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GEOLOGIC STRUCTURE AND OCCURRENCE OF  
GAS IN PART OF SOUTHWESTERN  
NEW YORK

PART 2. SUBSURFACE STRUCTURE  
IN PART OF SOUTHWESTERN NEW YORK  
AND MODE OF OCCURRENCE OF GAS  
IN THE MEDINA GROUP

BY

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#### NOTE

The Geological Survey in 1934, 1935, and 1936 studied the geologic structure and the occurrence of natural gas in the Oriskany and Medina sandstones in a large part of southwestern New York. The geologists have prepared separate reports on the areas for which they were responsible. However, as these areas are adjacent and form a real unit both geographically and geologically, the two reports are issued as parts of a single bulletin. No edition of the consolidated volume will be published, but the two parts may be bound together if desired.

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By G. B. RICHARDSON

### ABSTRACT

Based on the records of several hundred deep wells, contour maps have been prepared showing the monoclinical structure of part of western New York, and isopach lines have been drawn showing the westward convergence of the rocks. The mode of occurrence of natural gas in the Medina group is briefly discussed. The location of the gas fields has not been determined by structural traps, but rather stratigraphy and lithology are the controlling factors in trapping the gas, which occurs in porous lenses and streaks of sandstone sealed within impermeable beds. This mode of occurrences of the Medina gas makes the search for new fields in western New York more hazardous than in most natural gas regions. As structure has not formed traps for the gas there is no surface guide to favorable sites for testing, and new fields are found by haphazard drilling. It would be helpful, however, when wells are sunk, to study the lithology of the gas-bearing zone by an examination of the drill cuttings and core samples of the sand and to have electrical logs made of the wells to obtain measurements of permeability and porosity. Such tests may indicate the direction of greatest porosity in which the sand is more likely to contain gas.

### INTRODUCTION

The records of several hundred deep wells were obtained in 1934 in connection with an investigation by the Geological Survey to determine the geologic structure in the general region of the Oriskany gas fields of south-central New York.<sup>1</sup> This investigation was financed with funds provided by the Federal Emergency Administration of Public Works. The well records were supplemented in 1935 by logs of selected wells that had been sunk in search of gas in the Medina fields in the western part of the State. With this information as a basis the accompanying maps (pls. 5-8) have been prepared showing the subsurface structure in part of western New York, the convergence

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<sup>1</sup> Bradley, W. H., and Pepper, J. F., Structure and gas possibilities of the Oriskany sandstone in Steuben, Yates, and parts of the adjacent counties, New York: U. S. Geol. Survey Bull. 899-A, pp. 1-68, 1938.

of the strata, and the relation of the occurrence of natural gas to geologic structure in part of Erie County.

The logs of the wells were obtained from many sources. For courteously supplying records and other information the writer is under obligation to the following organizations and individuals:

Belmont Quadrangle Drilling Corporation, F. M. Brewster and J. A. Thompson; Godfrey L. Cabot, Inc., C. D. Whorton; Empire Gas & Fuel Co., G. Holbrook and C. T. Major; Finance Oil & Gas Co., Thomas Mills; Iroquois Gas Co., L. A. Brown and A. M. Nicholson; Keystone Gas Co., H. A. Wallace; Lycoming Producing Corporation, J. F. Robinson, U. F. Boyer, and F. H. Finn; New York State Museum and State Geological Survey, C. C. Adams, R. Ruedemann, D. H. Newland, and C. A. Hartnagel; New York State Oil Producers Association, N. Sullivan; North Penn Gas Co., J. Gaddess; Pavilion Natural Gas Co.; Penn-York Natural Gas Co., J. Reeves, H. E. Boyd, and N. C. Davies; Republic Light, Heat & Power Co., S. B. Severson and G. M. Merrill; Rochester Gas & Electric Co., A. M. Beebe and L. H. East; Solvay Process Co., R. H. Perkins and W. C. Phalen; Torrey, Fralich & Simmons, C. E. Fralich, A. C. Simmons, and W. H. Young; University of Rochester, H. L. Alling; and G. H. Chadwick, of Catskill, F. L. Dougherty, of Dunkirk, H. H. Cranston, of Fredonia, and S. T. Lockwood, of Buffalo.

#### STRATIGRAPHY

The generalized stratigraphic sequence in central and western New York is shown in the accompanying section, after Newland and Hartnagel and Goldring, of the State Museum.<sup>2</sup> The section shows the stratigraphic position of the principal gas-producing zones and of the key beds reported in the driller's logs of wells. The stratigraphic nomenclature used in the present report follows that given in the section and also follows current usage in the gas fields of western New York. The Medina group as thus used is assigned entirely to the Silurian. The strata here designated Oswego and Queenston in the lower part of the group have been correlated with formations elsewhere that are assigned an Ordovician age in other reports of the Federal Geological Survey.

<sup>2</sup> Newland, D. H., and Hartnagel, C. A., Review of the natural gas and petroleum developments in New York State: New York State Mus. Bull. 295, pp. 106-107, 1932. Goldring, Winifred, Handbook of paleontology for beginners and amateurs; Part 2, The formations: New York State Museum Handbook 10, pp. 190-191, 1931.

*Generalized geologic section in central and western New York*

[Chiefly after D. H. Newland, C. A. Hartnagel, and Winifred Goldring]

System or series	Group or formation	Description	Thickness (feet)
Pennsylvanian.	Olean.	Coarse conglomerate with well-rounded pebbles mostly of vein quartz. Texture changes rapidly both horizontally and vertically into coarse white sandstone.	60-70
	Unconformity.	Absence of Mauch Chunk and associated formations.	
Mississippian or Upper Devonian.	Knapp.	Conglomerate and interbedded shale.	60-105
	Oswayo.	Fossiliferous olive-green and rust-colored limonitic shales. Two-foot bed of very fossiliferous limestone near base. Probably small unconformity between Oswayo and Cattaraugus. A few thin beds of sandstone.	160-250
	Cattaraugus.	Bright-red shales with interbedded green or bluish shales and fine-grained micaceous sandstones. Local beds of conglomerate characterize the formation. At base is Wolf Creek conglomerate. Conglomerates of Cattaraugus beds have flat or discoidal pebbles, some of jasper, distinguishing them from Olean.	300-350
Devonian.	Chemung.	Gray, olive, and bluish shales, some dark purple or chocolate color. Many thin beds of argillaceous sandstone. Lower half of Chemung contains the oil-producing sands of the State.	1, 200-1, 500
	Portage.	Sandstone, flags, and black carbonaceous shales. Has gas-bearing strata.	1, 200-1, 400
	Genesee.	Black shale.	25-50
	Tully.	Gray limestone.	0-30
	Hamilton.	Blue, gray, and olive shales. Basal portion, Marcellus black shale, which is gas-bearing.	600-700
	Onondaga.	A heavy bedded limestone, the "flint" of the drillers. Gas-bearing.	60-130
	Oriskany.	Sandstone. Gas-bearing in Schuyler, Yates, Steuben, and Allegany Counties.	0-20
	Unconformity.	Absence of Helderbergian formations.	
Silurian.	Salina.	A series of water limes, gypseous shales, beds of anhydrite and gypsum, rock salt. Red shales at base. Upper portion of series gas bearing.	700-800
	Niagara.	Heavy bedded dolomites, Lockport and Guelph. Rochester shale at base is of Clinton age but usually logged with Niagara. Gas in Seneca and Ontario Counties.	200
	Clinton.	Limestones, shales, with thin bed of hematite.	30-150
	Medina.	Upper 150 feet white and red sandstones (Albion). Most prolific gas horizon in State. Main mass red shale (Queenston); white Oswego sandstone at base.	1, 100-1, 200
Ordovician.	Lorraine, or "Hudson River," and Utica.	A series of alternating beds of sandstones and shales. At base is Utica black shale.	500-600
	Trenton.	Alternating dark limestones and shales. Productive in Onondaga, Oswego, Oneida, and Lewis Counties. Many large gas pockets.	700-900
	Tribes Hill and Little Falls.	Heavy bedded limestones. Also known as the "Calciferous" formation. Basal beds in part belong to the Cambrian, the boundary being indefinite.	100-140
Cambrian.	Potsdam.	A sandstone where present directly overlying the pre-Cambrian. Reported in a few deep wells in western New York. Gas in one or two wells in central New York.	10-50
Pre-Cambrian.		Reported in several wells in western and central New York.	

