

# Silurian Salt of New York State<sup>1</sup>

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## ABSTRACT

*The history of the salt industry of western and central New York covers more than 300 years. This industry depends on the Syracuse Salt Formation of the Silurian Salina Group. The Salina included, from the top down: Camillus gray shale, dolomite and gypsum, Syracuse salt (dolomite, shale, salt and anhydrite), and Vernon red and green shales. The salt zone thickens progressively southward to more than 1300 feet south of Seneca Lake and pinches out westward in Erie and Chautauqua Counties and eastward in Madison and Chenango Counties. Minor structures are superimposed on this stratigraphic wedge of saline sedimentary rocks.*

## INTRODUCTION

The making of salt in New York State dates back to 1661, but it was not until 1789 that the first regular commercial production of salt took place from the Onondaga field, near Syracuse, New York (Figure 1). Almost 100 years more passed before rock salt was discovered in New York State when on June 20, 1878, the Vacuum Oil Company struck rock salt in a well drilling south of the village of Wyoming, Wyoming County, New York. This well is better known as the Pioneer well.

The first salt shaft was completed in 1885 by the Retsof Mining Company in York Township, Livingston County. Salt was encountered at a depth of 995 feet. In the next twenty years (1885-1905), four other salt mines were established, three were in Livingston County and the other in Genesee County. It was not until 1917 that a sixth salt mine was completed in Lansing Township, Tompkins County.

At present, there are only two operating salt mines in New York State. They are the Cayuga Rock Salt Company, Inc. at Myers, Tompkins County, and the Retsof Mining Company, a subsidiary of International Salt Company at Retsof, Livingston County, New York.

Other salt companies produce salt by drilling to the salt beds and bringing the salt to the surface as an artificial brine. They are: International Salt Company at Watkins Glen, Schuyler County; Morton Salt Company at Silver Springs, Wyoming County; Solvay Process Division, Allied Chemical and Dye Corporation at Tully, Onondaga County; Watkins Salt Company at Watkins Glen, Schuyler County; West Shore Company at Ithaca, Tompkins County.

The salt beds of New York State are also being used for underground storage by the oil and gas companies. This interest was stimulated by the closeness of this type of underground storage

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to their New England and New York City markets. In 1952, the first well was completed into the Syracuse Formation in Cortland County, for the specific purpose of underground storage of LPG. This was drilled by the Suburban Propane Gas Corporation. In 1954, the Anchor Petroleum Corporation completed their first well in Steuben County for underground storage of propane and butane.

### Data Derived

The data for the study of the subsurface occurrence of rock salt beds were derived from wells drilled predominantly for gas into or through the Salina Group. For this report, it was necessary to rely mainly on well driller logs, due to the scarcity of geologic logs. It soon became apparent that the driller's logs varied in their salt calls. Some drillers would call the top of the salt, where the first mixture of salt and shale occurs, others, where the first salt bed was encountered, and a few would record individual salt beds. The base of the salt would be called in similar fashion. Because of the above reasons, the name Syracuse Formation will be avoided and 'salt zone' will be used in discussing the structural contour map and isopach map of the salt zone.

### Location

The beds of rock salt extend south of the outcrop belt of the Salina Group and underlie the post-Salina beds of New York. Exploratory drilling for natural gas and rock salt have established the westward extent of the underlying salt beds in eastern Chautauqua, southern Erie, and western Wyoming and Genesee Counties of western New York State. In eastern New York, salt beds have been encountered by drilling wells in western Madison County. Exploratory wells in eastern Madison County indicated the absence of the salt beds. It is believed that rock salt beds underlie the western part of the two counties south of Madison County and extend into Pennsylvania.

## GEOLOGY

### Stratigraphy

The commercial salt beds of New York State are entirely subsurface, due to solution at the surface by ground water, and occur in the Syracuse Formation of the Salina Group (Late Silurian Age) (Figure 2). Referring to the stratigraphic column (Fisher, 1960), it can be seen that the Syracuse Formation consists of interbedded shale, salt, dolomite, and anhydrite. Individual salt beds are not continuous over a large area and are apparently lenses that lie at different levels within the Syracuse Formation. The underlying Vernon Formation consists of red and green shale and the overlying Camillus Formation consists of gray shale, dolomite and gypsum.

In New York State, the Salina Group crops out a few miles south of Lake Ontario and is exposed from the Niagara River east through the city of Syracuse (Figure 1). South of here, the Salina Group dips beneath the younger Devonian formations. The regional dip of the surface beds is predominantly south at a rate of 25 feet to 60 feet per mile.

