The Hewitt Oil Field, Carter County, Oklahoma.

Louis Roark.

Introduction.

The Hewitt Oil Field which is one of the most important fields in Oklahoma is located in the western part of Carter County, Oklahoma. The field was discovered June 1, 1919, by the Texas Company, when their well No. 1, on the A. E. Denny lease, was drilled in with an initial production of 410 barrels flowing. This well is located in the northeast corner of the NW. ¼ of the NW. ¼ of the NW. ¼ of section 27, Township 4 South, Range 2 West. This discovery well of the field is located on the south edge of the field and is now an edge well.

Since the bringing in of this well development has been very rapid until at the present time there are about 550 producing wells with an average daily production of about 45,000 barrels of oil. As yet the field has not reached its maximum production.

The writer commenced studying the geological conditions of this field for the Roxana Petroleum Corporation in January, 1920, and spent about five months' time on the work. A report was submitted the latter part of June, 1920.

At the present time the Carter Oil Company, the Wolverine Oil Company, the Westheimer and Daube interests and the Humble Oil and Refining Company are the largest producers in the field. The Carter Oil Company is leading in production with a daily average of about 9,000 barrels. The specific gravity of the oil varies from 34 degrees to 38 degrees Baume.

The writer is greatly indebted to the Roxana Petroleum Corporation for giving permission to publish this article and to Mr. R. A. Conkling, head geologist of the Roxana Petroleum Corporation, under whose supervision this work was done, for his advice and suggestions.

Location and Area of the Field.

The Hewitt field is located in Township 4 South, Range 2 West. This township is in the western part of Carter County, Oklahoma, about 25 miles north of Red River, the southern boundary of Oklahoma, and about 20 miles west of Ardmore, Oklahoma.

The field is 3 miles east of the southeast extension of the Healdton field and about 12 miles southwest of the western part of the Arbuckle mountains. The field covers an area of 6 to 7 square miles. There are 13 sections in the township with producing wells as follows: Sections 9, 15, 16, 21, 22, 10, 23, 25, 26, 27, 28, 35 and 36, of which the first five are the principal producing sections.

Topography and Drainage.

The relief of the Hewitt field proper is about 100 feet. The highest point is near the southwest side of the field in the southwest corner

of section 22, Township 4 South, Range 2 West. This point has an elevation of 929 feet above sea level and the lowest point is along the bottom of Bayou Creek which passes thru the northern and eastern portion of the field. The elevation of this flood plain is 837 feet above sea level. There are no steep escarpments along the sides of the valley. The topography may be classed as late maturity in age since the area is well drained and the larger streams have developed flood plains to some extent.

The field is drained by Bayou Creek and its tributary streams. Bayou Creek flows southeast and empties into Red River and thence into the Mississippi River.

The production in Hewitt is not confined to a major divide as in Healdton. Wells are found on the highland and also in the bottom along Bayou Creek and its tributaries.

The Hewitt field was covered for the most part with scrub oak timber, commonly known as black jack, at the time the discovery well was drilled. This timber has been greatly removed and thinned during the progress of development of the field.

Stratigraphy.

