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GAS IN THE ORISKANY SAND
OF
POTTER COUNTY, PENNSYLVANIA

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Gas was discovered in the Oriskany sand on the Hebron anticline, Hebron Township, Potter County, November 10, 1931. The initial well, Booth No. 1, came in wild and after being controlled was rated at 8 to 9 million cubic feet a day under 2135 pounds rock pressure. June 24, 1932, Nugent No. 1 well, 1500 feet east of Booth No. 1, was brought in, good for about 16 million cubic feet with rock pressure of 2160 pounds. On July 1 four other wells are drilling on this structure and several additional locations are active. That a sizable field will be developed here seems to be assured.

Historical resume. The attempt to develop an Oriskany field on this anticline was prompted by the discovery of gas in the Oriskany sand on the Sabinsville anticline in Farmington Township, Tioga County, 40 miles east. That field, discovered in September 1930, now has about 30 wells with an aggregate potential production of about 500 million cubic feet a day. The field has been discussed by the Pennsylvania Geological Survey in Bulletins 102-A and 102-B.

Shallow gas on the Hebron anticline*. Gas has been produced from shallow sands on the Hebron anticline for many years, but the Oriskany sand had never before been tested. The shallow gas field is known as the Roulette field and is made up of several pools located on the north flank and the southwest plunge of the structure. On the north production extends well out into the Oswayo syncline, but the south flank has yielded only a few small wells, and the axis has been productive only on the southwest plunge.

Production is from the Bradford, Richburg, and Chipmunk sands, and wells are 1800 to 2000 feet deep. The best wells started at 1 to $1\frac{1}{2}$ million cubic feet, but the average well settled rapidly to about 200,000 cubic feet. The gas is wet and has a B. t. u. value of 1150 to 1175. Rock pressure varies in the several pools, ranging up to 300 pounds. This shallow production was discovered about 1905 and the field was drilled up about 1910 although some wells have been drilled as recently as 1928. The field is operated by the Allegheny Gas Company.