## KEY BEDS

The logs of wells as reported by the drillers in general show only a few readily recognizable or key beds. (See list of wells, pp. 79-91.) One of the most useful of these beds for determining the stratigraphy and structure is the Onondaga limestone, of Middle Devonian age, which is widely distributed and readily recognized by well drillers. It immediately underlies the black Marcellus shale and overlies the Oriskany sandstone where that is present. The Onondaga is a massive gray cherty limestone ranging from less than 50 to more than 150 feet in thickness and is reported as "flint" by the drillers. It crops out, commonly forming an escarpment, from Lake Erie in the vicinity of Buffalo to the Hudson Valley in the vicinity of Albany and extends southward into Pennsylvania. In New York the Onondaga is a persistent limestone, though locally it is somewhat shaly in its upper part.

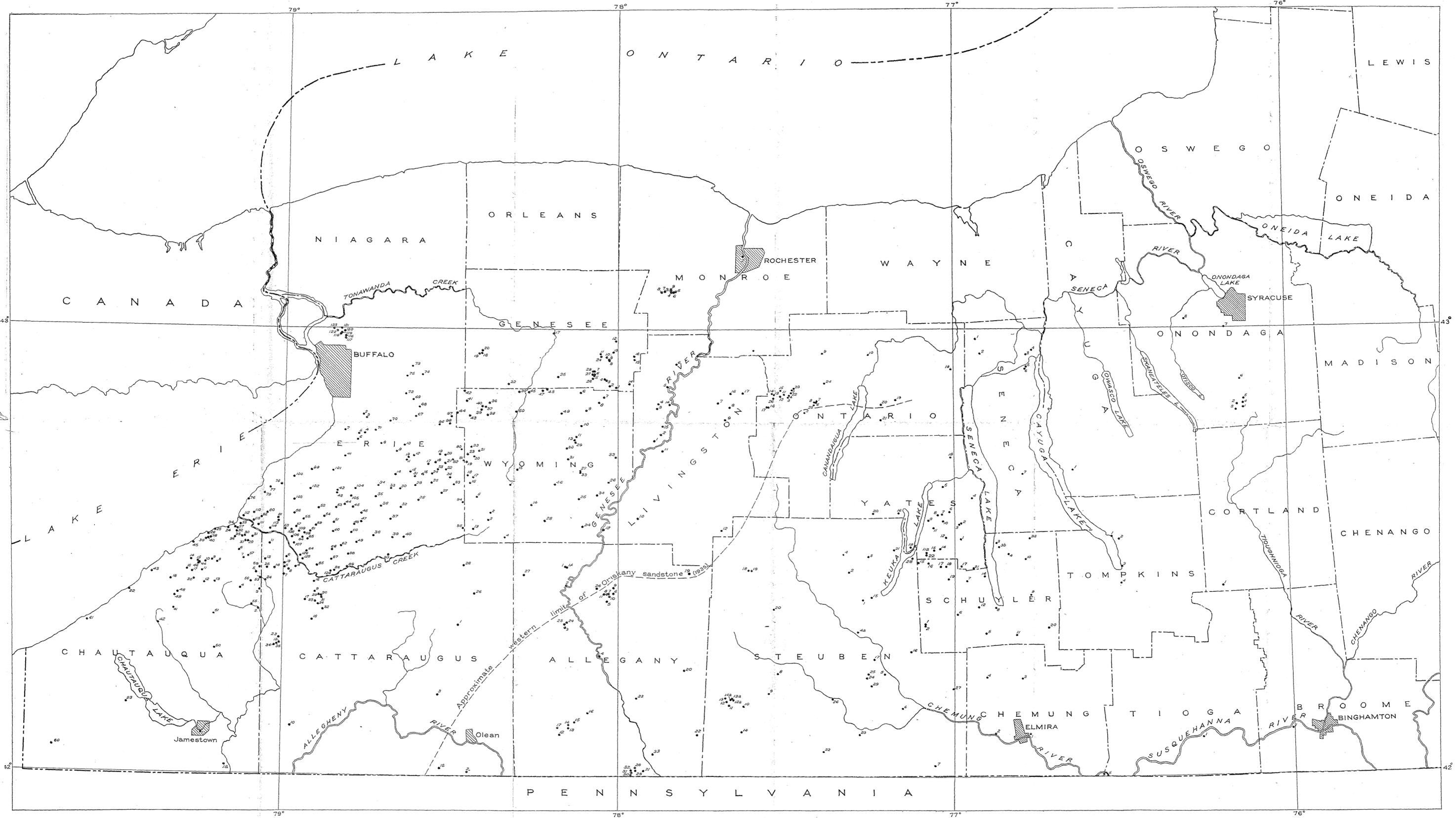
The Oriskany sandstone lying at the base of the Devonian system in western New York was deposited in irregular thickness in a sea transgressing the eroded surface of an old land mass. It locally disappears, yet it is apparently more continuous as a sheet deposit than the lenticular beds of sandstone that constitute some of the oil and gas reservoirs of Upper Devonian age. The type locality of the Oriskany is at Oriskany Falls, Oneida County, N. Y., where it is a light-gray fossiliferous coarse-grained quartz sandstone about 20 feet thick. The Oriskany sandstone is of economic importance because of the occurrence in it of large quantities of natural gas. The structure and gas possibilities of the Oriskany in a part of the State are discussed by Bradley and Pepper in part 1 of this bulletin.<sup>3</sup> Numerous well records show the occurrence of the Oriskany sandstone in central New York. The approximate northwestern limit of its occurrence underground, as indicated by the records of wells drilled before 1936, is shown on plate 5.

Another important key bed is the Tully limestone, lying at the base of the Upper Devonian series, between the overlying Genesee black shale and dark shale in the uppermost part of the Hamilton group. It apparently does not underlie so large an area as the Onondaga limestone, but recent drilling shows that it has a greater extent than was formerly realized. The Tully limestone crops out in the Finger Lake region of central New York and extends into Pennsylvania, where its outcrop has recently been observed in the central part of the State.<sup>4</sup> In New York the Tully is a massive gray limestone as much as 30 feet thick.

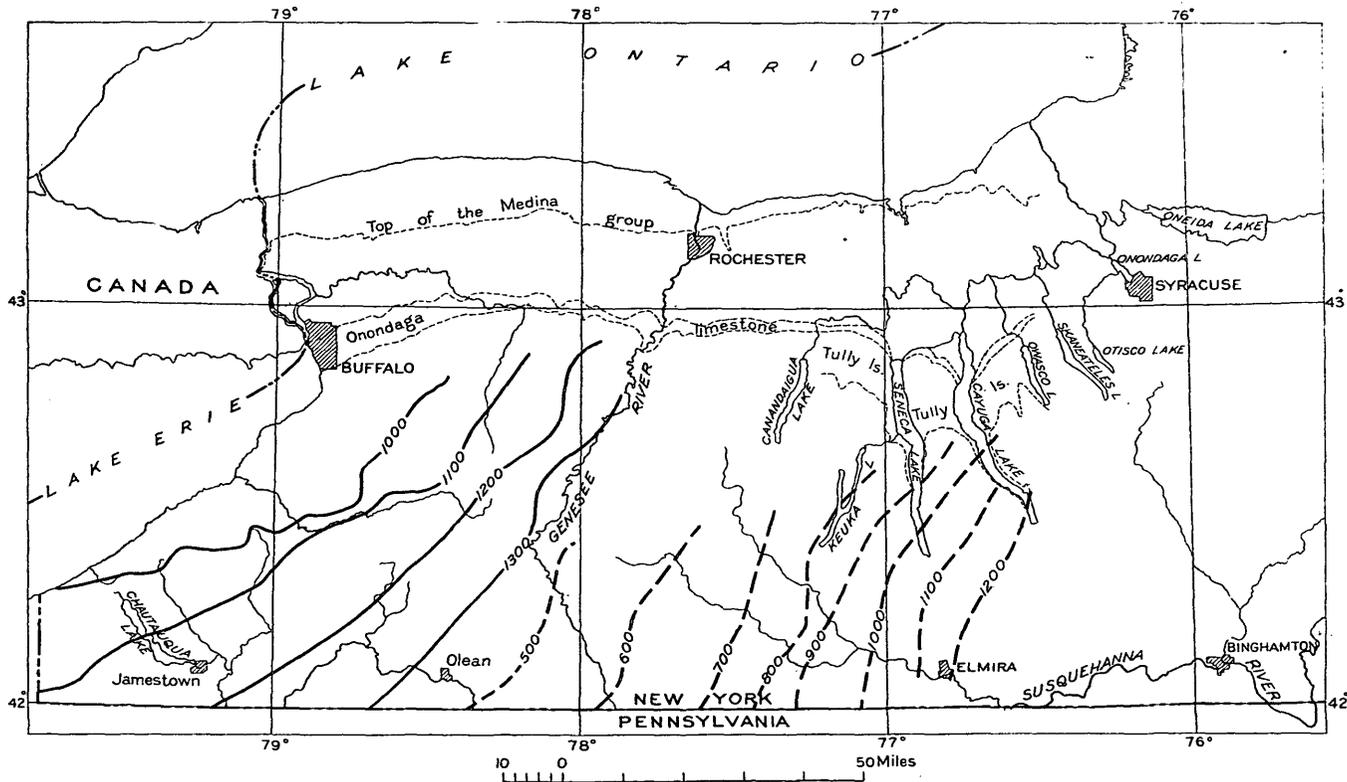
The key horizon that serves as a marker for the gas-bearing beds of Medina age (see p. 71) is designated by drillers as the "top of the