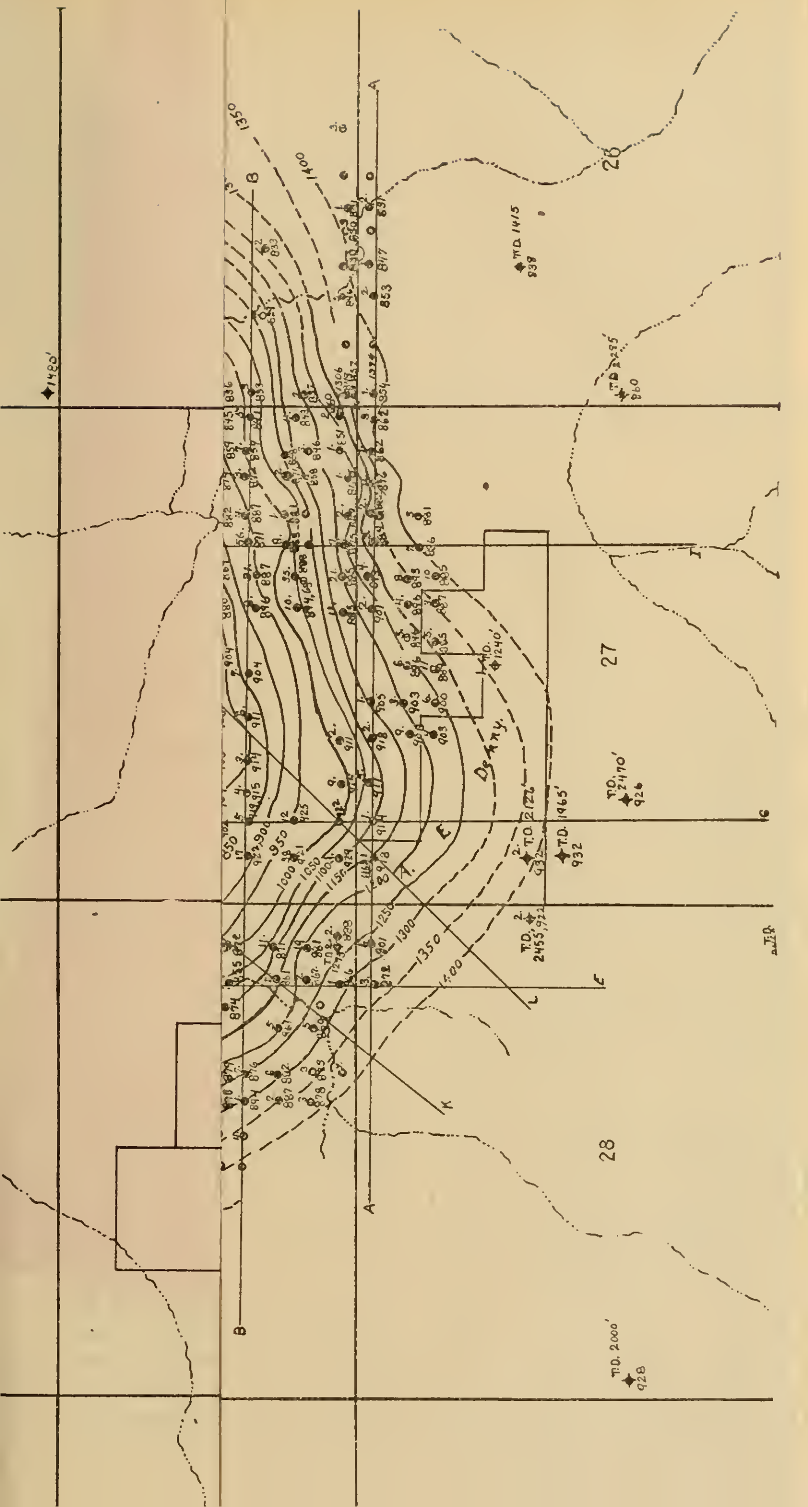
The generalized geologic section of Southern Oklahoma as given by J. A. Taff in his report on the Geology of the Arbuckle and Wichita Mountains, U. S. G. S. Prof. Paper No. 31, is shown below, and a brief description is also given of those principal formations that occur in the Hewitt field.

Geologic Section Southern Oklahoma (After J. A. Taff.)

Cretaceous	Cambrian
Permian	Pre-Cambrain
Pennsylvanian	Franks Conglomerate
Undifferentiated	Caney shale
Undifferentiated Red Beds	Sycamore limestone
Sandstones, shales, limestones and coals	Woodford chert
Wapanucka limestone	Hunton limestone
Pennsylvanian	Sylvan shale
Mississippian	Viola limestone
Devonian	Simpson formation
Siluro-Devonian	Arbuckle limestone
Silurian	Reagan sandstone
Ordovician	Igneous rocks
Cambro-Ordovician	

Cretaceous.—The Cretaceous occurs in the Hewitt field only as a capping for a few of the highest hills and consists of undifferentiated sand and gravel and is of little or no importance.

