

MINERAL INDUSTRIES IN PARTS OF ONONDAGA, CORTLAND

AND TOMPKINS COUNTIES

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Central New York has had important production of industrial minerals and rocks for many years. In 1967 (Minerals Yearbook) the order of value of these products in Onondaga County was as follows:

- 1st Salt
- 2nd Lime
- 3rd Stone (also 3rd county in state)
- 4th Cement
- 5th Sand and gravel
- 6th Clays

Industrial minerals and rocks now being produced in the field trip area are described briefly. Those formerly produced are discussed in the following section.

Salt

The first commercial salt production was in 1788 from springs and wells near the south end of Lake Onondaga. Production continued for over 135 years, but amounted to very little after 1923 because of reduction in the salt content of the brine (Newland, 1921, p. 222). No bedded salt is known in the area, and the brine is thought to have come from leaching of salt beds to the south.

At the present time salt is mined by the Cayuga Rock Salt Company at Myers on the east side of Cayuga Lake and is obtained from brine wells in Onondaga Creek valley near Tully by the Solvay Process Division of the Allied Chemical Corporation. The International Salt Company operated brine wells until 1962 about a mile north of the Cayuga Rock Salt Company's shaft. Danger of water entering the mine from the brining operations may have been a factor in the termination

of production.

The Cayuga Rock Salt Company's mine is on the crest of the Firtree Point anticline (also called the Portland Point anticline). A folded and deformed bed of salt has been mined at a depth of about 1800 feet. Geological work by Dr. J. J. Prucha (1968) has demonstrated the presence of a decollement below which the salt beds are not appreciably deformed and mining conditions much better.

The Solvay Process Division of the Allied Chemical Corporation has produced salt brine from wells in Onondaga Creek Valley near Tully, about 17 miles south of Syracuse, since 1888. The brine is obtained from salt beds at depths of 1100 to 1400 feet below the surface and is piped to the company's plant at Solvay for use in the manufacture of soda ash products and chemicals.

According to Gordon French, Solvay Process Div. geologist, the Syracuse Formation is about 345 feet thick in the Tully area about half of which is salt in three or four beds. Gypsum, anhydrite, and shale are the chief impurities in the salt. No salt has been found in the Vernon shale below the Syracuse Formation.

The top contact of the Syracuse Formation is placed at a vuggy bed of dolomite not far above the highest salt bed. The Camillus Formation above the Syracuse Formation contains beds of gypsum but no salt beds, and gypsum beds are lacking in the Syracuse Formation.

How far the salt beds originally extended northward is not known. No bedded salt is known north of Route 20, but this may be largely a consequence of solution. Gordon French is of the opinion that the northern limit may have been near the present limits.

Formerly water was added to the wells to dissolve the salt. In recent years, however, enough ground water has been available to make addition of water unnecessary. As wells are depleted, new ones are drilled in the area, usually about four new wells are drilled each year.

The salt beds of the Syracuse Formation are of Upper Silurian age and occur in the Salina Basin throughout much of central and western New York. The large available reserves has made New York one of the leading salt producing states. In 1967 (Minerals Yearbook) the state ranked 4th in tonnage and 3rd in value of salt production in the United States.

Limestone

Limestone is used in central New York for crushed stone, lime and cement manufacture, and building stone.

Crushed Stone

Crushed stone quarries are located along the plateau front in Onondaga and adjacent counties in the Manlius and Onondaga Formations.

Stratigraphic Section to show the
formations quarried in the Syracuse area
(listed in order of age with the oldest at the bottom)

Formation	Member
Onondaga Limestone (75-80')	Seneca Limestone
	Tioga bentonite (8")
	Moorehouse Limestone
	Nedrow argillaceous limestone
	Edgecliff Limestone
	(may be several feet of sandstone at base)

Formation	Member
Oriskany Sandstone (generally absent but usually in some sandstone in base of Onondaga Limestone)	
Manlius Limestone (60')	Pools Brook Limestone Jamesville Limestone Clark Reservation Limestone Elmwood limestone and argillaceous dolomite Olney Limestone Thacher Limestone
Rondout argillaceous dolomite	
Cobleskill Dolomite	

The Tioga bentonite, the sandstone if thick, the Elmwood argillaceous dolomite, and the Rondout dolomite are not satisfactory for concrete aggregate and are not quarried. Also an argillaceous dolomite bed in the lower part of the Thacher Limestone is not satisfactory and limits quarrying downward for good quality stone. These problems will be discussed further at the quarry stops.

The old quarry of the Pennsylvania-Dixie Cement Company in the Tully Limestone near Myers in Tompkins County has been worked by the Cayuga Crushed Stone Company since 1961 (Minerals Yearbook). This quarry illustrates the value of a good location for marketing stone. It is the farthest south of the limestone quarries in the central and western parts of the state and is able to reach the market in the southern tier counties and northern Pennsylvania to best advantage. As a result of this, the quarry operation is unusual in the thickness of glacial overburden and shale that it is economic to strip to quarry the limestone.

See the descriptions of the quarry stops for additional information concerning the quarries visited.

Building Stone

Both the Manlius and Onondaga Limestone formations have been quarried for building stone in the Syracuse area. The Onondaga Limestone was used for the exteriors of a number of the older buildings, much of which was obtained from the large quarry just south of Syracuse on the Onondaga Indian Reservation. This quarry has been idle for many years. The Manlius Limestone has been used for foundations and walls and production still continues from this formation near Manlius. Present production is mainly for retaining walls, flagstone, and fireplaces, including some for house exteriors.