### Structure

In New York State, the salt zone is in the northern part of the Allegheny synclinorium. In Pennsylvania, there are rather prominent anticlinal and synclinal folds with axes trending north-east, or approximately parallel to the long axis of the Allegheny synclinorium. These folds are less pronounced and generally decrease to the north as they enter New York State, so that they are hardly perceptible in northern Allegany, Steuben, and Schuyler Counties.

In the past thirty years, numerous wells, drilled for Oriskany gas in the Southern Tier counties of New York State, have proved the existence of anticlines, synclines, and faults. The faults generally parallel, but in places cross the anticlinal trends. The displacement by faulting is greatest at depth and gradually decreases upward, as there is often very little evidence of faulting at the surface. It is believed that the faults intersect the salt zone, but they have been omitted from the maps and cross-sections (profiles) due to the wide spacing of wells drilled to or through the salt zone. For the same reason, it was also not possible to project the anticlinal and synclinal trends on the structural map contoured on top of the salt zone, or the isopach map of



the salt zone. Therefore, the contouring on top of the salt zone is only an approximate structural contour map (Figure 3).

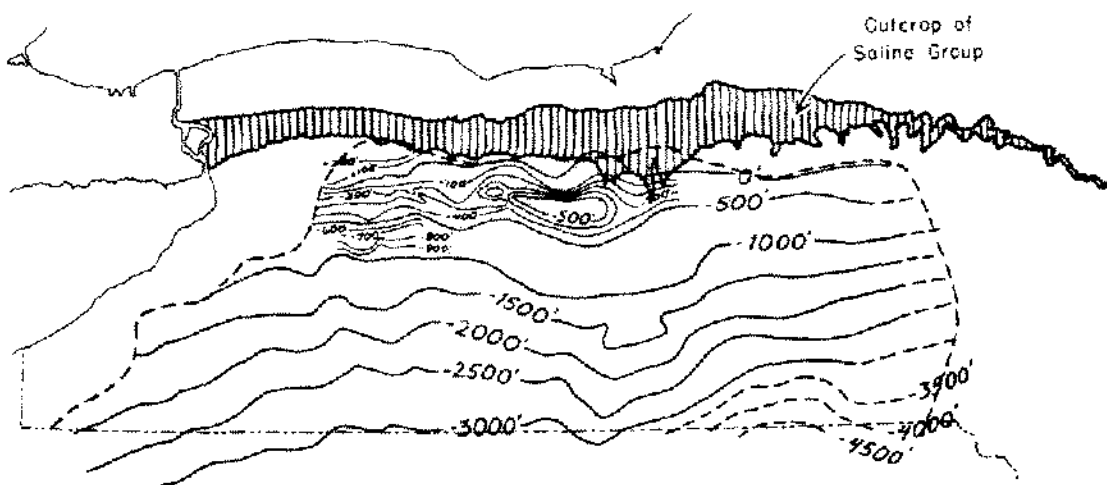


Figure 3  
Contours on Top of Salt Zone in New York

#### Structural Contour Map

Sea level is the datum used. The top of the salt zone is based on the occurrence of the first "vein" of salt or mixture of salt and shale appearing in the wells used for this report. The first bed of rock salt of commercial value may be 50 feet to 100 feet below the mixture of salt and shale. The base of the salt zone was picked where the last evidence of salt and shale mixture was recorded. The individual salt beds are not continuous over the whole area and are apparently lenses that interfinger laterally with the shales, dolomites, and anhydrites. A 500-foot contour interval was chosen in contouring the top of the salt zone because of the wide spacing of the wells. A 100-foot contour interval was chosen in the northwestern area where more wells gave better control.

