THE POSSIBILITY OF OIL AND GAS FROM DEEPER DRILLING
IN WESTERN PENNSYLVANIA.

By

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Introduction. Many people are asking nowadays whether additional supplies of oil and gas may be found by drilling deeper, the hope being to strike some oil or gas sand below those already drilled in any area, thus opening up new reservoirs, as was done at McKeesport. Interest has centered particularly in the possibility of finding the Speechley sand south and west of McKeesport, or of finding the Clinton sand that has produced gas so abundantly in central Ohio.

In order to test these lower beds a number of deep drill holes have been sunk in Pennsylvania and West Virginia during recent years. None of these holes have as yet reached the Medina sandstone outside of an area in the northwest corner of Pennsylvania and in northeastern and central Ohio. The Oriskany sandstone has been pierced in at least two wells in Pennsylvania.

This paper has been prepared in answer to the general question as to the possibility of getting oil or gas from the deeper sands. The deep sands that will be discussed here are the Speechley, which is about 3,200 feet below the Pittsburgh coal in the Pittsburgh district; the Oriskany which is about 3,000 feet below the Speechley; and a sand called in Ohio the Clinton and now generally considered to be part of the Medina of New York and the same as the Tuscarora sandstone which outcrops in central Pennsylvania east of the Allegheny Front.

Speechley sand. The possibility of the Speechley and other deep sands carrying gas in Washington, Greene, Beaver and other counties on the western border of Pennsylvania has recently been asked. It has long been known that not only do all of the beds, including those
containing oil and gas, become thinner toward the west, but that most of the oil and gas "sands" of the Pittsburgh and Allegheny River region become finer grained at the west and either disappear as sandstones or become too fine grained to produce flowing wells. In eastern Ohio nearly all the oil and gas comes from one sandstone, there called the Berea, and correlated with the First or Murrysville sand of the Allegheny River and Pittsburgh region. Deep drillings below the Berea sand in eastern Ohio find only shale for a thousand feet or more, indicating the entire absence of the oil and gas sands below the Murrysville.

Not enough drilling has yet been done in Beaver, Washington, and Greene counties to indicate just where the Speechley and other lower beds run out and whether they are absent under all of those counties. However, a number of wells have reached a position below the horizon of the Speechley sand in Washington and Greene counties and western Allegheny county, and all agree that at those points the Speechley and other lower sands have thinned out or are too thin to be reservoirs for oil or gas.

This drilling of course proves only that the Speechley is absent at the points drilled. Yet the facts known regarding the general thinning of nearly all of the rocks toward the west, and especially of the sandstones, taken in connection with the results of the drillings mentioned, do not hold out large hope of production from wells sunk to the Speechley in Greene, Washington, western Allegheny and Beaver counties.

On the other hand the possibility of finding large volumes of gas in the Speechley sand northeast of McKeensport invites drilling. Many holes have been put down to the Speechley in that large region but many areas have not been drilled that deep; and considering the variable character of the Speechley both in thickness and grain it remains true that no area can be wholly condemned until fully tested with the drill.

Oriskany sand. The Oriskany sandstone has been pierced in at least two wells in Pennsylvania and in one of them has proved to be gas bearing. One well is in the McDonald field; Washington County, where the Oriskany was encountered at 6100 feet, and the other at McCance near Ligonier, Westmoreland County, where the sand was found at 6800 feet. This sandstone is a prominent ridge maker in the Appalachian Valley region of central Pennsylvania and would seem to be a hopeful horizon for the occurrence of oil and gas.

Medina or Clinton sand. The Clinton sand which furnished a supply of gas at Cleveland, Ohio, many times larger than that from the McKeensport pool, underlies all of western Pennsylvania and outcrops in the steep ridges of the Appalachian Valley region where it is known as the Tuscarora or Medina sandstone. It will be called Medina in this discussion.

It would appear that none of the deep wells yet drilled in the oil and gas fields of Pennsylvania, have reached the Medina sandstone which under another name has proved in Ohio so rich a gas producer and, on a smaller scale, an oil producer. In general, it may be
estimated that this sandstone lies about 9000 feet below the Pittsburgh coal in the Pittsburgh region, increasing to nearly 11,000 feet in the Chestnut Ridge area, and to 13,600 feet at the Allegheny Front. Whether that sandstone would be found gas bearing or oil bearing in Pennsylvania cannot be told without an actual test by the drill. Considering the extreme difficulties of drilling at depths of over 7000 feet, it is likely to be some time before the Medina sandstone is tested.

**Depth to Oriskany and Medina sands.** In determining the depth to these sands at any point, it must be remembered that all of the formations involved thin rapidly from the Allegheny Front westward. If the sandstone 3200 feet below the Pittsburgh coal at Lancaster, Ohio, is the same one that is 15,600 feet stratigraphically below this coal near Altoona, the decrease in distance between these beds from Altoona to Lancaster is 10,400 feet. As the distance in an air line between these cities is about 212 miles, the formations thin westward at a rate of approximately 49 feet per mile. On the assumption that the rate is regular it is possible to estimate the depth of the Medina sandstone below the Pittsburgh coal at any point between these cities.