Lime

Old lime kilns are all that remain of the former widespread lime production in the Syracuse area. Luther (1895, p. 271-273) described lime production in Onondaga County in the late 1800's. The Manlius and Onondaga Limestones were quarried in many places along the outcrop in the Syracuse area for lime manufacture, but by 1914 the output had nearly ceased (Hopkins 1914, p. 28-29). At the present time only the Solvay Process Division of Allied Chemical Corporation produces quick lime and mostly for its own use.

Portland Cement

Both marl and limestone have been used for the manufacture of portland cement in Onondaga County. The plants that used marl are described separately below under the section on former mineral industries.

The Pennsylvania-Dixie Cement Company operated a cement plant near Myers in Tompkins County until 1948 using Tully limestone and Geneseo Shale for raw material. This plant is said to have been closed because of obsolescence. Some efforts have been made

in recent years to revive production at this plant but without results.

The Alpha Portland Cement Company has operated a cement plant for many years at Jamesville just south of Syracuse. This plant was rebuilt and enlarged in 1952 to have a capacity of 900,000 bbls. per year. Limestone is obtained from the Solvay Process Division of the Allied Chemical Corporation, and shale is quarried at the company's own quarry 1 and 1/4 miles east of Jamesville. Most of the shale used is from the Cardiff Member of the Marcellus Formation, some has been obtained from the underlying Chittenango Member. Use of the Chittenango Shale is limited because the presence of considerable pyrite makes the shale too high in sulphur for some of the types of cement manufactured.

Lightweight Aggregate

The Onondaga Lightweight Aggregate Corporation, formerly the Onondaga Brick Corporation, began operations in September 1954 at the Warners plant. According to W. D. Rogers, sales manager for the company, this is the oldest lightweight aggregate company in the State. Over a million tons of lightweight aggregate have been manufactured and sold during the past 15 years. The product has been used in concrete for many buildings in central New York and as far away as New York City and Buffalo.

Vernon Shale, obtained at the old quarry on the northwest side of Brickyard Road about 0.6 of a mile northeast of Warners, is used for the raw material. This is the same quarry previously worked by the Onondaga Brick Corporation for shale for brick manufacture. (See the quarry stop for description of the shale)

At the plant, which is located on the railroad about half a mile east of Warners, the shale is crushed, screened, and mixed with coal. It is then sintered on a 66-foot sintering machine at 2400 degrees F. for about 15 minutes. The coal burns out leaving the shale aggregate porous and partly vitrified. After sintering the chunks of material are crushed and screened to four sizes for marketing. Each size has particular uses such as for lightweight blocks, structural material, roof fill, concrete aggregate, bridge abutments, etc.

Pottery

Flower pots and urns, some of which are enameled or glazed, have been manufactured by the Syracuse Pottery Company since about 1875. The first plant was on Division Street in Syracuse. In 1920 it was moved to the present site about 2 miles east of Warners to be near the clay pit. The present plant was built after a fire destroyed the previous plant in 1947.

The clay used is dug from the bottom of the valley just west of the plant. Some is obtained from a swamp area and some from higher ground adjacent. Although the clay of these two sources differs somewhat in physical and burning properties, they are parts of the same deposit and probably were the same originally. To obtain the best results the two types of clay are blended. The clay from the higher ground burns redder and has higher shrinkage than the clay from the swamp area. Leaching of some calcium carbonate from the clay under the higher ground probably is the main reason for the different firing behavior. That leaching has occurred is indicated by the presence of small irregular calcium carbonate nodules in the

clay in places 2 or more feet below the surface.

The clay deposit is lens-shaped and occupies a depression in the bottom of the valley. Although the clay is not varved, it probably is of glacial origin.

Each year in June, after the water level has receded, the clay pit is pumped out and enough clay is dug in the course of a few days to meet the needs of the plant for a year. The clay is stockpiled and used as needed. About 8 feet of the clay is dug after stripping 6 to 10 inches of overburden. Although some clay occurs deeper, it is said to be too high in calcium carbonate to be satisfactory.

The clay is prepared for use by blending and mixing with pug mills and rolls. After the pots are shaped from soft clay on presses, they are fired in a tunnel kiln at about 1800 degrees Fahrenheit. A second firing is required for glazed pots.

Sandstone

The Finger Lakes Stone Company operates dimension sandstone quarries in the Enfield Formation, on the south side of Cascadilla Creek Valley, about 2 and 1/2 miles east of Ithaca. The old quarry was first operated early in the 20th Century to obtain stone for construction of Cornell University buildings and is still owned by the University. The Finger Lakes Stone Company began operating the old quarry about 1955. The stone is marketed widely in the state and has been used in buildings and walls at Syracuse University, Cortland State College, and many other places.

The stone is quarried in large slabs without blasting. Wedges are used to separate the slabs along joints and bedding. Usually the slabs consist of one bed of sandstone 6 to 12 inches thick bounded above and

below by layers of shale.

A considerable amount of the material quarried is waste. In places it is necessary to strip as much as 60 feet of overburden to obtain good stone. The company has acquired new property west of the old quarry where the amount of stripping is less.