THE HEBRON FIELD

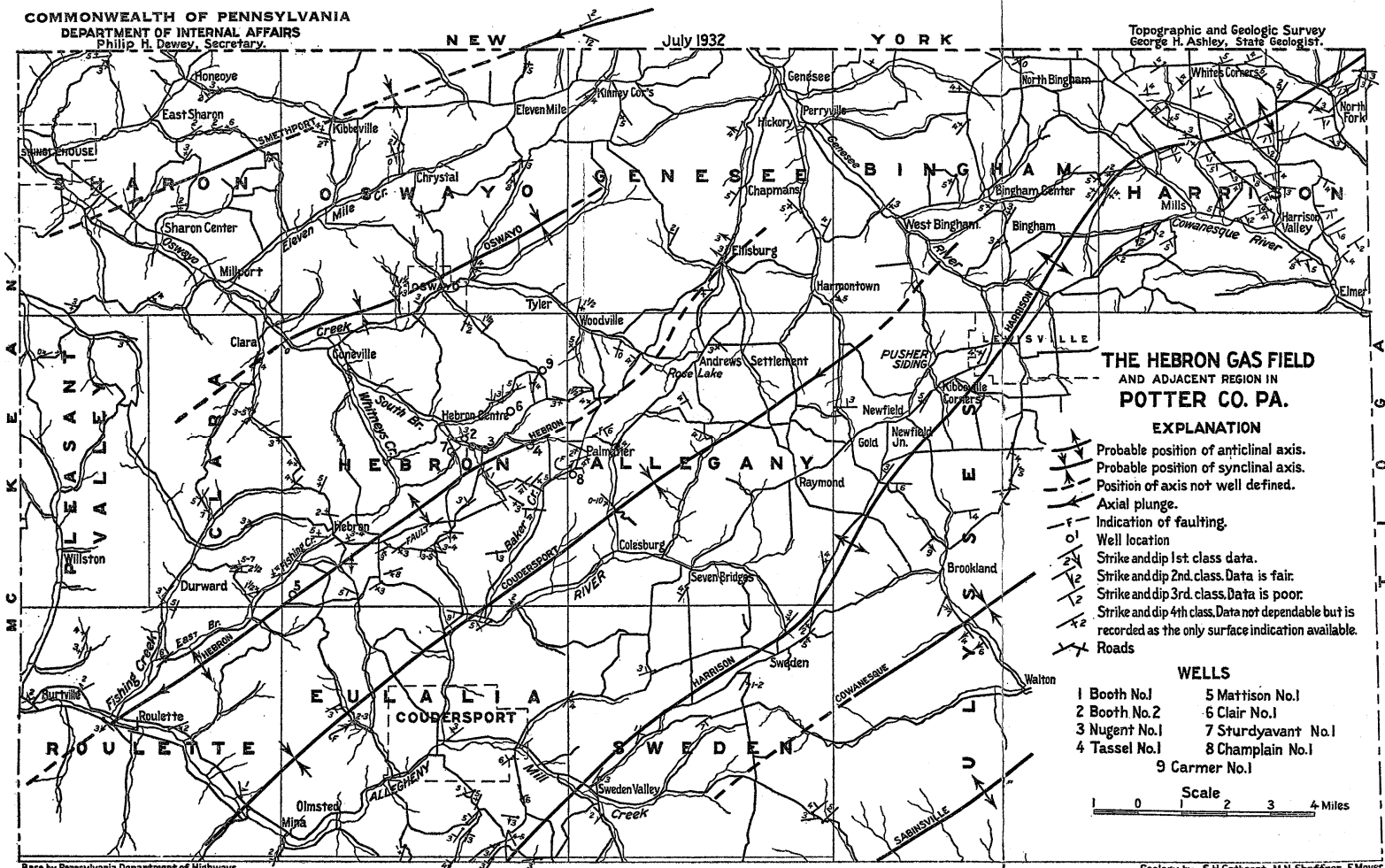
The Hebron anticline and its relation to other anticlinal and synclinal axes in northern Potter County is shown on the map attached to this report. Pertinent data relating to wells drilled to or having the Oriskany sand as their objective are given on another page, and all well locations are indicated by number on the map.

The country rock. Throughout most of the prospective area of the field the country rock is the Catskill red beds. Chemung rocks are exposed near the axis of the anticline in the following stream valleys: Allegheny River for about 1 mile east and west of Roulette; East Branch of Fishing Creek to near Hebron; South Branch of Whitney Creek southeast of Hebron Center.

Pocono rocks cap the hills in the Oswayo basin and Pocono with small patches of younger rocks cap the hills in the Coudersport basin.

Structure. The Hebron structure is a distinct dome on the Hebron anticline. Surface structural data are not adequate to permit an accurate graphic picture of the dome but by observing strikes and dips the position of the axis can be defined with fair assurance, and by observing the elevation of the base of the Catskill red beds on Allegheny River, Fishing Creek, and South Branch of Whitney Creek

* Courtesy of the Allegheny Gas Company



**THE HEBRON GAS FIELD
AND ADJACENT REGION IN
POTTER CO. PA.**

EXPLANATION

- Probable position of anticlinal axis.
- Probable position of synclinal axis.
- Position of axis not well defined.
- Axial plunge.
- Indication of faulting.
- Well location
- Strike and dip 1st class data.
- Strike and dip 2nd class. Data is fair.
- Strike and dip 3rd class. Data is poor.
- Strike and dip 4th class. Data not dependable but is recorded as the only surface indication available.
- Roads

WELLS

- | | |
|---------------|-------------------|
| 1 Booth No.1 | 5 Mattison No.1 |
| 2 Booth No.2 | 6 Clair No.1 |
| 3 Nugent No.1 | 7 Sturdyvant No.1 |
| 4 Tassel No.1 | 8 Champlain No.1 |
| 9 Garner No.1 | |