Permian.—The undifferentiated red beds of the Permian which covers the Hewitt field to a depth of 50 to 400 feet, consist of alternating beds of red, gray and white shale, and brown, white and red sandstones. The Permian is thinnest near the center of the subsurface structural high as mapped, this high being about the center of the field as now outlined. The Red Beds, as the Permian is commonly called,



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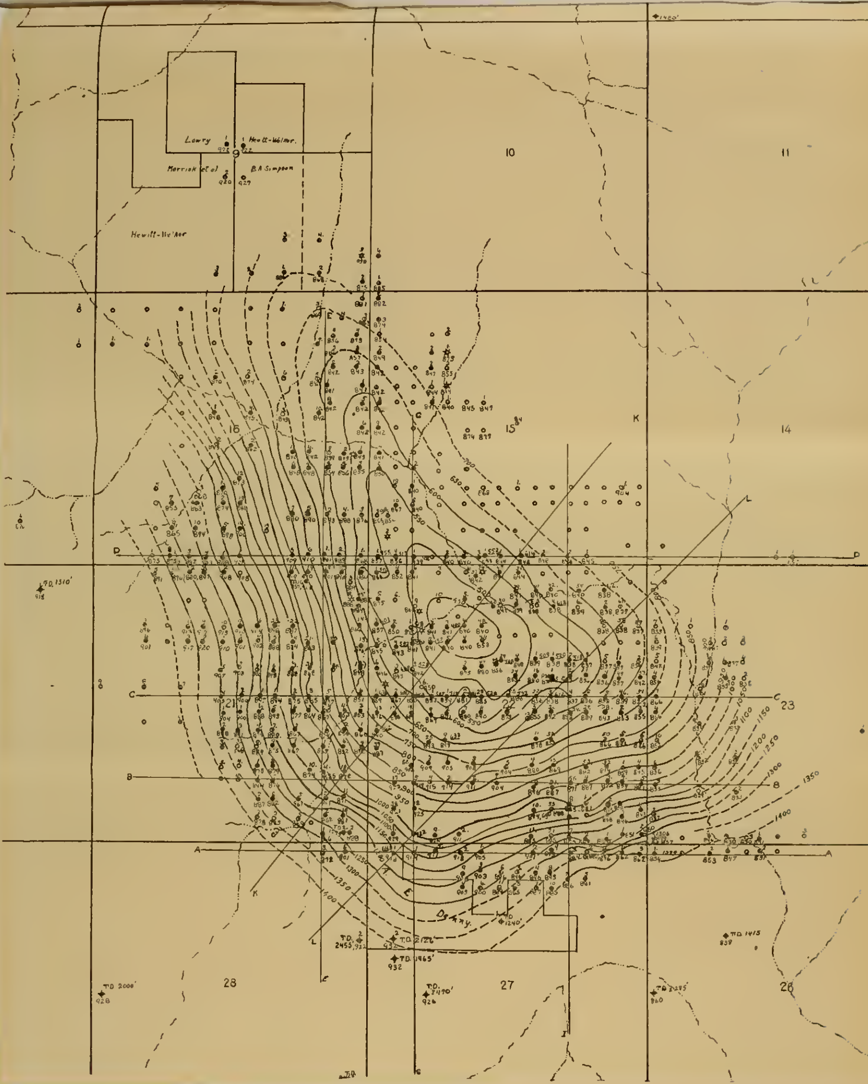

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thicken rapidly toward the edges of the field and as the lower part of the anticlinal structure is reached. In the producing wells along the edge of the field, especially the south and west side, the Red Beds attain a thickness of 400 feet. The Permian thickens tremendously away from the field where the angular unconformity between the Permian and Pennsylvanian decreases. Many of the sandstones found in the Permian carry fresh water in considerable quantities. There is not a well defined basal water sand of the Permian in the Hewitt field as, in the Healdton field. (The Healdton Field, Oklahoma, by J. G. Bartram and Louis Roark. Bull. Am. Assoc. of Petroleum Geologists. Vol. 5.)

Unconformity Below the Permain.—The Permain rests upon the underlying Pennsylvanian in the Hewitt field with an angular conformity. Beneath the Permian is a thick blue shale interval with occasional sandstone and thin limestone lenses, the former carrying gas, oil and water . This blue shale is of Pennsylvanian age and steeply dipping while the Permian on the surface shows only slight dips, therefore resting upon the Pennsylvanian with an angular unconformity. The Permian on the surface dips about 30 to 40 feet to the mile while the underlying Pennsylvanian shows dips of about 1,000 to 1,200 feet to the southwest.

