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STRUCTURE AND OIL AND GAS RESOURCES OF THE OSAGE RESERVATION, OKLAHOMA

T. 27 N., R. 9 E.

BY

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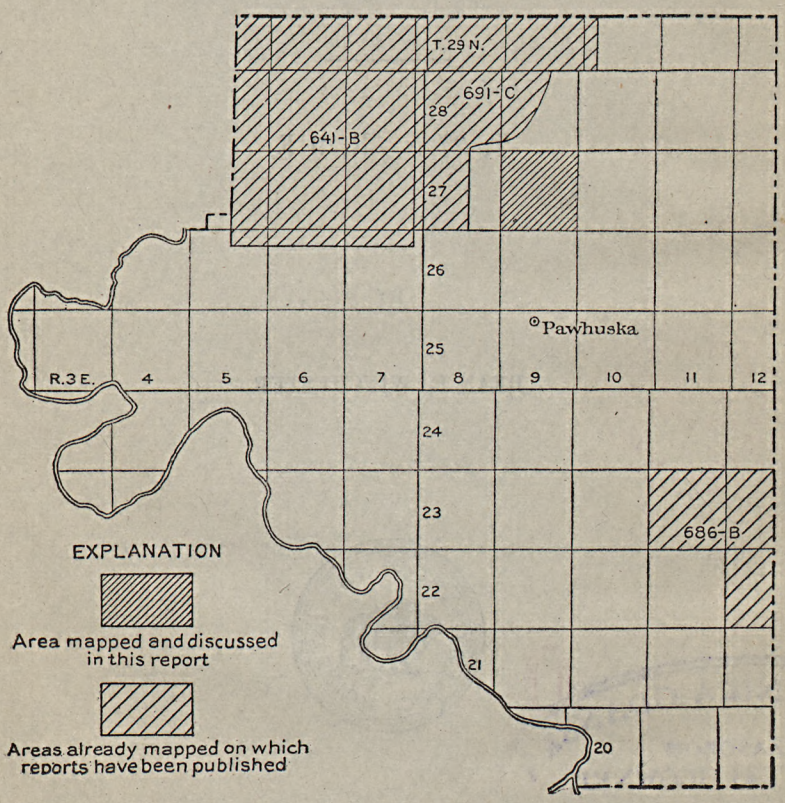


FIGURE 1c.—Key map of Osage Reservation showing areas discussed in this and previous bulletins of the United States Geological Survey.

T. 27 N., R. 9 E.

By Dean E. Winchester.

STRATIGRAPHY.

The rocks exposed in T. 27 N., R. 9 E. (see fig. 1), consist of limestone, sandstone, and shale of Pennsylvanian age (see columnar section, fig. 3). The oldest beds crop out along the eastern edge of the township and comprise red, gray, and yellow shales, thin sandstones, and a single persistent bed of limestone that is correlated with the middle bed of the Oread limestone of the Kansas section. Above this shale series is the Elgin sandstone, consisting of about 175 feet of irregularly bedded sandstones with a few lenses of shale and limestone. The sandstone series crops out along the valleys of Sand, Mud, and Cedar creeks and gives rise to rough, timber-covered areas. Distinctive or persistent beds which may be used as marker beds in mapping the geologic structure are lacking in most of the area. About 125 feet of limestone, shale, and thin sandstones, constituting a series of beds known as the Pawhuska limestone, occur above the Elgin sandstone. The Pawhuska is terminated at the top with two thin beds of "red lime." Limestone and shale give rise to untimbered prairie land, so that the key beds in this series can be easily followed. In the extreme northwest corner of the township are about 100 feet of massive sandstone, shale, and some limestone, which constitute the highest beds exposed in the area.

Key beds that are useful in determining the geologic structure are abundant in the western part of the area but much less so in the middle and eastern parts. The outcrops of three are shown on the accompanying map (Pl. IV). The middle bed of the Oread limestone crops out near the east edge of this township and is very well exposed west of the Pawhuska-Elgin wagon road in the NE. ¼ sec. 36. This limestone weathers as a grayish-white rock, which contains many *Fusulina* and other easily recognizable fossils and in this part of Osage County is about 2 feet thick. In many places the presence of the bed at the outcrop is indicated only by very small fragments of yellowish-white clayey lime or perhaps by a few of its characteristic fossils. The next higher key bed of importance is here named the Plummer limestone member (of the Pawhuska