<sup>3</sup> Bradley, W. H., and Pepper, J. F., op. cit.

<sup>4</sup> Willard, Bradford, A Tully limestone outcrop in Pennsylvania: Pennsylvania Acad. Sci. Proc., vol. 8, pp. 57-62, 1934.



MAP OF SOUTHWESTERN NEW YORK SHOWING LOCATION OF WELLS.



**MAP SHOWING ISOPACH LINES THAT REPRESENT INTERVALS BETWEEN THE TOP OF THE MEDINA GROUP AND THE TOP OF THE ONONDAGA LIMESTONE (SHOWN BY SOLID LINES) AND BETWEEN THE TOP OF THE ONONDAGA LIMESTONE AND THE TOP OF THE TULLY LIMESTONE (SHOWN BY BROKEN LINES).**

*Location of outcrop of top of Medina group and outcrop of Onondaga and Tully limestones from Geologic map of New York by New York State Museum.*

Red Medina." This marks the change from gray shale in the lower part of beds of Clinton age to an underlying bed of sandstone that despite the drillers' term "Red Medina," is not everywhere red. In places this sandstone beneath the Clinton is the so-called Gray band or Thorold sandstone, which averages only about 5 feet in thickness. The age of the Gray band, whether Clinton or Medina, is doubtful, though the New York State Museum<sup>5</sup> now includes it in the Clinton. The Gray band seems to be locally absent where shale in the Clinton is reported to lie directly on red sandstone at the top of the Albion sandstone of the Medina group.

#### CONVERGENCE OF STRATA

Measurement of the stratigraphic intervals between the key beds reported in the records of the wells shows clearly the convergence of the strata. The rocks constitute a great wedge of sediments that decrease in thickness from east to west. The intervals between the top of the Medina group and the top of the Onondaga limestone and between the tops of the Onondaga and Tully limestones are shown by isopach lines on plate 6.

The Onondaga-Tully interval decreases from 1,700 feet in the vicinity of Owego, Tioga County, to 500 feet in the vicinity of Portville, Cattaraugus County, at the rate of about 13 feet per mile. The Onondaga-Medina interval decreases from 2,500 feet in the vicinity of Ludlowville, Tompkins County, to 1,400 feet in the vicinity of Livonia, Livingston County, at the rate of about 22 feet per mile, and from more than 1,500 feet in eastern Allegany County to less than 1,000 feet in western Erie County, at the rate of about 11 feet per mile. These isopach lines are based on scattered measurements and are necessarily generalized.

Relatively few measurements have been published showing the convergence in the beds above the Tully limestone, but an indication of conditions is afforded by rough measurements at two places of the interval between the Onondaga limestone and the Dunkirk shale, a formation in the Upper Devonian series. Near Dunkirk, Chautauqua County, that interval as shown by well records is about 800 feet, and in the vicinity of Woodhull, Steuben County, where the Dunkirk shale has become the Dunkirk sandstone, the interval between the base of the Dunkirk and the Onondaga limestone in a deep well, Steuben County No. 22, is about 4,000 feet, indicating a convergence of about 3,200 feet in a distance of a little more than 100 miles.

#### THICKNESS OF STRATIFIED ROCKS IN THE VICINITY OF OLEAN

One of the results of the recent deep drilling has been to permit a closer estimate than heretofore has been possible of the thickness of the rocks between the Olean conglomerate member of the Pottsville

<sup>5</sup> Goldring, Winifred, op. cit., p. 321.

formation, of Pennsylvanian age, and rocks of pre-Cambrian age. The well on the Quinlan farm located 5 miles south of Olean (Cattaraugus County well No. 2, p. 80), drilled in 1933, was started about 600 feet below the Olean conglomerate and reached the top of the Onondaga limestone at a depth of 4,188 feet. At this location the isopach lines show an interval of about 1,450 feet between the top of the Onondaga limestone and the top of the Medina group (pl. 6) and, assuming that the Medina-pre-Cambrian interval is at least as much as that at Rochester—2,847 feet—(Monroe County well No. 2), a thickness of about 9,085 feet between the Olean conglomerate and the pre-Cambrian rocks in the vicinity of Olean is indicated.

### STRUCTURE

That part of New York State lying south of Lake Ontario and west of the escarpment of the Catskill Mountains is in the northern part of the Appalachian synclinorium. This trough lies between the Allegheny Front and the Cincinnati arch and at the northeast rises on the flank of the Adirondack dome. Northwestward from the Allegheny Front, which marks the western border of the zone of closely folded rocks of the Appalachian province, the folds decrease in steepness and gradually fade away in irregular wrinkles. Locally the rocks are faulted. Farther northwestward the beds form a monoclinial slope on the flank of the Cincinnati arch, and north of Lake Ontario the strata rise to the Laurentian Shield.

In western New York on the northwestern flank of the Appalachian synclinorium, where the structure is monoclinial, the well records (pp. 79-91) are sufficiently numerous for structure contours to be drawn on the top of the Onondaga limestone at intervals of 100 feet, as shown on plate 7. These show that the strata dip east of south at an average rate of 40 to 50 feet to the mile. The Onondaga limestone along its outcrop in the western part of the State ranges in altitude from 600 to 800 feet above sea level, and the contours show the area in which the dip carries the limestone down to a depth of 700 feet below sea level. Records of a few wells show that farther south the Onondaga limestone lies as much as 1,700 feet below sea level in Chatauga County and 3,400 feet below sea level in Broome County. These depths are due in part to folding and in part to the eastward thickening of the strata.

Structure contours drawn at intervals of 500 feet on the top of the Medina group and on the top of the Trenton limestone in central and western New York have recently been published by Hartnagel.<sup>6</sup> In part of Erie County these Medina contours have been supplemented by the structure contours drawn at intervals of 50 feet on the top of the Medina group, as shown on plate 8. This map, which also shows

<sup>6</sup> Hartnagel, C. A., The Medina and the Trenton of western New York: Am. Assoc. Petroleum Geologists Bull. 22, pp. 79-99, 1938.

the location of selected gas wells and dry holes, is based on data courteously supplied by L. A. Brown and A. M. Nicholson, of the Iroquois Gas Co., and by other companies. In the area where these contours have been drawn the structure is distinctly monoclinical. In places there is some irregularity in the trend and spacing of the contours, but there is no suggestion of closure.

#### GAS IN THE MEDINA GROUP

Natural gas occurs in New York in rocks of the Devonian, Silurian, and Ordovician systems, but the principal source for many years has been the Albion sandstone of lower Silurian age, the uppermost formation of the Medina group. The Medina gas occurs in several fields, chiefly in Chautauqua, Cattaraugus, Erie, Genesee, and Wyoming Counties, in wells of small capacity but long life. The gas fields have been discussed in publications by Bishop, Newland, and Hartnagel.<sup>7</sup>

The present writer in 1935 obtained a few facts concerning the mode of occurrence of the Medina gas that are here summarized.

#### RELATION OF GAS TO STRUCTURE

The Medina gas fields of western New York are localized on a monocline (see plate 7). The structure of a relatively small area of the gas-bearing rocks in part of Erie County is shown in more detail on plate 8, on which structure contours are drawn on the top of the Medina group at intervals of 50 feet. Selected gas wells and dry holes are also shown. It is evident from the maps, which do not indicate any closure, that structure has not determined the localization of the natural gas, although presumably the monocline was effective in facilitating the migration of gas up the rise of the strata until it became trapped.