At Lancaster, Ohio, the Medina or "Clinton" sand is estimated to be about 3200 feet, stratigraphically, below the Pittsburgh coal. At Junction City, Ohio, 3800 feet, at McConnelsville, Ohio, at least 550 feet lower. In the McDonald field west of Pittsburgh the Oriskany sandstone was encountered at 6100 feet and the Medina is estimated to lie 2200 feet below the Pittsburgh bed. At the McCance well near Ligonier the Oriskany sandstone was encountered at 8822 feet; its stratigraphic position at that point is estimated at about 8450 feet below the Pittsburgh, and the Medina sandstone at 10,650 feet. In central Pennsylvania east of the Allegheny Front the Oriskany sandstone is estimated to lie at a little over 11,000 feet below the horizon of the Pittsburgh coal and the Medina sandstone 2600 feet lower.

Coming down now to the depth of these two sandstones at various points, the following information dealing only with southwest Pennsylvania may be of interest.

The Laurel Hill anticline is cut by the Conemaugh River west of Johnstown and by the Youghiogheny between Confluence and Ohiopyle. Conditions at both places are very similar; the rivers cut far below the coal measures so that while the interval between the Pittsburgh coal and the Oriskany sand is about 9100 feet and between the Pittsburgh coal and the Medina 11,500 feet, the Oriskany sandstone lies only about 6200 feet below the level of the two rivers, and the Medina 8600 feet. Account must be taken of the fact that no oil and but little gas has as yet been found so far to the east of the main field.

The next principal anticline is the Chestnut Ridge which crosses the Youghiogheny, Loyalhanna, and Conemaugh rivers and Black Lick Creek. In general the Oriskany lies about 8400 feet below the Pittsburgh coal along Chestnut Ridge and the Medina some 2200 feet deeper.
Where these streams cut the ridge the rocks are exposed to a considerable depth below the Pittsburgh bed. Subtracting this depth gives the depth of the sandstones below the river bottoms. The Oriskany sandstone is 6200 feet below Youghiogheny River and the Medina 8500 feet. Where the Loyalhanna cuts the ridge just west of Ligonier it is 6822 feet by actual measurement to the Oriskany which is at that point gas bearing, and the Medina is estimated at 2200 feet deeper. Where this anticline is cut by Conemaugh River it may be roughly estimated that the Oriskany sandstone will be met at about 7200 feet and the Medina at about 9400 feet.

The next anticlines to the west are the Fayette in Westmoreland and Fayette counties and the Grapeville in northern Westmoreland and Indiana counties. The Fayette anticline is cut by the Youghiogheny River, Jacobs Creek, and Sewickley Creek. The Oriskany is estimated to lie about 6650 feet below the Youghiogheny River, 6750 below Jacobs Creek, and 6850 below Sewickley Creek at Youngwood. The Medina sandstone should be looked for within 2000 feet below the Oriskany. The Grapeville anticline is cut by Conemaugh River and it is estimated the Oriskany should lie not more than 6850 feet and the Medina at not over 8850 feet below the river.

The next major anticline is the Murrysville which crosses the Monongahela, Youghiogheny, and Kiskiminnitas rivers. Where this anticline is cut by Kiskiminnitas River between Apollo and Saline, it is estimated as not over 6,050 feet to the Oriskany and not over 8,000 feet to the Medina. At McKeesport on Youghiogheny River it is estimated that the Oriskany is about 6,650 feet below the river and the Medina 8,600 feet. Where cut by Monongahela River the depth would be about 200 feet greater because of the dip between the crossing of the two rivers.

Exact information is not yet available in the northern and northwestern parts of Pennsylvania. Attention may be called to three general facts. First: the Oriskany appears to thin out before reaching Erie County. Probably therefore it is thin in most of northwestern Pennsylvania and should not be counted on as a large producer in that part of the State. Second: the general rise of the strata combined with their general thinning toward the northwest brings the Medina sandstone nearer the surface, so that it is only 2,500 feet deep at Erie. Account must, however, be taken of its dip and of the varying elevation of the land. At Erie this sandstone is about 1,800 feet below sea level, while at Pittsburgh it is about 8,100 feet below sea level. Assuming a fairly uniform dip between Pittsburgh and Erie, it may be estimated that the depth of the Medina below sea level is about 6,000 feet at Butler, somewhat over 4,000 feet at Franklin, and about 3,500 feet at Meadville. To these depths must be added the elevation above sea level of the place where drilling is done. Third: the lack of pronounced anticlinal folds in the northwestern part of Pennsylvania may prevent the large accumulation of gas at any one spot, and makes it difficult or impossible to select definite points as favorable localities for drilling.

Conclusion. A general review of the subject indicates: First, that there are two sands, the Medina and the Oriskany, underlying
most of the oil and gas fields of Pennsylvania and probably of a considerable adjoining area in Ohio and West Virginia. Second, the upper of these sands is within practical drilling distance at a number of points in western Pennsylvania and is a possible source of gas if drilled on the anticlines. Third, that because of the great depth of these sands few wells will reach them. If gas is found, the wells, because of their small number, should be very long lived. These sands therefore seem to offer a good gambling chance for gas companies strong enough to afford the risk of failure. The lower of the two sands, the Medina, which has yielded large volumes of gas along its western extension, might be supposed to contain either oil or gas under western Pennsylvania but it lies so deep that it has not as yet been reached by the drill. That it is beyond reach no one believes who has watched the gradual increase in the depth of the holes, but whether the volume of gas that might be obtained would be sufficient to pay interest on the cost of such excessively deep drilling may well be questioned.