Pennsylvanian.—The Permian is underlain by a thick series of blue shale, sandy shale, sandstones and limestones of Pennsylvanian age, it is from these formations that the oil of the Hewitt field is produced. So far as known from present drilling records the Pennsylvanian varies in thickness from 1,200 to 2,200 feet in the Hewitt field and nowhere has the Pennsylvanian been drilled thru and older rocks penetrated. It is therefore impossible at the present writing to determine the thickness of the Pennsylvanian because of this lack of information, which can be obtained from deep wells penetrating the older rocks. The Pennsylvanian outcrops about 12 miles east of the Hewitt field where dips of 65 to 85 degrees can be observed. It is also impossible to project these formations and estimate the thickness of the Pennsylvanian in the Hewitt field because of the angular unconformity between the Pennsylvanian and the older formations below and the unconformity of the Pennsylvanian with the Permian above. In addition to these unconformities the Pennsylvanian formations have flattened out until they are dipping only about 10 to 12 degrees on the sides of the Hewitt field.

The writer has not been able to accurately determine to which part of the Pennsylvanian these shales, sandstones and limestones belong, but believes they belong to the lower Pennsylvanian or Glenn formation.

Beneath the Permian Red Beds there is a thickness of 1,000 to 1,800 feet of blue shale with sandstone and limestone lenses. These irregular sandstone lentils carry water, oil and gas and occasionally make small gas and oil wells. Immediately under this shale interval is the main body of oil and gas sands called the Hewitt Sand Zone. The thickness of this zone has not been fully determined but is about 600 to 700 feet thick, carrying one to seven sandstones interbedded with shale, sandy shale and limestone.

The lower Pennsylvanian has not been definitely identified in the Hewitt field due to either its absence or the fact that the wells have not

been drilled to sufficient depth to reach the lower member, unless the producing zone is Glenn, which is now believed to be the case.

Unconformity Below the Pennsylvanian.—So far as known the unconformity below the Pennsylvanian has not been reached by any wells drilled in the Hewitt field. The writer believes that old buried hills of rocks older than the Pennsylvanian exist beneath the Hewitt field as in the Healdton field (Unpublished data on Healdton Oil Field by J. G. Bartram and Louis Roark). Old limestone hills similar to the Criner Hills, twelve miles southeast of the Hewitt field, exist beneath the Healdton field and it is believed that a similar condition exists in the Hewitt field except that such hills are more deeply buried than in the Healdton field, where the older formations are found as shallow as 800 feet in some parts of the field. Deep drilling in the heart of the Hewitt field will eventually penetrate these old limestones making up the buried Hewitt hills. The rocks in these buried hills are believed to be sharply folded with the Pennsylvanian resting unconformably on the steeply dipping eroded edges of the earlier rocks. This is the condition in the Criner Hills southeast of Hewitt where the Pennsylvanian overlaps the earlier formations and in the Healdton field northwest of Hewitt.

Older Formations.—The formations older than the Pennsylvanian have not been identified in the Hewitt field and therefore will not be discussed here. These older formations have been fully described from a study of exposures at their outcrop in the Arbuckle Mountains, about 12 miles northeast of the Hewitt field, by J. A. Taff in U. S. G. S. Prof. Paper No. 31. (Geology of the Arbuckle and Wichita Mountains.)

Structure of the Permian.

There is a slight folding of the Permian in this area, giving a small anticlinal doming of the surface formations. The highest portion of this dome is near the section corner of sections 21, 22, 27 and 28, Township 4 South, Range 2 West. The Permian structure is probably due to a slight deformative movement after the deposition of the Permian. A small part of the Permian structure may be due to sagging and settling of the Permian.

This surface structure is a flat dome-like fold with dips of 30 to 40 feet to the mile. The discovery well of the field was drilled by the Texas Company on their A. E. Denny lease, known as Denny No. 1 well, and is located in the northeast corner of the northwest quarter of the northwest quarter of section 27, Township 4 South, Range 2 West and was well located on the surface structure for a favorable test. Due to the unconformity between the Permian and Pennsylvanian formations the discovery well was near the south edge of the field as well No. 2 on the same lease drilled by the Texas Company 1,600 feet south of No. 1 was a dry hole 2,126 feet. The writer believes that this No. 2 well should have been drilled to 2,250 or 2,300 feet before being condemned as a dry hole.

Structure of Pennsylvanian.

In studying the Pennsylvanian structure of the Hewitt field nine cross-sections were plotted on tracing linen. The oil sands were used

as a datum plane on which to draw subsurface contours. Four east-west cross-sections, three north-south sections and two northeast-southwest sections were drawn. In addition to these cross-sections the logs of all producing wells were plotted on individual graphic log forms, thus making sections in any direction available for purpose of correlation and study.