The monoclinical structure of the rocks in the Medina gas fields is in marked contrast to the structure in the Oriskany gas fields in south-central New York and northwestern Pennsylvania. In those fields the gas occurs on structural highs along the axes of anticlines, the structure serving as a trap for the gas.<sup>8</sup> In the Medina gas fields, on the contrary, the gas traps are porous lenses or streaks sealed by nonpermeable parts of the reservoir rock (pp. 77-78).

#### RELATION OF GAS TO LITHOLOGY

The Medina group crops out in a belt about 10 miles wide south of Lake Ontario, and the Albion sandstone, at the top of the group, is well

<sup>7</sup> Bishop, I. P., Report on petroleum and natural gas in western New York: New York State Geologist Ann. Rept. 17, pp. 9-63, 1899. Newland, D. H., The mineral resources of the State of New York: New York State Mus. Bulls. 223-224, pp. 165-197, 1921. Newland, D. H., and Hartnagel, C. A., Review of the natural gas and petroleum developments in New York State: New York State Mus. Bull. 295, pp. 101, 182, 1932. Recent natural gas developments in New York State: New York State Mus. Bull. 305, pp. 97-161, 1936. Harrnagel, C. A., The Medina and the Trenton of western New York: Am. Assoc. Petroleum Geologists Bull. 22, pp. 79-99, 1938.

<sup>8</sup> Bradley, W. H., and Pepper, J. F., op. cit.

exposed in the gorge of the Niagara River. Dipping southward, in conformity with the regional structure, the Medina group extends underground far beyond the state boundary, and in southern Allegany County the gas sand lies more than 4,000 feet below sea level.

The Albion sandstone forms a sandy zone lying in the midst of a mass of shale. It is overlain by the Clinton formation and is underlain by the Queenston shale (see p. 71). The Albion sandstone consists of lenticular beds of red, gray, and white sandstone and interbedded red and gray shale somewhat more than 100 feet in thickness. The Whirlpool sandstone member, at the base of the formation, is the principal reservoir of natural gas. Although the Albion sandstone has been penetrated by many hundred drill holes put down in search of gas, very few detailed sections have been recorded. The following measurements are the most complete.

*Section of Albion sandstone, Niagara Gorge*<sup>9</sup>

Clinton formation:

Shale, gray.

Albion sandstone:

	<i>Feet</i>
Sandstone, gray (Thorold sandstone member)-----	5
Sandstone, red and gray, cross-bedded-----	6
Sandstone, red, thin-bedded, and shale-----	20
Sandstone, gray, thick-bedded-----	4
Shale, reddish, and thin-bedded sandstone-----	18
Sandstone, gray, thin-bedded-----	5
Shale, blue-gray argillaceous or sandy-----	19
Sandstone, white, cross-bedded (Whirlpool sandstone member)-----	22
	99

Queenston shale:

Shale, red.

*Section of Albion sandstone in a core drill hole at the Sterling salt mine, Cuylerville, Livingston County*<sup>10</sup>

Clinton formation:

Shale, gray.

Albion sandstone:

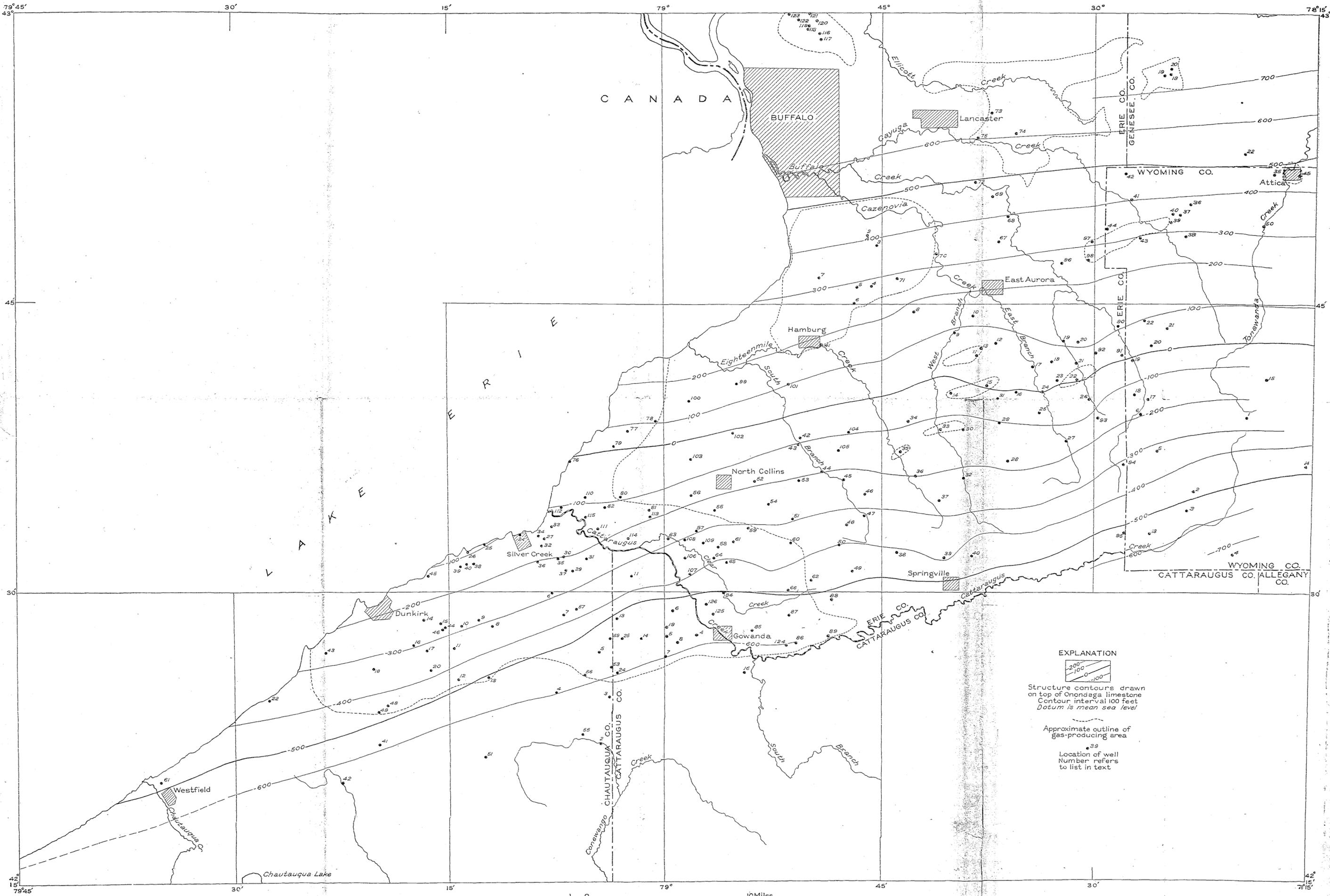
	<i>Feet</i>
Sandstone, gray-----	6.8
Sandstone and shale, gray, green, and red-----	4.8
Shale, red and green-----	19.7
Sandstone, shaly, red, brown, and gray-green-----	32.0
Shale, sandy, red, brown, and gray-green-----	4.8
Sandstone, white to brown-----	5.9
Shale, red, brown, and green-----	3.5
Sandstone, white to brownish-----	2.8
Not recorded-----	1.0
Sandstone, brown, red, green, and white-----	8.7
Sandstone, coarse, brown-----	10.3
	100.3

Queenston shale:

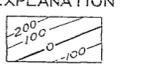
Shale, red.

<sup>9</sup> Kindle, E. M., and Taylor, F. B., U. S. Geol. Survey, Geol. Atlas, Niagara folio (No. 190), p. 6, 1913.

<sup>10</sup> Courtesy of International Salt Co.



**EXPLANATION**



Structure contours drawn on top of Onondaga limestone  
 Contour interval 100 feet  
 Datum is mean sea level

Approximate outline of gas-producing area

Location of well  
 Number refers to list in text

MAP SHOWING BY CONTOUR LINES DRAWN ON THE TOP OF THE ONONDAGA LIMESTONE THE SUBSURFACE STRUCTURE IN PART OF SOUTHWESTERN NEW YORK, APPROXIMATE OUTLINE OF PRINCIPAL GAS-PRODUCING AREAS, AND LOCATION OF SELECTED WELLS.