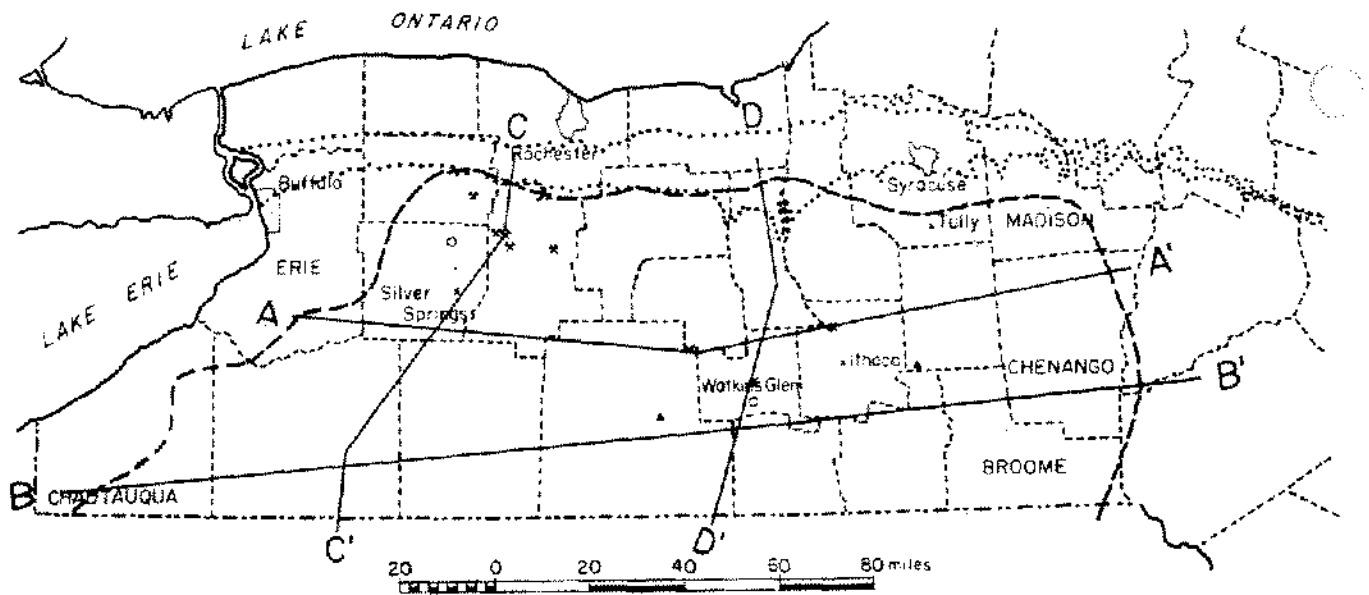
It is believed that the contouring on top of the salt zone is sufficiently accurate to permit a rough approximation of the depth at which the top of the salt zone can be expected. The area in which the greatest discrepancy will be found is in the anticlinal and synclinal area in southern Allegany and Steuben Counties.

#### Stratigraphic Cross Sections

The stratigraphic sections show the salt zone and other key horizons, such as the top of the Onondaga and Lockport Formations, in respect to the sea level datum plane. The locations of the stratigraphic sectional lines, each of which begin and end with a well, are shown on Figure 4. Figure 4 shows the locations of the two east-west lines of sections and the two north-south lines of sections.

The well record selected for the east-west sections that do not fall on line A-A' or B-B' are connected by a line drawn normal to the section line. The proper regional dip was used to bring such wells, with the key beds, to corrected elevations. Bends in the section line are indicated by a vertical line.

In western New York, the regional dip at the surface is estimated at 25 feet to 30 feet per mile in Erie County and increases eastward to an estimated 60 feet per mile in Otsego County. This was taken into consideration in compiling the east-west stratigraphic sections (Figure 5).