Scale

1 0 1 2 3 4 Miles

STATUS OF ORISKANY WELLS IN POTTER COUNTY, PENNSYLVANIA - JULY 1, 1932

No. on map	Name of well	Owned by	Town- ship	Elev. of well	Elev. top Orsky.	Total depth	Anti- cline	Status	Results
1	Booth #1	Hungiville et al.	Hebron	1847	-3076	4924	Hebron	Producing to Allegheny Gas Co. line	9,000,000 cu.ft. 2135 lbs. r.p.
2	Booth #2	" " "	"				"	Drilling 100 feet	
3	Nugent #1	Williamsport Nat. Gas Co.	"	1869	-3008	4888	"	Shut in	16,000,000 cu.ft. 2160 lbs. r.p.
4	Tassel #1	Schrach et al.	"	2034			"	Drilling 4700 ft.	
5	Mattison #1	Potter Dev. Co.	"	2180			"	Drilling 2850 ft.	
6	Clair #1	Rogers et al.	"	2190			"	Rigging up	
7	Sturdyavant #1	Lycoming N.G.Corp.	"				"	Location	
8	Champlain #1	Reed et al.	Allegheny	2158			"	Shut down 2800/ feet	
9	Garmer #1	Potter Dev. Co.	Hebron				"	Location	
*	Emporium Lumber Co. #1	East Penn Dev. Co.	East Fork District	1934			Marshfield	Fishing 5677 feet	

* About 14 miles S.20°E. of Coudersport. See regional structure map, Bulletin 102-A.

Information by courtesy of operators in this field, especially The Allegheny Gas Company.

where those streams cut into the Chemung at the axis it is possible to get some idea of the axial profile.

The axis as shown on the map trends northeast from Roulette and maintains a regular course to near the east line of Hebron Township where it becomes sinuous and apparently dies out in the vicinity of Ellisburg. Northeast of Ellisburg data are few and poor. General indications, however, suggest a northwest dipping monocline in northern Bingham Township; certainly if present at all the anticline is too weak to make its presence felt. The anticline continues southwest of Roulette into McKean County.

The elevation of the base of the Catskill red beds at Roulette (here obtained by graphic reconstruction) is about 1600 feet, south of Hebron 2110 feet, and west of Palmatier 2070 feet. As only red beds are exposed northeast of Palmatier the northeast plunge cannot be determined by this method. The base of the red beds is not a sufficiently well defined or easily determined horizon to be used with great accuracy, but when used throughout a small area it has some value. An axial profile based upon the data available would show (1) a high extending from the vicinity of the Mattison well to the vicinity of the Tassel well, a distance of about 6 miles. (2) Between the Mattison well and Roulette, a distance of 4 miles, the axis plunges about 500 feet. (3) Northeast of the Tassel well the axis would seem to plunge northeast and to lose its identity near Ellisburg. The amount of closure on the northeast has not been determined, but may be less than the 500-foot closure on the southwest.

Like most of the Allegheny Front folds that have been mapped the Hebron shows a steepened south limb. Also, there is fairly good evidence that the south limb is broken. The absence of topographic and detailed geologic maps, and of readily recognized stratigraphic horizons and reliable structural data in this area make it difficult to define accurately the relative steepness of the north and south limbs. It will be noted, however, that the distance from the Hebron axis to the Oswayo axis on the north is about 4 miles and to the Coudersport axis on the south is about $2\frac{1}{2}$ miles. That the Coudersport basin is deeper than the Oswayo basin is certain, but we are not prepared to express the relation in terms of feet. On the above basis the south limb may be something like 2 to 3 times as steep as the north limb. Most of the dips shown on the map represent sandstones in the red beds. These dips so often are questionable that they should not be used quantitatively. For the sake of clarity, however, we may say that if dips are thought of as being of the order of magnitude of 6° on the south and $2\frac{1}{2}^{\circ}$ on the north the impression probably will not be too much in error.

Indication of faulting. The south flank probably is not steepened uniformly. Evidence of faulting was observed at Palmatier and southeast of Hebron. At Palmatier the evidence consists of a belt of steep-dipping to vertical beds that in the farther east exposure is about 20 feet wide. Southeast of Hebron fossiliferous Chemung beds outcrop between Catskill rocks. If the three localities are representative of a fault line then a break exists about half a mile south of and parallel to the axis. Unfortunately no detail of the probable displacement could be worked out.