In the logs of wells as reported by drillers the Albion sandstone is subdivided into the White Medina sandstone (the Whirlpool sandstone member) at the base, the Red Medina sandstone and shale at the top, and an intervening shale "break." The following measurements selected at random from well drillers' records indicate the lenticularity and varying thicknesses of the subdivisions of the Albion sandstone in Erie County. The shale "break" and the White Medina locally disappear.

*Measurements showing lenticularity of Albion sandstone in Erie County*

[Thickness, in feet, as reported by well drillers]

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
Albion sandstone:																					
Red Medina sandstone																					
and shale, at top.....	80	84	98	80	120	81	83	90	84	85	82	65	100	85	97	85	81	81	72	98	80
Shale "break".....	18	15	0	10	0	14	9	3	12	26	7	7	0	16	0	11	14	10	10	2	0
White Medina sand-																					
stone, at base.....	20	12	0	20	0	22	18	13	20	21	26	32	0	8	0	20	20	20	10	14	0

The White Medina, or Whirlpool, sandstone member of the Albion sandstone is indurated and fine-grained and is composed almost entirely of semirounded and subangular quartz grains of variable size, the maximum measured being less than 0.5 millimeter in diameter and the smallest less than 0.05 millimeter. A very subordinate amount of mica is present. The cement is chiefly secondary quartz, but locally it contains some calcite. The porosity and permeability of the sandstone are characteristically variable. The Albion sandstone as a whole, is generally reported to yield little or no water, but in places salt water is present in small quantity.

Natural gas occurs at various horizons in the Albion sandstone, chiefly in the White Medina but also in places in the overlying Red Medina. There is locally a tendency toward a linear distribution of the gas reservoirs somewhat north of east, possibly parallel to the old shore line of the sea in which the sand grains were distributed and sorted.

Gas occurs irregularly in parts of the sandstone that are sufficiently porous to serve as a reservoir and is absent where the sandstone is practically impermeable or "tight" as described by well drillers. The presence of gas is characteristically erratic, dry holes being surrounded by gas wells and vice versa. The irregular distribution of the gas is shown also by new wells in which the gas is under relatively high pressure, adjacent to old wells in which the pressure has been much reduced. The gas-bearing rocks are not continuously permeable beds; if they were the gas would migrate up the slope of the monocline and escape along the outcrop. The reservoirs are in effect lenses and irregular streaks of porous sandstone enclosed by impermeable rock. Lenses of sandstone are traps for gas in places where the sandstone

merges into shale. Traps for gas in beds of the Albion sandstone are caused also by the deposition of secondary quartz upon the original quartz grains so as to enclose porous lenses within the cemented, impermeable rock. Moreover, the distribution and relative abundance of the coarser and finer grains of which the sandstone is composed have locally formed traps. This is shown by the physical tests of samples of the White Medina sandstone tabulated below.

Two samples of the White Medina sandstone, shot from wells in Erie County, were tested by P. G. Nutting, of the United States Geological Survey with the results here shown. Sample A represents an unproductive sand in a dry hole and Sample B represents the pay streak in a commercial gas well. The differences in porosity and sand-grain distribution are striking. Fine grains, less than 0.052 millimeter in diameter, constitute more than 15 percent of the barren sand whose low porosity, less than 2 percent, is due to the abundance of the finest material, which is enough to prevent the occurrence of considerable voids in the rock; on the other hand the fines in the sample that represents a reservoir of natural gas are so few that voids remain unfilled and the porosity is more than 10 percent.

*Physical tests of two samples of the Whirlpool sandstone member (White Medina) of the Albion sandstone shot from wells in Erie County*

Grain-size distribution		Percent	
Mesh	Size (millimeters)	Porosity	Gas well
		A	B
Finer than 270.....	Less than 0.052.....	15.59	7.98
270-200.....	0.052-0.074.....	8.38	4.73
200-150.....	0.074-0.104.....	7.18	22.95
150-100.....	0.104-0.147.....	12.05	22.82
100-65.....	0.147-0.208.....	37.35	19.19
65-48.....	0.208-0.295.....	20.15	9.43
48-35.....	0.295-0.417.....	4.30	8.62
On 35.....	More than 0.417.....		4.26

A. Unproductive sand, porosity 1.909 percent.

B. Reservoir sand, porosity 10.45 percent.

This mode of occurrence of the Medina gas makes the search for new fields in western New York more hazardous than in most natural-gas regions. As structure has not formed traps for the gas there is no surface guide to favorable sites for testing, and new fields are found by haphazard drilling. It would be helpful, however, when wells are sunk, to study the lithology of the gas-bearing zone by an examination of the drill cuttings and core samples of the sand, and to have electrical logs<sup>11</sup> made of the wells to obtain measurements of permeability and porosity. Such tests may indicate the directions of greatest porosity, in which the sand is more likely to contain gas.

<sup>11</sup> Gillingham, W. J., Electrical logging in the Appalachian fields: Pennsylvania State College Bull. Mineral Industries Experiment Station No. 21, pp. 30-52, 1937.

WELL RECORDS

WELL RECORDS

Records of selected wells drilled to the Onondaga limestone or deeper prior to 1936<sup>1</sup>

[Locations shown on plate 5]

Allegany County

No. on pl. 5	Town	Farm	Approximate altitude above sea level (feet)	Depth (feet) to top of—				Total depth	Status
				Tully lime-stone	Onondaga limestone	Oriskany sandstone	Medina group		
1	Hume	Connor	1,525		2,456			5,084	Dry.
1A	do	Buell	1,447		2,380		3,736	3,326	Do.
2	Canaeada	Thayer	1,200		2,245			2,447	Do.
3	Belfast	Ford	1,725	2,808	3,287	3,378		3,450	Do.
4	Anglica	Clark	1,350	2,740	3,250	3,368		4,260	Salt water.
5	Allen	Sheldon	1,630	2,340	2,856	2,964		3,027	Show of gas.
6	do	Slaight	1,654		2,905	2,999		3,050	Dry.
7	do	Vincent	1,627	2,316	2,830	2,929		3,059	Gas.
8	do	Woodruff	1,644	2,358	2,864	2,962		2,974	Show of gas.
9	do	Smith	1,595	2,279	2,780	2,873		2,892	Do.
10	do	Bank of Anglica	1,638	2,325	2,859	2,947		2,948	Do.
11	do	Vincent	1,655	2,349	2,855	2,956		2,976	Do.
12	Wirt	Chadwick	1,860	3,852	4,347	4,453		4,850	Dry.
13	do	Dick	2,140	4,114	4,620	4,688		4,750	Do.
14	do	Gilbert	2,071	3,990	4,538	4,630		6,024	Gas.
15	do	Reed	2,130	4,063	4,300	4,380		6,250	Dry.
16	do	Newton	1,917	3,791(?)	4,300	4,514		4,675	Do.
17	do	Ballard	2,101	4,005	4,314	4,559		6,500	Do.
19	Burns	Randolph	1,260		2,650(?)			4,615	Do.
20	Alfred	Ryan	2,250	3,707	4,320	4,364		3,200	Do.
21	Willing	Clark	2,074	4,211(?)	4,803	4,842		4,381	Salt water.
22	Independence	Black	2,288	4,302	4,991	5,042		4,842	Gas and salt water.
23	Scioto	Murray	1,778	3,470	4,025	4,097		5,050	Salt water.
24	Belfast	Barringer	1,634	2,641	3,119	3,206		4,103	Do.
25	do	Steadman	1,556	2,592	3,070	3,165		3,210	Gas.
26	Allen	Williams	1,685	2,325	2,814	[Absent.]		3,165	Water.
27	Centerville	Costello	1,915		3,006			4,388	Dry.
28	Willing	Van Campen	2,006	4,114	4,704	4,742		4,744	No white Medina. Dry.
29	do	Colligan	2,091	4,150	4,720	4,754			Do.
30	Alma	Dean	1,954	3,591	4,582	4,609			Do.
31	do	Moran	1,970	4,000	4,580	4,627		4,631	Do.
32	do	Loring	1,706	3,842	4,428	4,468			Do.
33	Willing		1,855	4,041	4,627	4,668			Salt water.

<sup>1</sup> For records of wells in Wayne-Dundee, State-Line, and Greenwood gas fields see U. S. Geol. Survey Bull. 899-A.