The blocks of sandstone quarried are cut into the desired sizes and shapes in the mill using diamond and wire saws. Seam faced stone is bounded on at least one side by joint surfaces which give the stone a pleasing color and surface texture. Seam face production is obtained especially from parts of the quarry where vertical joints are numerous. Advantage also is taken of the interesting patterns produced on bedding surfaces by sole markings. Blocks with good markings are placed in structures so as to expose them to view.

Sand and Gravel .

Sand and gravel deposits of glacial origin are widespread and extensively worked in central New York. The quality of the sand and gravel is determined by the degree of weathering and the amounts of such unsound and deleterious materials as:

- 1) shale
- 2) clay in lumps or coatings on stones
- 3) other soft rock or rock such as siltstone that splits readily
- 4) calcium carbonate cement

The types of rock that compose the stones of gravel are dependent in a considerable measure upon the kind of bedrock in the area. Where shale is prevalent, it usually is common in the gravel. This is illustrated by the large glacial lake deltas in Onondaga Creek Valley southwest of Syracuse. The glacial meltwaters that deposited the gravel of these deltas flowed east-

ward along the edge of the plateau through shale areas and, as a result, the gravel is shaly.

The valley trains that occupy the bottoms of large north-south valleys south of the Valley Heads moraine constitute another large reserve of sand and gravel. The route of the field trip is over the valley train between Tully and Cortland where interesting features of these deposits are illustrated.

One of the surprising aspects of most of these valley train deposits is the high percentage of far-travelled stones such as crystalline rocks, limestone, and red Medina Sandstone. Although the valley trains are in valleys that have bedrock walls composed of shale, siltstone, and sandstone primarily, the amount of shale and poor stone in the gravel is surprisingly low. The meltwater from the melting ice transported the sand and gravel southward down the valleys frequently without a large admixing of local shale. As the gravel was transported by the streams, it was milled by the grinding action of the stones, and soft stones were progressively eliminated. Only the hard resistant stones have survived long transportation. This is well illustrated by the gravel along the Susquehanna River in the Binghamton area where sandstone, limestone, and gneiss from the northern part of the state are common.

In several of the large valleys, such as the Chemung River Valley, the terrace and kame gravels often are of poorer quality than the gravel in or near the bottoms of the valleys. If, however, the gravel deposit is so low that it is flooded periodically, the gravel may contain too much clay and silt to be usable.

Post-glacial alluvial fans formed by temporary streams in ravines on the sides of the large valleys also may interfere with working of gravel in

the bottoms of the valleys. The larger fans can be recognized on topographic maps by their shapes. Usually they are composed of blocks of siltstone, shale, and dirt unsuitable for anything but fill. The larger fans may cover considerable good gravel on the valley bottom and also may contaminate good gravel nearby.

Sand and Gravel of the Tioughnioga River Valley between Tully and Cortland

A large tonnage of sand and gravel underlies the Tioughnioga River Valley between Tully and Cortland. Zoning laws of the towns partly restrict commercial development of the gravel, and, therefore, information concerning the geology of the deposits is particularly important for locating the best available gravel.

Numerous gravel pits have been worked between Tully and Cortland, but most are small and were operated only temporarily. A number were worked during the period of construction of Route 81. At the present time two pits are operated about a mile north of Homer. A third active pit is located half a mile southeast of the city limits of Cortland. A fourth pit just south of Green Lake, near the moraine, is worked intermittently for bank-run gravel.

The limited subsurface information available indicates that the valley is underlain by about 200 to 250 feet of drift. Durham (1954, p. 31-32) mentioned a well at Little York Lake that reached bedrock at 220 feet, and a seismic survey at the south end of Tully Lake that located bedrock at a depth of about 225 feet. In the Cortland area bedrock may be somewhat deeper (Asselstine, 1946, p. 15).

Workable gravel is limited to the upper 30 to 50 feet of the valley

fill. At the operating pits north of Homer, sand and gravel are dug to a depth of about 40 feet to the top of a thick deposit of silt and clay. About half a mile south of these pits, where Route 81 crosses Route 11, test holes drilled by the Bureau of Soil of Mechanics of the State Department of Public Works showed sand and gravel to a depth of 39 to 45 feet with chiefly sand in the bottom 8 to 18 feet. The sand and gravel deposit is underlain by silt with some clay to the bottom of the deepest hole at 91 and 1/2 feet. Logs of wells in the Cortland area show the presence of two gravel beds each about 50 feet thick separated by about 100 feet of sandy silt (Asselstine, 1946, p. 17). The thick deposit of silt appears to be widespread below the upper gravel and limits the depth to which the gravel can be worked. This deposit of silt probably is a lake deposit formed after the deposition of morainic material in the valley of Fall Creek and Otter Creek southwest of Cortland blocked the previous course of the Tioughnioga River (von Engeln, 1961, p. 43-44). The overflow from this lake very likely escaped to the southeast over a divide between two tributary valleys. (Fairchild, 1925, p. 85; Muller, 1966, p. 2-3). In time a combination of filling of the lake basin and erosion of the divide drained the lake and the sand and gravel outwash was deposited.