From these cross-sections and plotted logs the accompanying subsurface map was made (Fig. 1). Correlation lines were drawn on the top of the producing sands and also on the water sands above the oil sands and thru sands carrying only slight shows of oil and gas. These correlation lines on the water sands help to check the correlation of the sands, although the water sands cannot be depended upon entirely because of their lenticular nature.

These correlation lines show that the oil sands have a considerable degree of regularity, although there are some irregularities due to local thickening and thinning of the sands and also to inaccurate logs. The sands in the Hewitt field are much more regular than in the Healdton field but not as regular as in the fields of the northern part of Oklahoma.

The structure of the Hewitt field as shown by the accompanying subsurface map (Fig. 1) is an elongated dome with the long axis extending north and south, about 10 degrees west of north. The top of the dome is flat, covering about one-quarter section and dipping off steeply to the west, southwest and south. Since the completion of the accompanying map further drilling, extending the field north, shows that the Hewitt anticline has as minor structural features two domes connected by a slight saddle.

The crest of the main Hewitt dome, or the dome further south, is in the northwest quarter of section 22, Township 4 South, Range 2 West. From the apex the Hewitt sands dip steeply to the west, southwest and south. The dips to the east and north are not nearly so steep as in the other directions. However, the east and north sides of the field have not been fully limited by dry holes so the amount of dip has not been determined. The sands dip north to about the west quarter of section 15, Township 4 South, Range 2 West, where they commence to rise to the second dome located probably in the northwest quarter of section 15, Township 4 South, Range 2 West.

The principal differences between the two domes of the anticline is that the north dome is higher structurally and yields strong gas wells whereas the south dome is lower and has never produced any dry gas from the Hewitt sand.

In addition to the two minor domes on the main anticline there are indications of the presence of two faults. Along the north line of section 22-4S-2W wells are producing at considerably different depths. Either the sands dip steeply to the north forming a very sharp syncline between the two domes or else the Hewitt sand zone is faulted. The failure to find sands at depths where the Hewitt sand should occur in offset wells strongly suggests a fault with the upthrow side to the south. On the north side of the north line of section 22 in section 15 the Hewitt sand not only is found about 300 feet deeper than in offset wells to the south, but the sand is not as productive as in the wells

where found at a higher elevation. If present this fault would extend almost parallel with the north line of section 22 dying out to the west before the northwest corner of section 22 is reached. This fault may be the cause of the two structural highs with a saddle between. The presence of this fault and its extent to the east has not been verified but is strongly suggested by the records of the wells in this area.

Indications also point to a fault limiting the field on the north thru the center of section 9-4S-2W with an east-west trend. The upthrow side of this fault would be to the south. This fault is strongly suggested by wells near the center of section 9. The Humble Oil and Refining Company found a typical Hewitt section in their Hewitt-Walker No. 2, which is producing from sands found at 1,390 feet and below while just across the line to the north Merrick, et al, in their Lowery No. 1 and the Hewitt-Walker No. 1 of the Humble Oil and Refining Company drilled to depths greater than 1,800 feet, and found nothing but red beds and water sands. The fact that the Hewitt sands were not found in these two north wells makes it almost certain that a fault with an east-west trend exists.

Future drilling will be necessary to prove the presence and extent of these two faults. However the writer believes that they exist and will have an important bearing on the limits of the field to the north and northeast.

The Hewitt anticline is very steeply folded. The formations dip west, southwest and south from the crest of the anticline at the rate of 1,200 to the mile. As mentioned above the east and north dips have not been fully established. The producing formations are more steeply folded in the Hewitt field than in any other producing field in Oklahoma with the possible exception of the southeast extension of the Healdton field where dips equally as steep in the producing sand have been observed by J. G. Bartram and the writer (Fig. 1, p. 472, Bull. Am. Assoc. of Petroleum Geologists. Vol. 5).

The Hewitt sands are of Pennsylvanian age, probably the Glenn formation, and are believed to have been deposited over and around a core of older rocks as is the case with the Healdton sands and were folded with the older rocks before the Permian was laid down and possibly again slightly folded after the deposition of the Permian. To date the Pennsylvanian has not been penetrated and the older formations discovered or at least they have not been identified. The Pennsylvanian is at least 2,000 to 2,100 feet thick at Hewitt.