Records of selected wells drilled to the Onondaga limestone or deeper prior to 1936—Continued

Broome County

No. on pl. 5	Town	Farm	Approximate altitude above sea level (feet)	Depth (feet) to top of—			Total depth	Status
				Tully limestone	Onondaga limestone	Oriskany sandstone		
1	Vestal	Chase	844		4,260	4,292	4,412	Dry.

Cattaraugus County

1	Franklinville	Howard	1,625		2,912		4,448	Dry.
2	Olean	Quinan	1,686		4,188		4,297	Do.
3	Humphrey	Hale	1,942	3,743	3,790	4,276	5,307	Do.
4	Perrysburg		960		1,535		2,514	Do.
5	do		1,202		1,774		2,752	Do.
6	do		977		1,505		2,430	Do.
7	do		1,560		2,158		3,128	Gas.
8	do		1,227		1,842		2,777	Do.
9	Persia	Palmer	1,407		2,119		3,232	Dry.
10	Randolph	Hotchkiss	1,764		3,390		4,684	Show of gas.
11	Perrysburg		864		2,330		2,148	Dry.
12	Leon	Greely	1,355		1,645		3,562	Gas.
13	Perrysburg	Hulbaken	1,100		1,920		2,589	Do.
14	do	Wells	1,340		1,820		2,884	Do.
15	Allegany	Scott	1,877	3,830(?)	4,260	4,357	4,370	Dry.
16	Persia	Kewly	1,352		2,123		3,011	Gas.
17	do	Fog	1,805		2,710		3,432	Do.
18	New Albion	Riche	1,135		2,170		3,967	Dry.
19	Perrysburg	Reitel	1,641		2,584		2,884	Gas.
23	Leon	Garvey	1,361		1,958		3,688	Dry.
24	Davton	Jolls	1,240		1,760		3,075	Gas.
25	Perrysburg	Arnold	1,998		3,120		2,842	Do.
26	Farmersville		1,520		2,397		4,321	Do.
28	Yorkshire		1,199		1,930		3,541	Dry.
29	Otto		1,389		2,135		3,673	Do.
30	do		1,399		2,150		3,167	Gas.
31	do		1,126		1,982		3,377	Dry.
32	do		1,372		2,116		3,413	Gas.
33	Persia		1,324		2,126		3,350	Dry.
34	do		1,324		2,126		3,225	Gas.

No White Medina.

Cayuga County

	Ledyard.	Mahaney.	824	17	1,010	1,065	3,083	6,166	Dry.
1	Ledyard.	Mahaney.	824	17	1,010	1,065	3,083	6,166	Dry.
Chautauqua County									
1	Jamestown.	.....	1,325	.....	2,775	.....	.....	3,263	Do.
1a	Kiantone.	Weiss.	1,244	.....	2,999	.....	4,194	4,700	Do.
2	Villonova.	Phillips.	1,310	.....	1,985	.....	3,077	3,219	Do.
3	do.	Wood.	1,665	.....	2,240	.....	3,325	3,467	Do.
4	do.	.....	1,720	.....	2,315	.....	3,270	3,417	Gas.
5	Hanover.	Parsell.	1,420	.....	1,970	.....	2,974	3,093	Do.
6	do.	.....	880	.....	1,176	.....	2,165	2,289	.....
7	do.	.....	1,120	.....	1,502	.....	2,496	.....	Dry.
8	Sheridan.	.....	1,080	.....	1,402	.....	2,373	2,552	Gas.
9	do.	Livermore.	880	.....	1,160	.....	2,129	.....	Do.
10	do.	Berns.	850	.....	1,121	.....	2,092	2,234	Do.
11	do.	Ransom.	1,080	.....	1,400	.....	3,037	3,396	Do.
12	Arkwright.	Thiess.	1,620	.....	2,084	.....	2,623	3,182	Do.
13	do.	Beebe.	1,130	.....	1,556	.....	2,623	2,783	Do.
14	Sheridan.	.....	720	.....	955	.....	1,895	.....	Do.
15	do.	.....	780	.....	1,090	.....	.....	.....	Do.
16	do.	Woods.	1,922	.....	1,965	.....	2,038	.....	Do.
17	do.	Gens and Wright.	1,925	.....	1,210	.....	2,181	.....	Do.
18	Pomfret.	.....	780	.....	1,150	.....	.....	.....	Do.
20	Arkwright.	R. and E. Theiss.	1,925	.....	1,500	.....	2,469	2,128	Do.
22	Portland.	Wenborne.	640	.....	1,010	.....	1,978	3,895	Dry.
23	North Harmony.	Randall.	1,530	.....	2,610	.....	3,717	1,855	Do.
24	Hanover.	Lake Shore.	580	.....	710	.....	1,672	1,839	Gas.
25	Sheridan.	Bally.	600	.....	700	.....	1,728	1,867	Do.
26	do.	St. Columban.	590	.....	680	.....	1,650	1,880	Do.
27	Hanover.	Bentley.	760	.....	820	.....	1,837	2,286	Do.
28	do.	Smith.	828	.....	1,000	.....	2,051	2,267	.....
29	do.	Ubel.	828	.....	1,000	.....	2,051	2,267	.....
30	do.	James.	690	.....	890	.....	1,964	2,145	.....
31	do.	Jacobs.	690	.....	890	.....	1,964	2,145	.....
32	do.	Taylor.	690	.....	890	.....	1,964	2,145	.....
33	do.	Codwell.	690	.....	890	.....	1,964	2,145	.....
34	do.	Bradley.	770	.....	970	.....	1,707	1,897	.....
35	do.	Smith.	770	.....	970	.....	1,707	1,897	.....
36	do.	.....	770	.....	970	.....	1,707	1,897	.....
37	do.	.....	740	.....	950	.....	1,655	1,798	.....
38	do.	De Salvo.	805	.....	1,010	.....	1,910	2,111	.....
39	do.	Brown.	695	.....	825	.....	2,043	2,050	.....
40	do.	Miglio.	677	.....	825	.....	1,808	2,178	.....
41	do.	Miglio.	706	.....	832	.....	1,775	1,963	.....
42	Pomfret.	Sanderson.	1,332	.....	1,798	.....	1,809	1,850	.....
43	Stockton.	Warren.	1,320	.....	1,948	.....	2,805	1,964	.....
44	Sheridan.	Merritt.	610	.....	895	.....	2,944	3,116	.....
			785	.....	1,090	.....	1,870	2,026	.....
				.....		.....	2,055	2,241	.....

Records of selected wells drilled to the Onondaga limestone or deeper prior to 1936—Continued

Chautauqua County—Continued

No. on Pl. 5	Town	Farm	Approximate altitude above sea level (feet)	Depth (feet) to top of—			Total depth	Status
				Tully limestone	Onondaga limestone	Oriskany sandstone		
45	Sheridan.....	Lincoln.....	660	.....	818	.....	1,767	.....
46	do.....	Bentley.....	778	.....	1,074	.....	2,047	.....
47	Arkwright.....	Vollone.....	1,240	.....	1,583	.....	2,602	.....
48	Pomfret.....	Sullivan.....	1,075	.....	1,530	.....	2,510	.....
49	do.....	Salhof.....	1,240	.....	1,697	.....	2,676	.....
50	Charlotte.....	Brown.....	1,726	.....	.....	.....	3,750	.....
51	Arkwright.....	Chase.....	1,550	.....	2,240	.....	.....	.....
53	Villenova.....	Ball.....	1,413	.....	2,013	.....	2,998	.....
55	do.....	Heath.....	1,327	.....	.....	.....	3,019	.....
56	do.....	Dubbett.....	1,120	.....	1,898	.....	2,876	.....
57	do.....	Harley.....	1,120	.....	1,500	.....	2,484	.....
59	Hanover.....	Ball.....	1,220	.....	1,780	.....	2,733	.....
60	French Creek.....	Reed.....	1,652	.....	2,861	.....	3,946	.....
61	Westfield.....	Betts.....	660	.....	1,130	.....	2,100	.....

Chemung County

1	Elmira.....	Murphy.....	1,336	1,800	3,116	3,175	3,960	Dry.
2	Big Flats.....	Berthod.....	911	2,150	3,235	3,314	3,433	Do.
3	Veteran.....	Turner.....	1,071	1,560	2,805	2,947	3,085	Do.
4	Catlin.....	Willis.....	1,230	1,960	3,064	3,115	3,135	Do.
5	Chemung.....	Ingram.....	778	2,220	3,744	3,776	3,820	Do.