The Valley Heads moraine swings southward to the west of the Tioughnioga Valley and during its formation outwash was brought to the Tioughnioga Valley through several tributary valleys, particularly Otisco Valley, Skaneateles Lake Valley, and Fall Creek-Otter Creek Valley. Some probably was also contributed by the tributaries that enter from the east. Each successive tributary southward tended to contribute coarser gravel

because of proximity to the ice margin, and, the grade size of the gravel in the main valley does not decrease uniformly southward from the moraine at Tully as might be expected. For example, gravel worked southeast of Cortland is coarser than the gravel worked north of Homer. This coarser gravel evidently came from the margin of the ice when it stood a short distance west of Cortland. Von Engel (1921, p. 60) noted that the alluvial fans built into the Tioughnioga Valley by outwash from the tributary valleys appear to indicate that outwash continued to come through these valleys longer than from the Onondaga Valley near Tully. He also pointed out that the outwash fans built up at the mouths of the tributary valleys on the west side of the Tioughnioga Valley have forced the river over to the east side.

The water table is close to the surface under much of the Tioughnioga Valley between Tully and Cortland. At the gravel pits just north of Homer, the water level is only 2 to 3 feet below the surface. Nearly all of the gravel there is dug from below water, and it is of better quality because of little or no weathering. In places, especially in the northern part of the valley, the water table is 10 to 25 feet below the surface. Much of this gravel above water does not pass state tests for concrete aggregate.

A few kames along the sides of the valleys predate the valley train gravels. They contain a high percentage of local shale and siltstone and are the Olean type of gravel (Moss & Ritter, 1962, p. 90-105) of poor quality. A good example of this type of gravel can be seen in a gravel pit worked for fill in a kame on the northwest side of Route 13 about 1.3 miles northeast of Cortland. In locating a gravel pit in the area between Tully and Cortland, it is especially important to take into consideration the various geological factors that might have influenced the quality and grade size of the gravel.

Industrial Minerals and Mineral Products Formerly Produced

Gypsum, bricks, natural cement, and marl for portland cement have been produced in important amounts in central New York. They are described briefly although only a few examples of these operations will be seen on the field trip because of insufficient time.

Some discontinued operations of mineral materials still produced are referred to above under the descriptions of the present-day operations.

Gypsum

The first discovery of gypsum in New York was in the town of Camillus in 1792. (Newland, 1929, p. 7). Although thin beds of impure gypsum occur in the Syracuse and Camillus formations of the Salina Group, the production of gypsum in the Syracuse area was limited to a layer 25 to 65 feet thick constituting most of the Forge Hollow Formation of the Bertie Group. According to Newland, (1929, p. 81) the quarries near Jamesville, Lyndon, Fayetteville, and Manlius were the leading quarries in the state for the production of "landplaster." The largest production came from a group of quarries in the hills north of Woodchuck Hill Road southwest of Fayetteville. Most of the gypsum was used as a soil conditioner. As this use was discontinued and purer gypsum was required for wall board and other uses, the quarries ceased to be operated about 1914 (Newland, 1929, p. 82). The bedded gypsum still can be seen exposed in the larger quarries near Lyndon.

Bricks

Although several brick plants have been operated in Onondaga County in the past, none remain in operation. The two largest producers were the Syracuse Brick Corporation and the Onondaga Brick Corporation. Both companies used Vernon shale for raw material.

The quarry of the Syracuse Brick Corporation was near Cicero, north of Syracuse, and the plant was in the north part of Syracuse. Production started in the 1850's and continued to 1959. The Onondaga Brick Corporation operated a plant and quarry at Warners a few miles northwest of Syracuse for many years. According to Luther (1895, p. 251), the company manufactured 10,000,000 building bricks annually in the late 1800's. Brick manufacture was terminated sometime prior to 1954 and in that year the plant was converted to the manufacture of lightweight aggregate. It is now operated by the Onondaga Lightweight Aggregate Corporation.

Natural Cement

Rock suitable for the manufacture of natural cement was first discovered in central New York in Madison County east of Syracuse about 1818 (Newland, 1921, p. 43). The cement rock was obtained from the Elmwood A and C beds of the Manlius formation (Hopkins, 1914, p. 28-29) which crops out in an east-west belt along the plateau front. The stratigraphic position of the Elmwood beds is as follows: (rock units listed in order of age from bottom up)

- | | | |
|-------------------|---|------------------------------------|
| | (| Pools Brook Limestone Member |
| | (| |
| | (| Jamesville Limestone Member |
| | (| |
| | (| Clark Reservation Limestone Member |
| | (| |
| Manlius Limestone | (| Elmwood Member |
| Formation | (| Elmwood C - argillaceous dolomite |
| | (| 3 to 4 feet thick |
| | (| |
| | (| Elmwood B - dolomitic limestone |
| | (| 4 feet thick |
| | (| |
| | (| Elmwood A - argillaceous dolomite |
| | (| 5 to 6 feet thick |
| | (| |
| | (| Olney Limestone Member |
| | (| |
| | (| Thacher Limestone Member |

The construction of the Erie Canal stimulated production and numerous small quarries were worked for the raw stone. Manufacture of natural cement was an important industry in central New York until about 1907 when curtailed by the growth of the Portland Cement industry. The natural cement industry in Onondaga County near the close of the last century is described by Luther (1895, p. 267-271).

Portland Cement from Marl

According to Eckel (1901, p. 863-866), T. Millen and Sons commenced producing portland cement from marl at Warners in 1886. The plant was purchased in 1890 by the Empire Portland Cement Company and almost completely rebuilt to obtain larger production. It was rebuilt again in 1901 and rotary kilns installed.

Operation of the plant continued until about 1908. Remains of the plant can still be seen on the north side of the old canal a few hundred feet west of Newport Road at Warners.