Other evidence of faulting was Chemung beds at the surface in an otherwise Catskill terrane, observed on the left fork of Dingman Run just west of Coudersport. This is practically on the axis of the Coudersport syncline. Whether there is any connection between this and the other points noted is not known.

To suggest that the structure is faulted on such meager data may appear to be unwarranted, but it is emphasized here because of experience in the Tioga field. There faulting was advocated on meager surface data and, although accepted reluctantly, proved to be a serious consideration. The surface evidence was slight and no details could be worked out, but recognition of its presence and timely ap-

plication of adequate subsurface methods might have saved some dry holes. The fault data observed in the Hebron area are slightly less convincing than those observed in the Tioga field; it does not seem probable that displacement, if any, can be so great here as it proved to be at Tioga. Even so the indications should not be treated lightly by operators proposing to drill the south flank. What we really are concerned with is the ratio - amount of displacement to effective closure. At Tioga the effective closure varies from a minimum of less than 100 to a maximum of less than 300 feet in the several pools. We do not know how many feet of closure will be productive at the Hebron field. In view of the foregoing it would therefore seem advisable to investigate the possibilities of faulting on this south flank by seismograph measurements before exploring it with the drill.

The Catskill-Oriskany interval. Nugent No. 1 well encountered the Oriskany at 4877 feet. The well appears to start about 200 feet below the base of the red beds. We should therefore assume an interval of about 5075 feet between the base of the Catskill and the top of the sand.

The gas sand. Two specimens of Oriskany sandstone blown from Nugent No. 1 well while the well was being drilled in were tested by C. R. Fettke of this Survey, and show 9.1 per cent and 9.6 per cent porosity.

In the Tioga field the porosity ranges from 4.0 per cent to 11.8 per cent and averages 9.1 per cent for 50 samples tested.

Neither of the Booth nor the Nugent well is known to have reached the bottom of the sand. The Nugent well was completed at 12 feet in the sand, at which depth it was reported as drilling in "shale," the report being based upon the smoothness of the bit. If the reported shale is present it may be a parting in the sand and does not necessarily indicate that the sand is only 12 feet thick.

Quality of the gas. The gas is dry, sweet, and has a B. t. u. value of 1020.

Below is quoted the drillers log of the Nugent No. 1 well. A log based upon examination of well cuttings is not available for publication at this time.

Drillers log of Nugent No. 1 Well.

	From	To		From	To
Clay and gravel	0	18	Shale, shells, white	952	1060
Broken lime	18	179	Lime, shells	1060	1200
Sand	179	203	Sand, gray, hard	1200	1238
Lime	203	298	Lime, dark, hard	1238	1390
Shale, pink	298	303	Shale, light, soft	1390	1402
Lime	303	324	Shale and lime	1402	1540
Lime	324	329	Shale, soft, brown	1540	1550
Lime, broken	329	450	Sand, dark, hard	1550	1572
Sand	450	478	Lime, dark	1572	1740
Sand	478	520	Shale, dark, soft	1740	1792
Sand	520	530	Shale, shells, soft	1792	1950
Lime, gray	530	570	Lime, dark, hard	1950	2003
Slate	570	600	Slate and shells	2003	2089
Lime and slate, broken	600	710	Lime hard	2089	2200
Shale and shells	710	765	Slate, shells, soft	2200	2258
Lime, white, hard	765	820	Lime, dark, soft	2258	2300
Slate, white	820	830	Lime and shells	2300	2325
Sand, gray, hard	830	843	Lime, hard	2325	2450
Lime, shells, slate	843	952	Lime and shells, hard	2450	2560

Slate and shells	2560	2612	Shale and shells	4400	4430
Lime and shale	2612	2633	Shale, dark	4430	4628
Slate and shale	2633	3040	Shale, dark	4628	4640
Slate and shale	3040	3100	Shale, dark	4640	4675
Lime, shells	3100	3200	Shale and shells, dark	4675	4685
Slate, shells	3200	3285	Shale, dark	4685	4770
Lime, shells	3285	3300	Shale, black	4770	4860
Shale, gray	3300	4000	Lime, Onondaga	4860	4877
Shale and shells	4000	4025	300,000 cu. ft.)		4877
Shale, black	4025	4250	13,800,000 cu.ft.) Oriskany sand		4884
Tully lime, black, hard	4250	4300	16,800,000 cu.ft.)		4885
Slate, dark	4300	4400			