Cortland County

1	Harford.....	Woodward.....	1,174	1,044	2,475	2,504	2,776	Dry.
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Eric County

2	West Seneca.....	.....	720	.....	818	.....	1,223	Gas.
3	East Hamburg.....	.....	730	.....	350	.....	1,270	Do.
4	do.....	.....	780	.....	507	.....	1,423	Do.
5	do.....	.....	780	.....	490	.....	1,418	Do.

6	do.	825	578	1,500	Do.
7	Hamburg	660	325	1,246	Do.
8	East Hamburg	940	772	1,710	Do.
9	Aurora	880	801	1,742	Dry.
10	do.	970	810	1,748	Do.
11	do.	1,310	1,272	2,219	Gas.
12	do.	1,195	1,148	2,108	Dry.
13	do.	1,240	1,196	2,146	Gas.
14	Colden	1,382	1,432	2,893	Do.
15	do.	1,543	1,630	2,630	Do.
16	do.	1,440	1,456	2,472	Dry.
17	Wales	935	885	1,919	Do.
18	do.	1,425	1,350	2,389	Do.
19	do.	1,131	1,010	2,066	Do.
20	do.	1,405	1,292	2,351	Do.
21	do.	1,133	1,061	2,136	Do.
22	Holland	1,261	1,257	2,314	Gas.
23	do.	1,486	1,497	2,528	Dry.
24	do.	982	975	2,002	Do.
25	do.	1,103	1,169	2,179	Do.
26	do.	1,252	1,222	2,371	Do.
27	do.	1,112	1,284	2,335	Do.
28	Colden	1,651	1,820	2,829	Do.
29	do.	1,726	1,825	2,853	Do.
30	do.	1,330	1,453	2,453	Do.
31	do.	1,607	1,638	2,655	Do.
32	Concord	1,244	1,500	2,519	Do.
33	Colden	1,141	1,275	2,232	Do.
34	Boston	1,610	1,663	2,623	Gas.
35	do.	1,020	1,180	2,152	Do.
36	Concord	1,071	1,267	2,286	Dry.
37	do.	1,199	1,460	2,520	Do.
38	do.	1,340	1,748	2,717	Do.
39	do.	1,459	1,850	2,969	Do.
40	do.	1,407	1,866	2,975	Do.
41	Hamburg	820	650	1,576	Gas.
42	Eden	977	1,050	2,000	Dry.
43	do.	836	940	1,875	Do.
44	North Collins	974	1,174	2,121	Do.
45	do.	1,065	1,314	2,283	Do.
46	do.	1,418	1,679	2,662	Do.
47	do.	1,267	1,595	2,550	Do.
48	do.	1,431	1,757	2,730	Do.
49	Collins	1,440	1,925	2,815	Do.
50	North Collins	1,542	1,935	2,904	Do.
51	do.	1,213	1,512	2,460	Do.
52	do.	1,178	1,364	2,280	Do.
53	do.	1,313	1,520	2,460	Do.
54	do.	1,262	1,509	2,445	Do.
55	do.	822	1,071	2,004	Do.
56	Brant	866	1,051	1,967	Do.
57	do.	911	1,215	2,151	Gas.

## Records of selected wells drilled to the Onondaga limestone or deeper prior to 1936—Continued

## Erie County—Continued

No. on pl. 5	Town	Farm	Approximate altitude above sea level (feet)	Depth (feet) to top of—			Total depth	Status
				Tully limestone	Onondaga limestone	Oriskany sandstone		
58	North Collins		819	1,190			Dry.	
59	do.		1,115	1,420		2,129	Do.	
60	do.		1,137	1,494		2,364	Gas.	
61	do.		985	1,280		2,246	Do.	
62	Collins		1,307	1,779		4,602	Dry.	
63	Catsaugus Indian Reservation		680	940		1,850	Gas. Top of "granite," 4,600 feet.	
64	Collins		827	1,220		2,155	Dry.	
65	do.		863	1,309		2,260	Do.	
66	do.		907	1,369		2,599	Do.	
67	do.		1,020	1,571		1,517	Do.	
68	Erma		690	875		1,387	Do.	
69	do.		700	928		1,280	Do.	
70	do.		822	905		1,400	Do.	
71	East Hamburg		875	600		1,915	Gas.	
72	Erma		772	980		1,632	Do.	
73	Leicester		710	95		1,072	Do.	
74	do.		740	130		1,025	Do.	
75	do.		692	90		1,525	Do.	
76	Evans		590	595		1,460	Do.	
77	do.		658	575		1,485	Do.	
78	do.		706	570		1,491	Dry.	
79	do.		697	580		1,687	Gas.	
80	Brant		666	760		1,883	Gas.	
81	do.		766	943		1,805	Do.	
82	Catsaugus		740	850		4,560	Dry.	
83	Concord		1,300	1,800		2,286	Do.	
84	Collins		816	1,327		2,620	Do.	
85	do.		1,040	1,580		1,045	Gas.	
86	do.		1,295	1,910		2,620	Do.	
87	do.		1,054	1,575		2,849	Dry.	
88	do.		1,330	1,854		2,732	Do.	
89	do.		1,045	1,609		1,941	Do.	
90	Wales		991	897		2,124	Do.	
91	do.		1,082	1,047		2,439	Do.	
92	do.		1,447	1,387		2,569	Do.	
93	Holland		1,361	1,515		2,648	Do.	
94	do.		1,082	1,678		3,107	Gas.	
95	Sardinia		1,450	1,990		1,789	Dry.	
96	Marilla		1,082	810				



Records of selected wells drilled to the Onondaga limestone or deeper prior to 1936—Continued

Genesee County—Continued

No. on pl. 5	Town	Farm	Approximate altitude above sea level (feet)	Depth (feet) to top of—				Total depth	Status
				Tully limestone	Onondaga limestone	Oriskany sandstone	Medina group		
19	Darien	Edseld	860		106		1,075	1,196	Gas
20	do	do	860		80		1,043	1,161	Do.
22	do	Chick	1,100		946		1,791	1,791	Do.
24	Stafford	Hunt	900		233		1,371	1,573	Do.
25	Bethany	Beaver	1,110		945		1,566	1,772	Dry.
26	do	Partridge	1,110		530		1,720	1,952	Gas
27	do	Chickner	1,080		530		1,679	1,840	Do.
28	do	Parson	1,000		448		1,593	1,747	Do.

Livingston County

1	Leicester		610		600			1,333	Salt
2	do		568		470			1,145	Do.
3	York		732		443			Do.	Do.
4	do		714		403			1,106	Do.
5	do		568		180			748	Do.
6	Caledonia		618		26			Do.	Do.
7	Livonia		824		508			1,073	Do.
8	do		1,008		705			Do.	Do.
9	do		1,082		866			1,432	Do.
10	Nunda		945		1,608			2,285	Do.
11	Mount Morris		574		1,720			1,422	Do.
12	North Dansville		735					3,310	Dry.
13	Portage		1,140					3,990	Salt.
14	York		564		265		3,150	1,909	Combined shaft and bore hole.
15	Leicester	Stealing mine	614		475		1,771	1,909	Gas in Onondaga.
16	Lima	Ollersha w	900		460		1,912	2,129	Gas in Medina.
17	do	Francis	960		520				

Monroe County

1	Mendon		685				1,284	3,100	Dry.
2	Rochester		506				250	512	Pre-Cambrian at feet.
3	Riga	Reber	542				430	565	Gas.
4	do	do	500				459		Do.

5	do	540	436	537	Do.
6	Ehrentraut	545	446	539	Do.
7	do	555	446	540	Do.
8	Embling	565	460	552	Do.
9	Giglio	565	433	Do.	
	Keck	555		Do.	

Onondaga County

1	Tully	901	769		Salt
2	do	814	607		Do.
3	do	854	770		Do.
4	do	774	695		Do.
5	do	730	528		Do.
6	Lafayette	620	445		Do.
7	Onondaga	1,013	244		Do.
8	Camillus	920	335	4,079	Dry
	Monroe		51	4,427	Do.