A small part of the dip on the structure may possibly be due to settling and sagging of the Pennsylvanian sediments about a core of older rocks. The structure is due primarily to deformative movements after the deposition of the Pennsylvanian. This is shown by the steep dips of the Pennsylvanian producing sands and the angular unconformity beneath the Permian.

Source of the Oil.

The oil of the Hewitt field and also of the Healdton field has come from either the Pennsylvanian shales and limestones and the asphaltic sands near the base of the Pennsylvanian, or from the Caney shales of

Upper Mississippian age, or from the Simpson formation of Ordovician age.

No doubt much of the oil, and possibly most of it originated in the Pennsylvanian shales and limestones and the Caney shale of Mississippian age where present. These shales are dark and appear organic which, with the presence of limestone, indicates plenty of organic life at the time of deposition for the formation of a considerable quantity of oil and gas.

The Simpson formation may have been a very important source of oil in the Hewitt and Healdton fields. This formation is known to carry oil in the Healdton field as there are two wells producing oil from sands of Simpson age at a depth of about 2,700 to 2,775 feet. The Simpson formation has much asphalt and other evidences of oil at its outcrop in the Arbuckle Mountains. This formation seems to have carried oil in great quantities and may have given up large amounts to the overlying Pennsylvanian sands thru faults, fissures and unconformable contact with the Pennsylvanian sands.

The regional movements which occurred in Pre-Pennsylvanian times before the deposition of the Pennsylvanian caused very extensive folding and faulting. These movements were followed by erosion over a long period which exposed the earlier rocks along the crests of the anticlines. The Pennsylvanian was then deposited upon these eroded upturned edges of older rocks and no doubt in direct contact with the Simpson and other oil forming formations. This made conditions ideal for the migration of oil from the older eroded beds into the overlying Pennsylvanian reservoirs from which the oil is now produced. This migration took place across the unconformity from the older oil bearing formations and also thru the faults which no doubt existed.

Oil Sands.

In addition to the main Hewitt sand which has produced most of the oil to date there are other oil and gas bearing sands. These sands will be discussed in order from the top down.

Shallow Gas Sand.—The shallow gas sand has produced considerable gas from wells drilled to it. This shallow sand is found on top of the structure at depths varying from 250 to 400 feet and lies about 1,000 to 1,050 feet above the Hewitt sand. These shallow wells produce from 100,000 to 3,000,000 cubic feet of gas per day. This gas was of considerable importance on account of the shortage of gas in the field and was used for operating purposes. Many of the gas wells in this shallow gas sand were short-lived and soon became exhausted. The sand varies considerably in thickness but has an average thickness of about 20 feet. Further down on the flanks of the structure this sand either produced water or was cut off entirely by the unconformity between the Permian and Pennsylvanian.

The 600 to 700 Foot Gas Sand.—A second shallow gas sand has been found 600 to 700 feet, which has produced some good gas wells. The wells which produce gas from this sand have an initial production from 3,000,000 to 10,000,000 cubic feet of gas per day. For the most part the wells in which this gas is encountered are bradenheaded and

the gas produced between the ten and twelve inch casing. The gas is then used for operating purposes while the well was then drilled to the oil sand. This sand is lenticular in character and varies considerably in thickness. The depth at which this sand is found varies with the position of the well on the structure and with the elevation of the well. If the well is on top of the structure the sand is found at a much shallower depth than when located off the top of the structure. The sand lies almost uniformly 625 to 650 feet above the Hewitt Sand Zone.

Stray Oil Sands.—There are several stray oil sands found above the Hewitt sand and below the 600 foot gas sand. These sands vary from 70 to 300 feet above the Hewitt sands. These sands are not regular and are of but small extent. Wells drilled to these stray sands vary greatly in initial production, and do not hold up in the amount of oil produced for very long. The initial production of wells drilled to these sands is from 25 to 200 barrels per day.

Hewitt Sand Zone.—The Hewitt Sand Zone includes a zone 600 to 700 feet in thickness made up of oil bearing sands, shales, sandy shales and dry sands but no water sands occur in this zone.