The marl was dug with a clam-shell bucket on a revolving derrick and was transported to the plant on a small railroad owned by the company. Plate 87 in Eckel's report is a picture of the pit operations. The process of cement manufacture also was described by Eckel (1901, p. 865-866) and illustrated by a picture of the plant (plate 88).

The marl bed covered several hundred acres about one hundred of which had been excavated by 1900. A section of the deposit where the clay and marl were dug, as given by Eckel (1901, p. 864), is as follows:

Muck	1'2"
Upper bed white marl	4'7"
Lower bed gray to brown marl	4'7"
Sand	0'1"
Bluish clay	2'5"

The average charge to the kiln was 25 per cent clay and 75 per cent marl. The marl ran 91 to 95 per cent CaCO_3 .

Another cement plant using marl was built in 1892 by the American Cement Company on the north side of the old Erie Canal about 5 and 1/2 miles west of Warners. This plant operated until 1900 when it was closed (Eckel, 1901, p. 861). The bed of marl worked is reported to be from 8 to 15 feet thick and to be underlain by blue clay which was dug for mixing with the marl.

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TRIPS E AND I: MINERAL INDUSTRIES IN PARTS OF ONONDAGA,
CORTLAND AND TOMPKINS COUNTIES

Newton E. Chute

STOP 1. - Finger Lakes Stone Company's sandstone quarry located on Quarry Road a short distance south of its intersection with Ellis Hollow Road, about 2 and 1/2 miles east of Ithaca.

The quarry is in the upper part of the Enfield Formation which is about 650 feet thick in the Ithaca area. Layers of sandstone alternate with layers of shale in the quarry. Slabs of sandstone are obtained without blasting by drilling holes on seams and separating them with wedges. The slabs are cut to the required sizes in the mill by diamond and wire saws. Pieces with good joint surfaces are used for seam face stone. Those with sole markings on bedding surfaces are used for special surface effects. The stone is laid in various patterns with different finishes, as illustrated by the exterior of the company's office at the quarry.

STOP 2. - Quarry of the Cayuga Crushed Stone Company on the east side of Cayuga Lake near South Lansing, about 5 miles north of Ithaca.

This is the old quarry in the Tully Limestone and the Genesee Shale that was worked by the Penn.-Dixie Cement Company until 1948. The quarry is on the crest of the Portland Point anticline above the Cayuga Rock Salt Company's mine. The Cayuga Crushed Stone Company reopened the quarry and has worked it for a number of years.

The Tully Limestone, which is 16 to 18 feet thick at the quarry, is underlain by fossiliferous Moscow Shale of Middle Devonian age and is overlain by unfossiliferous Genesee Shale of Upper Devonian age.

Two peridotite dikes have been known in this quarry for many years. They are marked on a map in the guidebook for the 31st annual meeting of the N.Y.S.G.A. sponsored by Cornell University in 1959. One is shown to extend for about 1700 feet across the southeastern part of the quarry.

A dike, 1'5" thick, is presently exposed in the southern part of the quarry face and for about 100 feet on the quarry floor. It diminishes in thickness to about 6 inches near the south end of the exposure. The dike is vertical and strikes N 5 to 10 degrees W parallel to a prominent set of joints about at right angles to the axis of the Portland Point anticline.

The first description of a peridotite dike in this quarry was by Sheldon in 1921. Other descriptions are by Martens (1924) and Broughton (1950).

A cluster of six or seven dikes each 6" to 8" thick was observed recently in the middle part of the quarry face by J. J. Prucha. He also knows of at least eight peridotite dikes in the salt mine below the quarry (personal communication, April 1970). Martens (1924) described this dike rock as kimberlite or alnoite depending upon the presence of melilite, an essential constituent of alnoite. Broughton (1950) did not observe any melilite in the thin sections he examined and called the rock kimberlite.

Of particular interest at this quarry is the unusual thickness of glacial overburden and shale that it is economical to strip to quarry the limestone. At the south end of the quarry in particular, the depth of the stripping is several times greater than the thickness of the limestone quarried. The favorable location of the quarry for marketing stone in the southern part of the state is an important factor in making the unusual depth of stripping possible. Small quarries have been worked in the Tully Limestone in various places in central New York in the past, but this is the only one worked in recent years.

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STOP 3. - The Cayuga Rock Salt Company's mine shaft and the former plant of the Penn.-Dixie Portland Cement Company.

A brief stop will be made to observe the headframe of the Cayuga Rock Salt Company's mine and the remains of the old cement plant on the lake shore.

Return to Cortland and take Route 81 north to Tully. Turn off onto Route 80 and proceed to the brine well field in the bottom of the Onondaga Valley near Tully.

STOP 4. - Brine well field of the Solvay Process Division of the Allied Chemical Corporation.

Brine is obtained from wells about 1100 to 1200 feet deep that penetrate salt beds in the Syracuse Formation of the Saline Group. The brine is piped to the company's plant at Solvay for the manufacture of soda ash and chemicals.

A tour of the brine field will be conducted by Mr. Michael Slexak who is a geological engineer with the Solvay Process Division.

STOP 5. - Lunch stop at Clark Reservation State Park south of Syracuse.

The remarkable abandoned waterfall and plunge basin in this park were formed by a temporary river that drained a glacial lake in Onondaga Creek Valley when glacial ice blocked the drainage to the north.