Ontario County

2	Bristol	1,287	1,077	2,740	Gas (Medina)
3	Richmond	920	610	2,032	Gas
4	West Bloomfield	880	575	2,221	Do.
5	do	895	525	2,170	Do.
6	Bristol	902	582	2,064	Do.
7	do	910	568	2,188	Do.
8	do	959	640	2,200	Do.
9	Victor	703	41	2,280	Do.
10	Canandaigua	663		1,913	Do.
11	West Bloomfield	880		1,551	Dry
12	Richmond	880		2,064	Gas
13	West Bloomfield	820		2,051	Do.
14	do	780		1,872	Do.
15	do	865		1,914	Do.
16	Richmond	800		2,042	Do.
17	do	800			Do.
18	Phelps	520		1,470	Dry
19	Gorman	335		2,070	Do.
20	do	985	18	2,080	Do.
21	do	1,104	450	2,435(?)	Do.
22	West Bloomfield	900		2,041	Salt water
23	East Bloomfield	890		2,070	Do.
24	do	823		2,218	Gas
25	Bristol	900		1,883	Dry
26	Richmond	820		2,075	Gas
				1,882	Dry
				470	Do.

Records of selected wells drilled to the Onondaga limestone or deeper prior to 1936—Continued

## Schenyer County

No. on pl. 5	Town	Farm	Approximate alti- tude above sea level (feet)	Depth (feet) to top of—			Total depth	Status
				Tully lime- stone	Onondaga limestone	Oriskany sandstone		
1	Orange	Engle No. 2	1,849	3,008	3,028	3,815	Dry	
2	do	Engle No. 1	1,666	2,820	2,860	3,004	Do.	
3	Hector	Callum	1,763	1,486	1,556	1,620	Salt water.	
3a	do	do	1,565	2,337	2,381	2,484	Do.	
4	do	Adams	841	1,516(?)	1,617	2,150	Dry	
5	Dix	McNetton	1,230	1,959	2,016	2,156	Do.	
6	Orange	Wentz	1,170	2,080	2,152	2,002	Do.	
7	Reading	Webb	1,679	2,820	2,890	3,002	Do.	
8	Dix	Phelps	1,647	2,342	2,418	3,424	Gas show and salt water.	
9	Hector	Hill	1,685	1,468	1,557(?)	3,043	Salt water.	
10	do	Kellogg	1,852	2,945	3,018	2,993	Dry	
11	Montour	Honseworth	1,734	2,516	2,559	2,461	Do.	
12	Reading	Hines	1,987	2,380	2,455	2,431	Salt water.	
14	do	Whalen	1,381	2,248	2,319	3,470	Dry	
15	Tyone	Kress	840	1,701(?)	1,790	1,800	Gas.	
16	do	Wyss	1,221	1,698	1,758	4,459	Do.	
17	do	Best No. 2	862	1,732	1,792	1,845	Do.	
18	do	Arday	1,277	1,725	1,828	2,082	Do.	
19	do	Pulver	1,506	1,863	2,075	2,002	Do.	
20	Catharine	Coolbaugh	1,238	1,880	2,002	2,002	Dry	
		Hager	1,472	2,385	2,425(?)		Do.	

## Seneca County

1	Junius	Bump	489			1,208	Dry.
2	do	McGhane	520			1,320	Gas.
3	Seneca Falls	do	444			1,305	
4	Tyve	do	402			1,205	
5	Seneca Falls	do	407			1,360	
6	do	do	436			1,400	
7	Ovid	Chapman	898	251	1,134	3,106	Salt water.

WELL RECORDS

Steuben County

1	Urbana	982	1,473	2,257	2,343	2,780	Dry.
2	Wheeler	1,394	1,740	2,470	2,554	Do.	Do.
3	Prattsburg	1,345	1,364	2,100	2,145	Do.	Do.
4	Dalry	1,837	2,155	2,874	2,896	Do.	Do.
4a	Bath	1,082	1,910	2,679	2,710	Do.	Dry (no sand).
5	White	1,046	2,020	2,910	2,936	Do.	Salt water.
6	Erwin	1,624	3,865	3,790	3,826	Do.	Do.
7	Lilly	1,552	3,692	4,706	4,736	Do.	Do.
8	Canisteo	1,889	3,415	4,098	4,130	Do.	Dry.
9	Jasper	1,545	3,938	3,938	3,993	Do.	Salt water.
10	Greenwood	1,619	3,453	4,083	4,143	Do.	Do.
11	do	2,222	4,021	4,676	4,702	Do.	Do.
12	do	1,791	3,554	4,203	4,256	Gas.	Gas.
12a	do	2,016	3,816	4,496	4,538	Do.	Do.
13	do	2,079	3,880	4,514	4,550	Do.	Salt water.
13a	do	2,299	4,057	4,715	4,737	Do.	Do.
14	do	2,234	4,243	4,911	4,941	Do.	Salt water.
14a	do	2,284	4,043	4,698	4,728	Do.	Salt water.
15	Urbana	738	1,131	1,937	1,962	Gas.	Gas.
16	Bradford	1,680	2,395	3,336	3,388	Do.	Dry.
17	Thurston	1,195	1,944	2,562	2,890	Do.	Salt water.
18	Dansville	2,006	2,664	3,278	3,345	Do.	Do.
19	do	2,071	2,713	3,317	3,409	Do.	Do.
20	Howard	1,872	2,965 (?)	3,475	3,505	Do.	Dry. Shows of gas in Marcellus and Onondaga.
21	Pulteney	1,210	1,047	1,824	1,92	Do.	Salt water and carbon dioxide.
22	Woodhull	1,600	3,198 (?)	4,046 (?)	4,106 (?)	Do.	Salt water.
23	Rathbone	1,664	3,300	4,200	4,232	Do.	Do.
24	Thurston	1,267	2,448	3,245	3,268	Do.	Salt water.
25	do	1,360	2,400	3,304	3,316	Do.	Do.
26	Rathbone	1,537	2,600	3,687	3,721	Do.	Do.
27	Hornby	1,052	1,941	2,968	3,008	Do.	Do.
28	Wayne	895	1,547	1,473	1,548	Do.	Salt water.
29	Thurston	1,331	2,525	3,363	3,374	Do.	Do.

Tioga County

1	Owego	925	2,280 (?)	3,976 (?)	3,988 (?)	4,130	Dry.
	Pumpelly						

Records of selected wells drilled to the Onondaga limestone or deeper prior to 1936—Continued

Tompkins County

No. on pl. 5	Town	Farm	Approximate altitude above sea level (feet)	Depth (feet) to top of—			Total depth	Status
				Tully limestone	Onondaga limestone	Oriskany sandstone		
1	Lansing	Cayuga Rock Salt	410		936	1,012	1,964	Salt.
2	do	Farkas	850	195	1,425	1,653	6,210	Dry.
3	Ithaca	Remington	400	365	1,555	1,650	2,192	Salt.
4	do		396	440	1,694	1,772	3,185	Dry.

Wyoming County

1	Java		1,740		1,990		3,129		Do.
2	Arcade		1,665		2,144		3,280		Do.
3	do		1,500		2,130		3,265		Do.
4	do		1,860		2,500		3,778		Do.
5	Java		1,500		1,828		2,918		Do.
6	Middlebury		1,235		1,630		1,904		Do.
7	Covington		954		555			1,236	Salt.
8	do		946		555			1,241	Do.
9	Middlebury		992		770			1,540	Do.
10	do		983		770			1,436	Do.
11	Warsaw		1,099		935			1,609	Do.
12	do		1,098		956			1,668	Do.
13	Arcade		1,600		2,162		3,288		Dry.
14	Wethersfield		1,390		2,250		3,430		Do.
15	do		1,580		1,733		2,873		Do.
16	Java		1,148		1,339		2,400		Do.
17	do		1,102		1,253		2,323		Do.
18	do		1,224		1,355		2,424		Do.
19	Sheldon		979		989		2,059		Do.
20	do		1,315		1,275		2,364		Do.
21	do		1,483		1,404		2,485		Do.
22	do		1,248		1,160		2,191		Do.
23	do		1,049		1,151		2,155		Do.
24	Pike		1,490		968		3,388		Do.
25	Gainesville		1,952		2,061		3,508		Do.
26	Castile		1,600		1,952		3,208		Do.
27	Gainesville		1,515		1,821		3,105		Do.
28	Eagle		1,400		1,551		2,744		Do.
29	Warsaw		1,820		2,447(?)		3,626		Do.
30	do		1,125		1,230		1,701		Salt.
			1,324				1,870		Do.





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