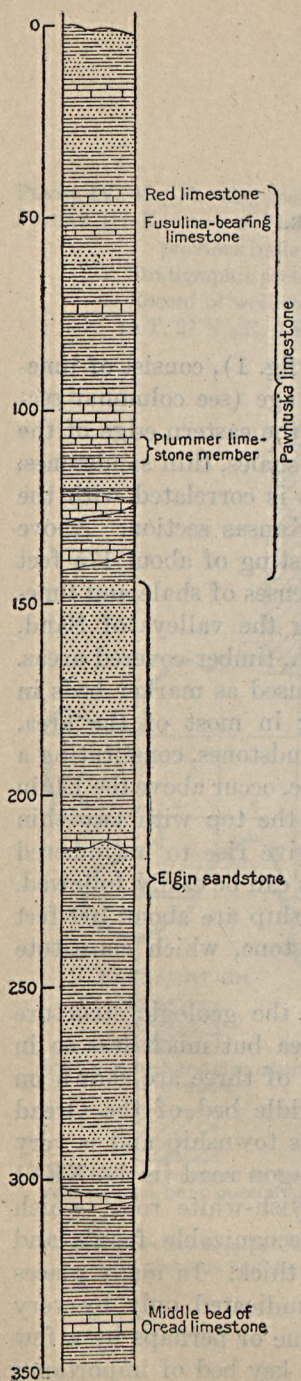


FIGURE 3.—Stratigraphic section showing rocks exposed in T. 27 N., R. 9 E.

limestone) because of its exposures near the house on the Plummer ranch, in T. 26 N., R. 9 E. This limestone is also present on the Myers gas dome, which is just southwest of T. 27 N., near Myers station on the Midland Valley Railway. The Plummer limestone consists of black flinty, angular limestone which is only locally fossiliferous, separated into two benches by 6 to 8 feet of shale. The outcrop of the upper bench of the Plummer limestone, beneath the gray ledge-making limestone of the Pawhuska formation, is usually marked by long, square-edged blocks, only one edge of which is exposed. The lower bench of this black limestone is of much less value as a key bed, and its outcrop is not shown on the accompanying map (Pl. IV). The limestone is well exposed in this township along the road on the south side of Sand Creek in sec. 30. About 15 to 20 feet below the top of the Plummer limestone there is a very persistent sandstone bed about 2 feet thick, which, because of its peculiar ragged manner of weathering, was called the "ragged sandstone" in the field. This is the only resistant sandstone bed in the series and is therefore easily identified, but because of its nearness to the outcrop of the Plummer limestone, its outcrop is not shown on the map. Two thin beds of reddish-gray hard, brittle limestone at the top of the Pawhuska limestone were followed in the field, and the outcrop of the lower of these is shown on Plate IV. At 9 feet below the lower of these red limestones is a very thin bed of limestone so full of *Fusulina* that it resembles a bed of dirty rice. This bed is of great value in correlation, even though it is not everywhere exposed. Good exposures of all these limestone beds are to be found near the southwest corner of sec. 6.

The log of a well drilled in sec. 8 of this township is shown in figure 4 and gives an idea of the character of the rocks which occur between the surface and a depth of 2,300 feet.

In drilling in this township sands that may yield oil should be found in at least four zones, namely:

1. A zone about 1,400 feet above the Fort Scott ("Oswego") limestone, as indicated by the show of oil in wells of the Myers gas field and in the well in sec. 8.

2. The Fort Scott ("Oswego") limestone.

3. The Cherokee shale, including a sand supposed to be the Bartlesville sand. Records of deep tests in this part of the county indicate that the sands of this zone are thin or possibly missing.

4. Sands in the upper 300 feet of the "Mississippi lime." The oil produced in the vicinity of Pawhuska, south of this area, comes from this zone.

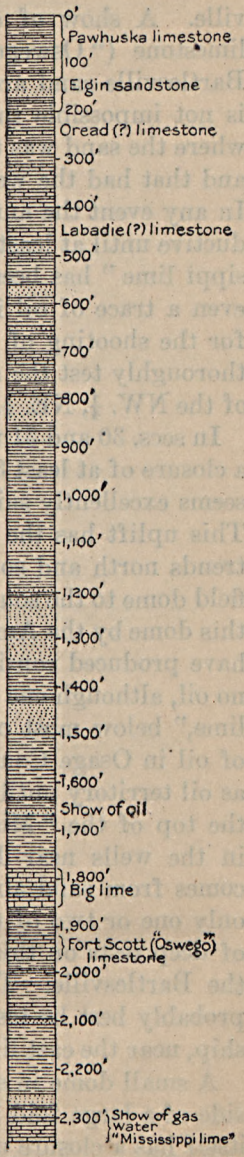


FIGURE 4.—Record of well showing stratigraphic conditions below the surface in T. 27 N., R. 9 E.

