's log, in red granite. The following log shows the various formations penetrated:

From	To	Formation
0	40	Clay, yellow
40	480	Shale, blue
480	490	Lime, white
490	635	Slate, white
635	665	Slate, dark
665	710	Shale, blue
710	750	Limestone, white
750	773	Slate, white
773	793	Peru Sandstone
793	918	Slate, white
918	985	Oswego Limestone, white

From	To	Formation
985	1010	Shale, white
1010	1020	Slate, white
1020	1025	Limestone, white
1025	1320	Slate, white
1320	1350	Bartlesville sandstone
1350	1486	Slate, white
1486	1538	Limestone, white
1538	1785	Limestone, dark
1785	1810	Sandstone, white
1810	2340	Limestone
2340	2368	Granite, red and hard

The above log furnishes no information relative to the presence or absence of oil and gas in the Peru and Bartlesville sands. Nor is there more definite information contained in the records of the Empire Gas and Fuel Company. In the absence of more definite data, there are two reasons for believing that this test is in no way condemnatory to the area: (1) The company desired to make a deep test in this area, and (2) the test was drilled at a time when the market value of oil was only thirty-five (35) cents per barrel and a well of thirty or forty barrels daily capacity was considered a very poor commercial proposition.

Recent Development:

The two dry holes in the southwest quarter of the southeast quarter of Section 25 were drilled in 1916 or 1917 by local parties. One was drilled to a depth of six hundred (600) feet, the other to twelve hundred ten (1210) feet. The former did not reach the Peru sand. The latter penetrated the Peru sand, but was not drilled sufficiently deep to encounter the Bartlesville. No information could be obtained relative to the presence or absence of oil and gas in the Peru sand in this test.

In the first part of August of the present year, oil was encountered in a test located in the northwest quarter of the southwest quarter of Section 25. The productive horizon is the Bartlesville sand, the top of which was encountered at a depth of thirteen hundred thirty-seven (1337) feet. The well has not been tested and is variously reported as having a daily capacity of from ten to fifty barrels. The former figure is probably the more reliable. Thirty feet of Bartlesville sand is reported to have been penetrated in this well.

At the present time, a test is being drilled on the Biggerstaff in the northeast quarter of the northeast quarter of Section 24. The test is reported to have a present depth of over one thousand (1000) feet. A showing of oil is reported in the Peru sand and a small volume of gas in the Oswego Limestone.

CONCLUSION

The geologic fold which obtains in this area is favorable to the accumulation of oil and gas in commercial quantities. It would appear that the Peru sand is depleted of its gas content over the major portion of the fold, if not over the entire area covered by the structure. The Peru is oil-bearing in various portions of the Bartlesville region, of which the Ochelata area is a part, and in consequence may be found to carry oil on the lower parts of the Ochelata Anticline.

Insofar as known, only two tests in this area have been drilled to the Bartlesville sand. One of these, the deep test near the center of Section 25, penetrated thirty feet of Bartlesville sand at a depth of thirteen hundred twenty (1320) feet. This test was drilled several years ago and nothing is not known concerning the presence or absence of oil and gas in the Bartlesville sand.

The only other test which is known to have reached the Bartlesville sand in this area is the small oil well recently completed on the west line of Section 25. This test also penetrated thirty feet of Bartlesville sand and obtained sufficient oil to make a small commercial producer.

It would appear from these two tests that the entire area covered by the Ochelata structure is underlaid by the Bartlesville sand. Inasmuch as the Bartlesville sand is the most prolific of the various productive horizons in the Mid-Continent region, and in view of the fact that favorable geologic folding occurs in this area, it is recommended that as much acreage as it is possible to obtain on favorable terms be qcquired in that portion of the area which is considered favorable structurally.

Very respectfully submitted.