The lip of the falls is on the Edgecliff Member of the Onondaga Limestone. The Nedrow and Moorehouse Members are exposed nearby at

higher elevations on the north and south sides of the plunge basin.

This is the type locality for the Clark Reservation and Jamesville Members of the Manlius Formation. These and other members of the Manlius, except the Thacher which is covered, are exposed along the stairway on the south side of the plunge basin. The section here is as follows:

Onondaga Limestone

17 to 18' Edgecliff Member, 2' of sandy limestone and calcareous sandstone at base.

-----Disconformity-----

Manlius Limestone

5'9" Pools Brook Member, dolomitic limestone

19' Jamesville Limestone, numerous stromatoporoids in upper 8 feet.

3'3" Clark Reservation oolitic limestone

9'10" Elmwood dolomite and dolomitic limestone member
2'7" Elmwood C argillaceous dolomite submember
2'9" Elmwood B dolomitic limestone submember
4'6" Elmwood A argillaceous dolomite submember

22' Olney Limestone to bottom of exposure.

STOP 6. - Limestone quarry of the Solvay Process Division of the Allied Chemical Corporation, located on the north side of the Seneca Turnpike just east of Jamesville.

This is one of the largest limestone quarries in the state and provides a good illustration of selective quarrying. The rock units quarried are as follows:

Onondaga Limestone Formation

Moorehouse Member
Nedrow Member
Edgecliff Member with several feet of sandstone at the bottom

Manlius Limestone Formation

Pools Brook Member
Jamesville Member
Clark Reservation Member

the quarry floor is at the top of the Elmwood Member below the Clark Reservation Member

The Clark Reservation, Jamesville, Pools Brook, and the noncherty part of the Edgecliff member have the highest purity, and they are quarried for use by the Solvay Process Division for kiln stone and for cement manufacture by the Alpha Portland Cement Co. The Onondaga Limestone above the Edgecliff Member is quarried for crushed stone. The sandstone at the base of the Edgecliff Member and the cherty part of the Edgecliff are stripped separately and wasted.

The Tioga Metabentonite, which is about 8" thick, overlies the Moorehouse Member and separates it from the Seneca Member above. The metabentonite is unsatisfactory in crushed stone and is stripped along with some of the Seneca Member where they occur at the south edge of the quarry.

Two reverse faults that strike about N 70 degrees W and dip southward offset the beds in the quarry a few tens of feet. Fluorite and calcite crystals have been found in fractures along the fault zones.

Additional points of interest to be seen on this quarry property are an old lime kiln, an old quarry worked for Elmwood argillaceous dolomite used for natural cement manufacture, and part of an old gypsum quarry in the Forge Hollow Formation of the Bertie Group.

STOP 7. - Split Rock quarry located at the west end of Split Rock Gulf Road about 0.7 mile southwest of the junction of Route 173 and Onondaga Blvd.

This quarry illustrates the influence of the unconformity at the base of the Onondaga Limestone on the amount of limestone available for quarrying. Here the Edgecliff Member of the Onondaga overlies Elmwood A unit of the Elmwood Member. The Clark Reservation, Jamesville and Pools Brook limestones, seen at the Solvay Process Division's quarry, were eroded prior to the deposition of the Onondaga Limestone.

Most of the floor of the bottom part of the quarry is on the top of the Rondout dolomite, about 33 feet of Olney and Thacher Limestone overlie the Rondout. Two or three stromatolite zones and a dolomite bed are present in the lower part of the Thacher. The upper part of the Thacher and the Olney are mainly the "drab and blue" type of alternating thin beds of dolomitic brownish weathering and purer gray weathering limestone. The Edgecliff Limestone at the top of the south side of the quarry contains some small coral reefs a few feet to a few tens of feet in diameter.

STOP 8. - Syracuse Pottery Company plant and clay pit. The plant is on the west side of Pottery Road about 0.9 mile north of its junction with Route 173 and 2.2 miles east of Warners.

This company, which manufactures mainly flower pots and urns from glacial clay dug a short distance west of the plant, has been operating nearly continuously since about 1875. The clay is dug to a depth of 8 feet after stripping 6 to 10 inches of topsoil. The part of the clay bed under a swamp has different firing characteristics from the part on higher ground. The part under the higher ground has been partly leached of calcium carbonate and this apparently causes the clay to burn redder and to shrink more than the clay

from below the swampy area. These two types of clay are blended to obtain the desired firing characteristics.

After the flower pots are molded by presses, they are fired in a tunnel kiln at a temperature of 1800 degrees F. Some of the pots are glazed and some are coated with colored enamel.

STOP 9. - The old portland cement plant of the Empire Cement Company and the marl pits. Ruins of the old cement plant can be seen on the north side of the old Erie canal a few hundred feet west of Newport Road at Warners. The water-filled marl pits are west of the plant between the canal and Canal Road.

This cement plant is historically significant because it was one of the early portland cement plants and because marl was used as a source of calcium carbonate. The plant was first built in 1886, and operated until about 1908. Depletion of the supply of marl suitable for cement manufacture may have been a factor in the plant closing. Two other cement plants that used marl were operated for a short time in this region. One was the American Cement Company's plant about 5 and 1/2 miles west of Warners and the other was at Montezuma north of Cayuga Lake.

STOP 10. - Plant of the Onondaga Lightweight Aggregate Corporation located about 0.6 mile east of Warners on the north side of the railroad.