Index Map of Central and Western New York State  
Lines of Section

Figure 4

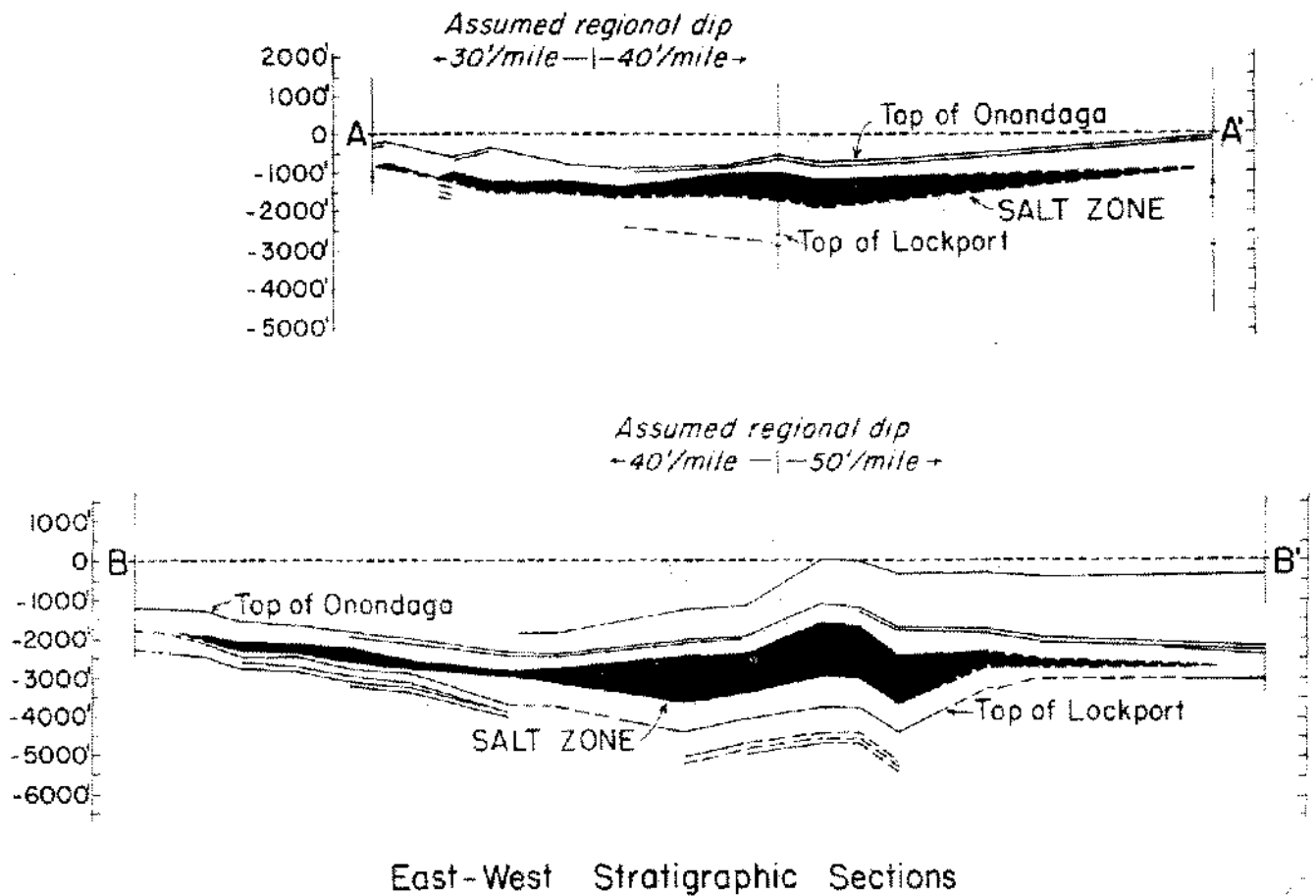
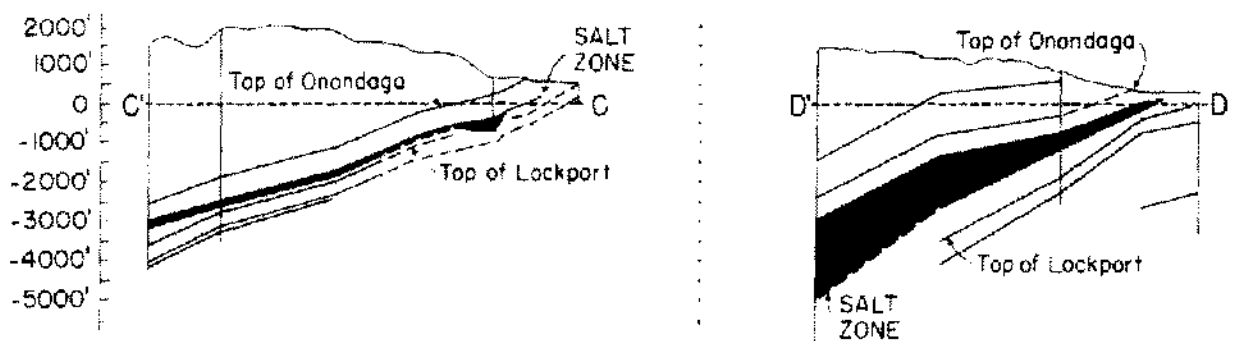


Figure 5

From sectional lines A-A' and B-B', it is apparent that the salt zone feathers out at its eastern and western extremities and has its maximum thickness in central New York. For instance, the Federal Land Bank No. 1 well, central New York, has a total thickness of 1,338 feet of the salt zone, with 1,010 feet of reported rock salt. One bed of rock salt is 548 feet thick.

In studying other key horizons, it becomes obvious that the interval between the top of the Tully and the top of the Onondaga decreases to the west. It is apparent that the east-west section lines indicate the interval between the top of the Onondaga and the top of the Lockport increases and decreases in direct proportion with the thickness of the salt zone.

The well records selected for the north-south sections that do not fall on line C'-C or D'-D are projected in the direction of the regional strike, a little south of east, to the point where they intersect section line C'-C or D'-D (Figure 6). Bends in sectional line are indicated by vertical lines.