Pipe lines. The only pipe line in the field is a small line of the Allegheny Gas Company to which the Booth No. 1 well has been delivering gas for some months. It is reported that the New York Natural Gas Corporation, which in March completed a 20-inch line from the Tioga field to Syracuse, N. Y., will extend that line to the Hebron field.

Cost of drilling. Wells equipped for production cost from \$20,000 to \$25,000.

Contract price for drilling is \$3.00 a foot. Four to five hundred feet of 8 $\frac{1}{4}$ -inch water string is set and 7-inch casing is cemented in the Onondaga lime.

Leasing. Most of the land on and near the Hebron structure has been leased. A large percentage of the acreage is held by the following companies:

Potter Development Co. (Allegheny Gas Company)	Williamsport Natural Gas Co.
Lycoming Natural Gas Co. (Standard Oil Co. of New Jersey)	North Branch Development Co. (Pennsylvania Power & Light Co.)
Penn York (Cities Service)	Penn United Gas Co.
R. E. Hungiville	United Carbon Co.

Large sums are reported to have been spent in acquiring favored acreage. The usual royalty offered was 1/8 or 1 $\frac{1}{2}$ cents a thousand. Bonus payments of \$3 to \$10 an acre were common.

THE ADJACENT REGION

A structurally favorable locality on any of the anticlines shown on the map is considered to be potentially productive Oriskany acreage. It remains to be demonstrated, however, that gas is present in the Oriskany sand on structures that lie southeast of the Sabinsville anticline. In this respect the results of a well now being drilled on the Marshfield anticline in East Fork District, about 14 miles south of Coudersport, are important.

Smethport anticline. Gas has been produced from shallow sands on the Smethport anticline in Sharon and Oswayo townships for many years. Production occurs throughout the axial area in Sharon Township and on both flanks. The field is known as Shinglehouse.

Surface data are so few and poor in this area that few details of this structure can be given. In Sharon Township, Chemung rocks are exposed at the axis throughout a considerable area, but no definite measurement of the relative height of the axis throughout this area was made. The north flank appears to flatten out

into a terrace a mile or so north of the axis in Oswayo Township.

Harrison anticline. This anticline lies between the productive Hebron and Sabinsville anticlines, and may logically be expected to produce where structural conditions are favorable. The only well drilled on the Harrison anticline was located well down the south flank in Brookfield Township, Tioga County. It found the sand to be 25 feet thick but nonproductive.

Structurally favorable localities are not well defined by the surface data available. One company that controls most of the acreage on this structure has mapped the subsurface by using the seismograph.

MAPS AND REPORTS

Topographic maps are not available for this area. Mapping of the Coudersport and Smethport quadrangles is in progress by the U. S. Geological Survey in cooperation with the Pennsylvania Geological Survey in 1932. An excellent base map constructed from aerial photographs is available through the Curtiss-Wright Flying Service, Aerial Survey Division, 350 West 31st Street, New York City, N. Y. A county map may be obtained from the Pennsylvania Department of Highways, North Office Building, Harrisburg, Pa. for 50 cents (stamps not accepted).

The geology of the region has not been studied in detail. The only geological report available for Potter County is Volume G-3 of the Second Pennsylvania Survey (1880). This report includes a geological reconnaissance map.

WORK OF THE PENNSYLVANIA GEOLOGICAL SURVEY

The anticlinal axes of Potter County were mapped during the summer of 1931 and the results published in Bulletin 102-A. The Harrison anticline north of Lewisville was mapped by F. T. Moyer, the remainder of the county by M. N. Shaffner. The Hebron anticline was studied in more detail by Mr. Shaffner and the writer in June 1932. The work of tracing the anticlinal axes through eastern McKean, Elk, and northern Clearfield counties is in progress.