STRUCTURE.

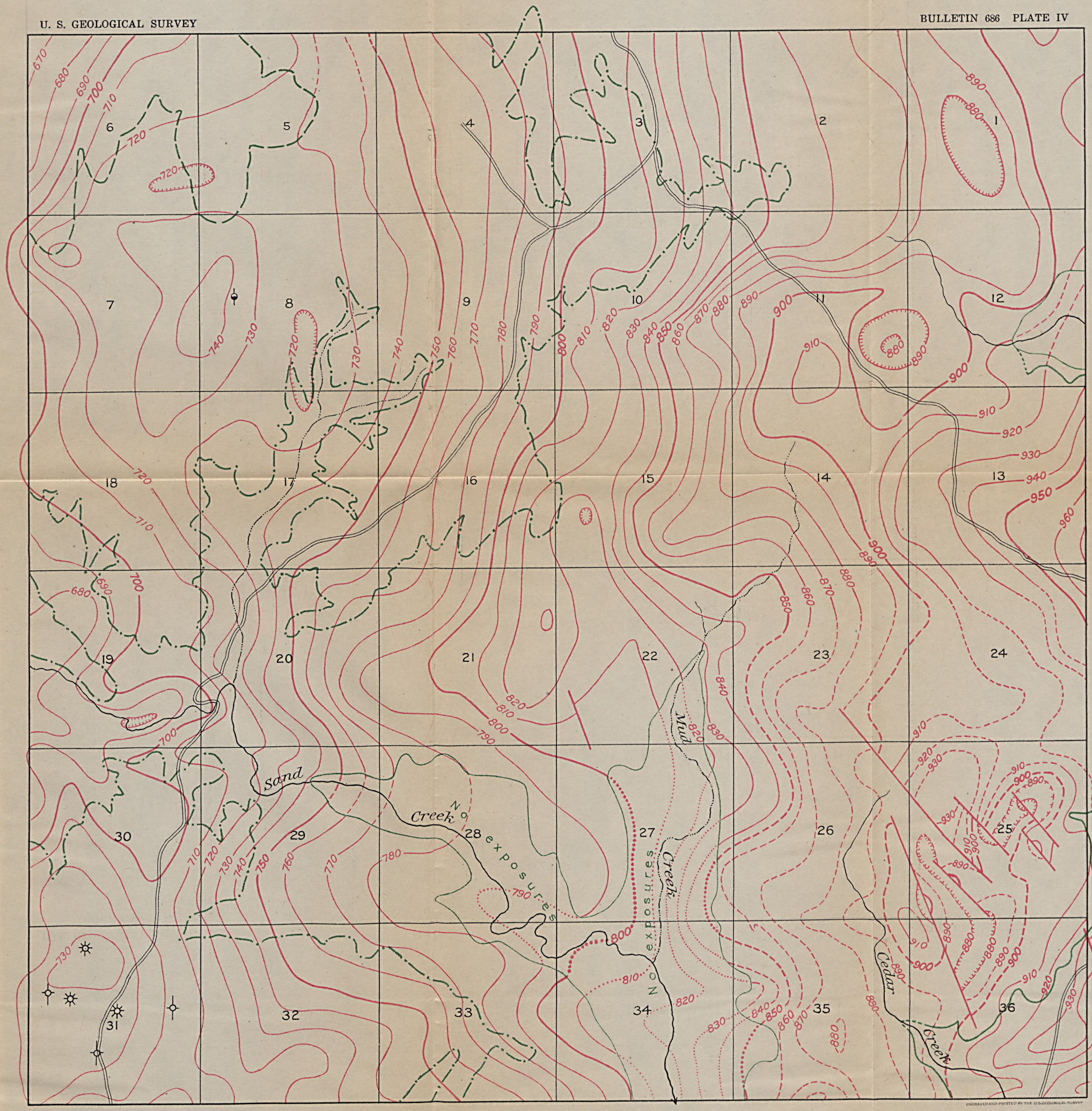
The surface structure shown by 10-foot contours on the accompanying map (Pl. IV) was determined by carefully following key beds and accurately determining elevations at short intervals along their outcrops. The contours represent the structure as indicated by the surface beds but are drawn on an imaginary bed which is about 300 feet below the middle bed of the Oread limestone. The rocks over a large part of this township dip gently westward and are not faulted except in the southeastern part, where the beds are badly crumpled and broken. There are, however, several upwarped structural features, as will be noted by reference to the map. These are described in detail below.