North-South Stratigraphic Sections

Figure 6

The late Dr. H. L. Alling called the writer's attention to the fact that on line C'-C in the area of the Retsof mine, the most accurate thickness of the salt zone can be derived by combining the Sterling Diamond drill core and the Fuller shaft core which overlap. The two cores can be matched by correlating the base of the 18-foot salt bed at 1,074 feet in the Fuller shaft with the Sterling mine floor at 500.2 feet below sea level. Therefore, on line C'-C, the thickness of the salt zone in the Retsof mine will be more than that recorded by the Fuller shaft record alone.

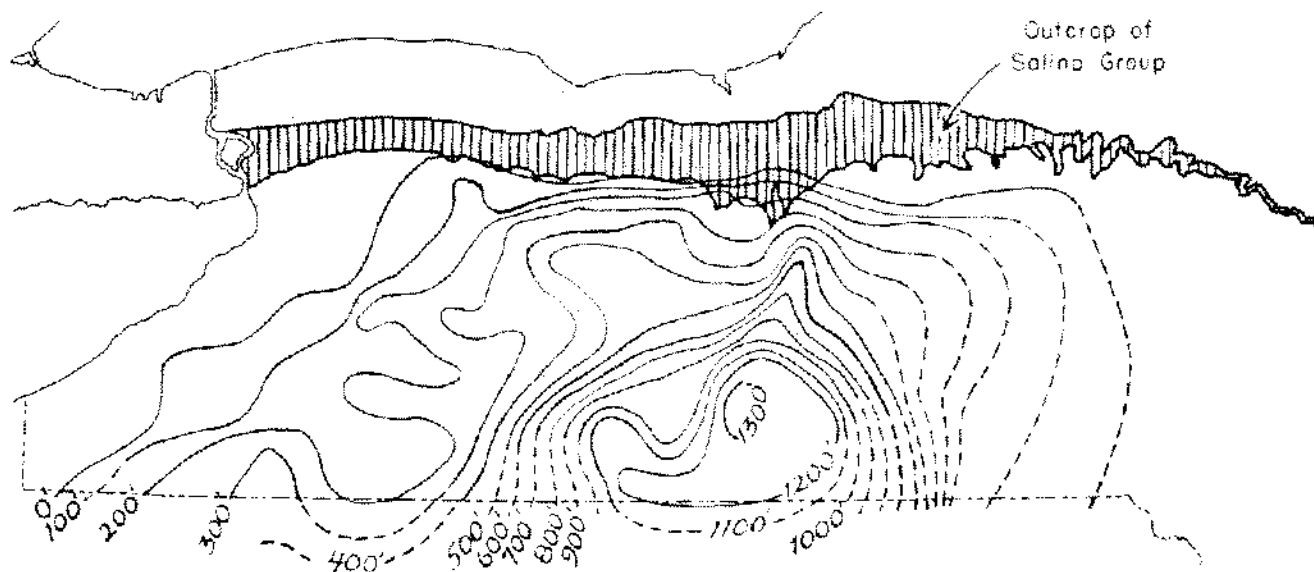
In examining section line C'-C and D'-D, it can easily be seen that the salt zone decreases in thickness and feathers out as it progresses north into the outcrop of the Salina Group. Also, the interval between the Onondaga and Lockport decreases to the north.

#### Isopach Map

On the isopach map, well data have established the western extent of the salt zone in New York, the northern extent of the salt zone being confined by the outcrop belt of the Salina Group. The eastern extent of the salt zone is partially defined and confined by scattered exploratory wells, and to the south the salt zone of New York State extends into Pennsylvania (Figure 7).

The isopach map shows the salt zone to have a maximum thickness of more than 1,300 feet south of Seneca Lake, with progressive thinning to the west, north, and east. It is interesting to note the axis of the Allegheny synclinorium is approximately where the maximum thickness of the salt zone is on the map.

It is believed that the isopach map is sufficiently accurate to indicate the minimum and maximum thickness of the salt zone. The area in which the greatest discrepancy will be found is the anticlinal and synclinal area in the Southern Tier counties.



Isopach Map of Salt Zone in New York

Figure 7

#### Conclusions

In 1960, the value of salt production constituted over 12 per cent of the total production value of all the mineral industries in New York State. New York continued to rank second in value with the other sixteen salt-producing states. In 1960, the value of salt produced was over 30 million dollars and the volume of production was 4 million short tons.

The U. S. Bureau of Mines prohibits the publication of the production data for rock salt, open pan salt and brine because the number of producers in each category was too small to conceal individual company figures.

Vacuum-pan production was 507,888 short tons with a value of \$11,432,974. The entire brine production was produced and used as a captive commodity by a chemical company. Salt produced in other processes was used for highway maintenance, dairy products, food preservation, seasoning, tanning, textile processing, water treatment, and other uses.

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