The first or main sand in the Hewitt Sand Zone has been the main producing sand in the Hewitt field. This sand is surprisingly continuous and is the datum used in making the subsurface structure map of this area. This first or main sand was the principal producing sand until November, 1920, when deeper drilling showed that some of the deeper sands were of more importance. This main sand is found in wells on top of the structure as shallow as 1,200 feet in the north central part of section 22-4S-2W and as deep as 2,100 to 2,300 feet along the north line of section 27-4S-2W. This sand dips at the rate of 1,200 feet to the mile to the west and 1,000 feet per mile toward the south.

The Hewitt Sand Zone is capped by a blue shale interval of about 400 feet with hardly a break. This shale separates the oil sands and the higher water bearing sands and also prevents the migration upward of the oil thus leaving the sands of the Hewitt Zone barren of oil.

The sands of the Hewitt Zone are soft, porous, and usually white and gray in color. The sand varies in porosity and size of grains. This variation in porosity and in the size of grains accounts for the difference in production of the various wells. The heaviest production comes from wells where the sand is fine grained and loose. The lighter production comes from sands with coarser grains and more firmly cemented but still comparatively soft.

Deeper sands in the Hewitt Sand Zone have been found to be of considerable importance. The intervals to these deeper sands are not constant due to the lenticular character of the sands. A few sands of importance have been found which persist with fair regularity in most parts of the field.

A second sand of importance about 75 to 100 feet below the main or top sand has been found in most parts of the field. In all cases this sand, when drilled into, increases the production of the wells. Occasionally in some parts of the field this sand is more prolific than the main sand. This sand when wells are deepened to it increases the production 20 to 100 barrels per day.

The next sand of any importance and regularity lies about 150 to 200 feet below the top or main sand of the Hewitt Sand Zone. This third sand in nearly all cases increases the production of wells when penetrated. This increase in production is from 25 to 200 barrels per day.

A fourth sand occurs about 275 to 325 feet below the top or main sand, which also increases production considerably in the wells which have penetrated it. This sand probably increases production around 100 to 200 barrels per day.

Another sand is found at about 400 feet below the top sand which increases production about 200 to 300 barrels. This sand may be called the fifth oil sand of the Hewitt Sand Zone.

The sixth oil sand probably will prove to be one of the most prolific sands of the zone and is found at about 600 to 650 feet below the top sand of the Hewitt Sand Zone. This sand has produced as much as 400 barrels per day in some of the few wells drilled to it.

The deepest producing sand stratigraphically in the Hewitt field is the seventh sand of the Hewitt Sand Zone and is found about 700 feet below the top or main sand. This sand will probably increase the production in the wells which have penetrated it 100 to 200 barrels.

Further exploiting of the sixth and seventh sands may prove them to be the most prolific sands of the Hewitt field.

There is no data available with which to predict whether there are deeper sands in the Hewitt field than this seventh sand. If there are deeper sands we are not able to predict whether they will carry oil or water.

No sands in the Hewitt Sand Zone have been found which carry water in the field and this factor will make it easy to produce from all sands without endangering the upper sands by permitting water to enter the sands. It will be a very easy matter to deepen the wells and produce from two or more sands in the same well.

Water Conditions in the Hewitt Field.

There are three sources of water with which the oil man has to contend, namely: (1) upper water, (2) edge water or water in the base of the sand and, (3) bottom water or water in a separate sand below the oil sand.

To date the first or upper water is the only source of water with which the Hewitt operator will have to deal. This upper water is easily taken care of by casing off the water before the oil sand is penetrated.

At the present writing there are only three or four wells in the Hewitt field making water along with the oil and these are known to be due to casing leak, that is, the casing failed to shut off the water or a leak has developed in the casing from some cause and permitted this upper water to enter the well.

Eventually edge water will make its appearance in the field and will have to be taken care of. This will first make its appearance in the wells along the edge of the field and migrate in on the field as the sands are drained of their oil.

Bottom water may make its appearance as deeper drilling continues and then will have to be shut off by one of the various methods of plugging or shutting off bottom water commonly used in the oil fields. The methods used in plugging and shutting off water will not be discussed in this article.

Oil Production.

There are about 550 wells producing in the Hewitt field with an average daily production of 45,000 barrels of oil. The average daily production per well in the Hewitt field is about 80 barrels. This average exceeds the average per well of any other field in the state. No doubt the average daily production of the wells could be greatly increased by the deepening of a great many of the wells in the field. The wells range in initial production from 50 to 2,000 barrels per day.