Parts of secs. 7, 8, 17, and 18 are included in an irregular-shaped anticlinal fold which has a southeasterly dip of a little more than 20 feet and a closed area of more than a section. This fold is quite large enough to influence the accumulation of oil and is worthy of complete tests. One well drilled near the top of the anticline by the American

Pipe Line Co., which holds the gas lease over this area, did not get oil or gas in paying quantity, although in the log of this well 15 feet of sand is recorded at the general horizon of the Bartlesville. A show of oil is reported in sands above the Fort Scott limestone ("Oswego lime"), but the sands at the horizon of the Bartlesville sand are reported to be dry, both of oil and water. It is not impossible that this well penetrated the oil sand at a point where the sand was too tight to yield its oil, even if it contained any, and that had the well been shot some oil might have been obtained. In any event the anticline should not be definitely classed as unproductive until at least one other well has been drilled and the "Mississippi lime" has been penetrated at least 300 feet. The presence of even a trace of oil in any sand should be sufficient evidence to call for the shooting of the sand in order to prove its possibilities. To thoroughly test the anticline wells should be drilled near the centers of the NW. ¼, NE. ¼, and SE. ¼ sec. 7.

In secs. 30 and 31 there is an area showing anticlinal structure with a closure of at least 30 feet and a closed area of about a section which seems excellently suited to bring about the formation of an oil pool. This uplift has the shape of an elongated dome whose longer axis trends north and south and which is separated from the Myers gas field dome to the south by only a low saddle. Several wells drilled on this dome by the American Pipe Line Co., the holder of the gas lease, have produced considerable gas, but the records of these wells show no oil, although one or more of them were drilled to the "Mississippi lime," below most of the sands which have been found productive of oil in Osage County. The area should not be finally condemned as oil territory until at least one well has penetrated the sands below the top of the "Mississippi lime," which are the source of the oil in the wells near Pawhuska. The gas obtained from this dome comes from sand above the Fort Scott ("Oswego") limestone, and only one or two of the wells have been drilled deeper. The records of deep tests on this dome show little or no sand at the horizon of the Bartlesville. The oil-producing possibilities of the dome can probably best be tested by drilling on its flanks west of this township, near the east line of sec. 36, T. 27 N., R. 8 E.

A small dome in secs. 11 and 14 is part of a long nose on the west side of a large fold in the township to the east. Although the dome itself has a closure of only a single contour its value is considerably greater than this would indicate, because of the fact that it is part of the larger fold. This dome should act as an accumulating ground for petroleum, as there is a very large area to the west and northwest from which the oil might be derived. It would appear that the W. ½ sec. 11 and the N. ½ sec. 14 are worthy of complete tests.



EXPLANATION

- Boundary of alluvium
- Red limestone at top of Pawhuska limestone
- Upper bed of Plummer limestone
- Middle bed of Oread limestone
- Faults
- Structure contours, interval 10 feet
- Abandoned well with show of oil
- Gas well
- Abandoned dry hole

MAP SHOWING GEOLOGIC STRUCTURE OF T. 27 N., R. 9 E.

Scale 1/31,250

1 ½ 0 1 Mile

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A small anticline, whose high point is near the center of the east line of sec. 21, shows but a single closing contour, but a long nose projecting to the west from a point near its south end adds considerable value to it and justifies its thorough testing. Wells drilled in the NW. ¼, near the northwest corner of the SE. ¼, and along the north line of the SW. ¼ will prove the value of this anticline as a source of oil.

Owing to the generally disturbed condition of the rocks in the southeastern part of the township this area is recommended as a probable source of oil. There is evidence of general anticlinal structure near the west line of sec. 25, and this locality is probably worthy of testing. Evidence seems to indicate that wells near the northwest corners of secs. 25 and 36 will test the area best. The faults shown on the map seem likely to prove a barrier and prevent the migration of oil to the small elongated anticline near the east line of sec. 36.

Areas of synclinal or monoclinal structure are considered generally unfavorable for oil accumulation, especially in the Mid-Continent field, but underground features, such as the presence of lenticular sands, may provide suitable conditions for the formation of an oil pool. Such pools can be located only by pure wildcat drilling.

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