Lightweight aggregate has been produced here since 1954. Some years previously the plant was used by the Onondaga Brick Corporation for the manufacture of building brick. The raw material is Vernon Shale obtained from an old quarry about half a mile north of the plant (Stop 11). After crushing the shale is sized, mixed with coal, and sintered on a sintering machine at 2400 degrees F. The sintered chunks are crushed and screened to four sizes for marketing. This plant is said to be one of the first lightweight aggregate plants in New York State. The product is marketed widely, especially in the central part of the state.

STOP 11. - Vernon Shale quarry of the Onondaga Lightweight Aggregate Corporation located in the hillside on the north side of Brickyard Road about half a mile northeast of Canton Street in Warners.

The quarry, which probably is in the upper part of the Vernon, exposes 25 to 30 feet of red and greenish gray shale. Gypsum nodules are present in the shale in places and also some small shiny black crystals of specular hematite. Usually the hematite crystals are associated with cavities that probably contained gypsum or salt. Some of the cavities are molds of salt hopper crystals. In places the red

shale contains very irregular patches of the green shale suggesting partial decolorization of the red shale.

This quarry is one of the few places in central New York where more than a few feet of the Vernon are well exposed for examination.

STOP 12. - Gravel pit on the south side of Lake Road, opposite the south end of Green Lake, about a mile west of Tully.

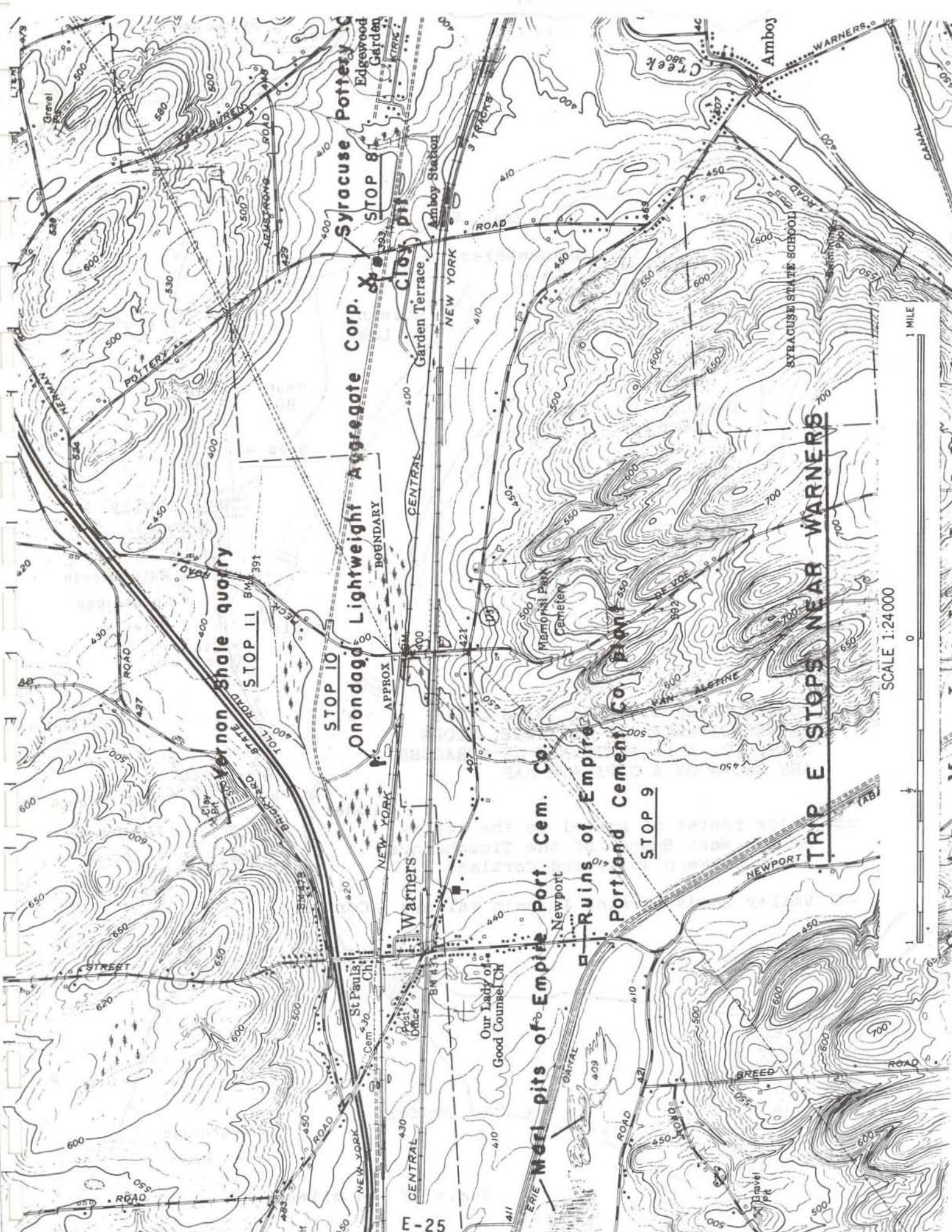
The pit is close to the Valley Heads moraine near Tully and has some interesting features. The gravel in the pit appears to have come from two different sources, probably because of diversion around the ice block that stood in the position of Green Lake. The gravel in the western half of the pit came from the northwest and is much lower in shale than the gravel in the eastern half which cross bedding and imbricate structure show came from the northeast. Shale is abundant in a layer 2 to 4 feet thick near the middle of the face on the east side.

STOP 13. - Stop on Route 281 at Preble to view the alluvial fan built in the main valley at the mouth of Otisco Valley.

STOP 14. - Gravel pit operated by the Cortland Ready Mix Company. This pit is on the west side of Route 11 about a mile north of the Homer city line. Entrance to the pit is opposite the end of Health Camp Road.

This pit, and the pit of the Concrete Materials Corporation nearby on the east side of Route 11, illustrate the kind of gravel available in this part of the valley of the West Branch of the Tioughnioga River. Gravel and sand are dug to a depth of about 40 feet below which is a thick deposit of silt and clay. Most of the gravel is dug from below water and is not weathered.

STOP 15. - Gravel pit in a kame on the northwest side of the valley of the east branch of the Tioughnioga River, about a mile northeast of Route 81. This pit provides a good illustration of the Olean type of gravel which is characterized by much local shale and siltstone. This type of gravel is of very poor quality and is usable mainly for fill. Varved clay exposed on the side of the kame may indicate the presence of a lake in the valley after the kames formed.



Syracuse Pottery
Edgewood Garden

STOP 8

Onondaga Lightweight Aggregate Corp.

STOP 10

Warners

STOP 9

Portland Cement Co. Ruins of Empire

STOP 11

Warners Shale quarry

Amboy Station

Garden Terrace

NEW YORK

Memorial Park Cemetery

NEWPORT

St. Paul's Ch.

Our Lady of Good Counsel Ch.

NEWPORT

Warners

Warners

Amboy

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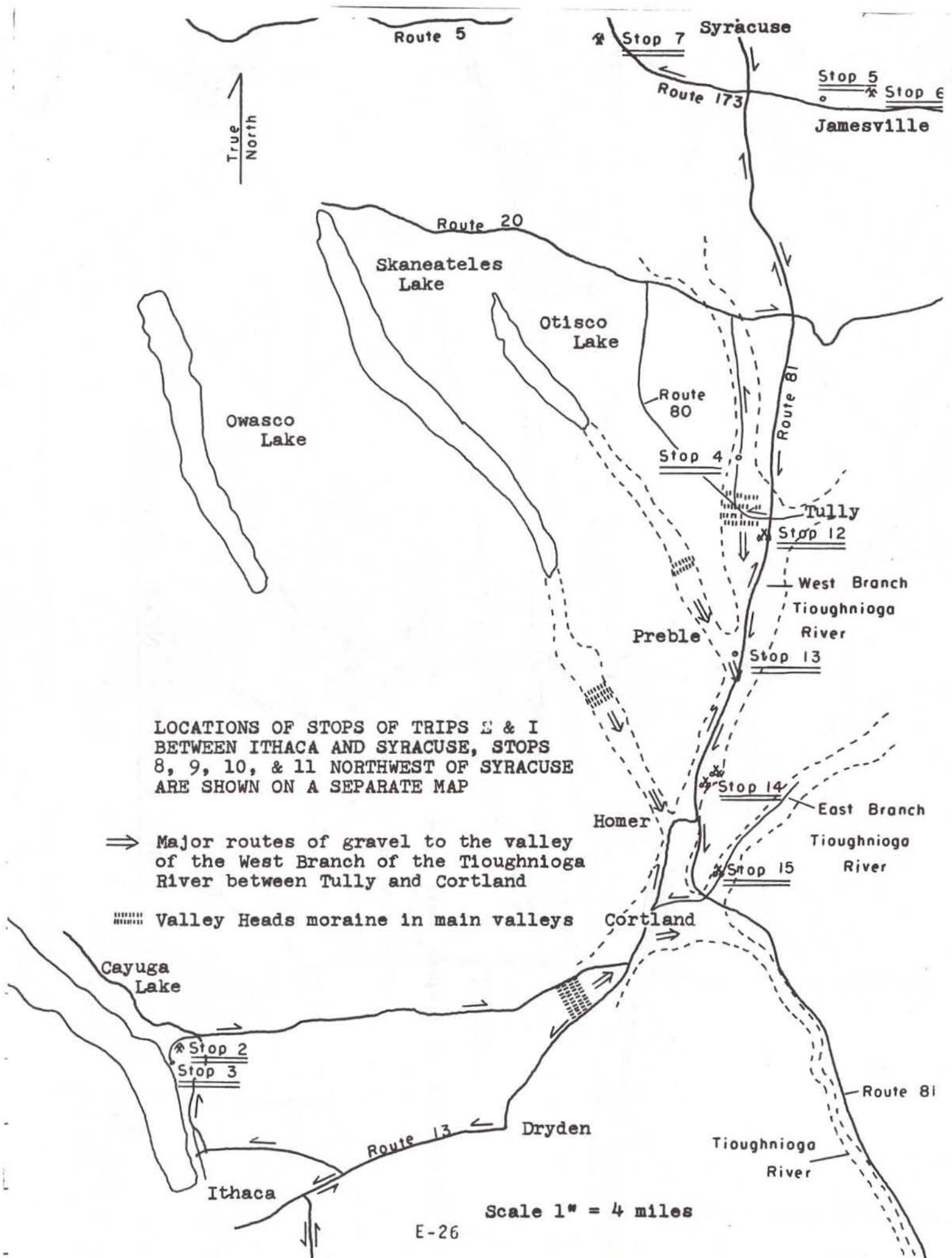
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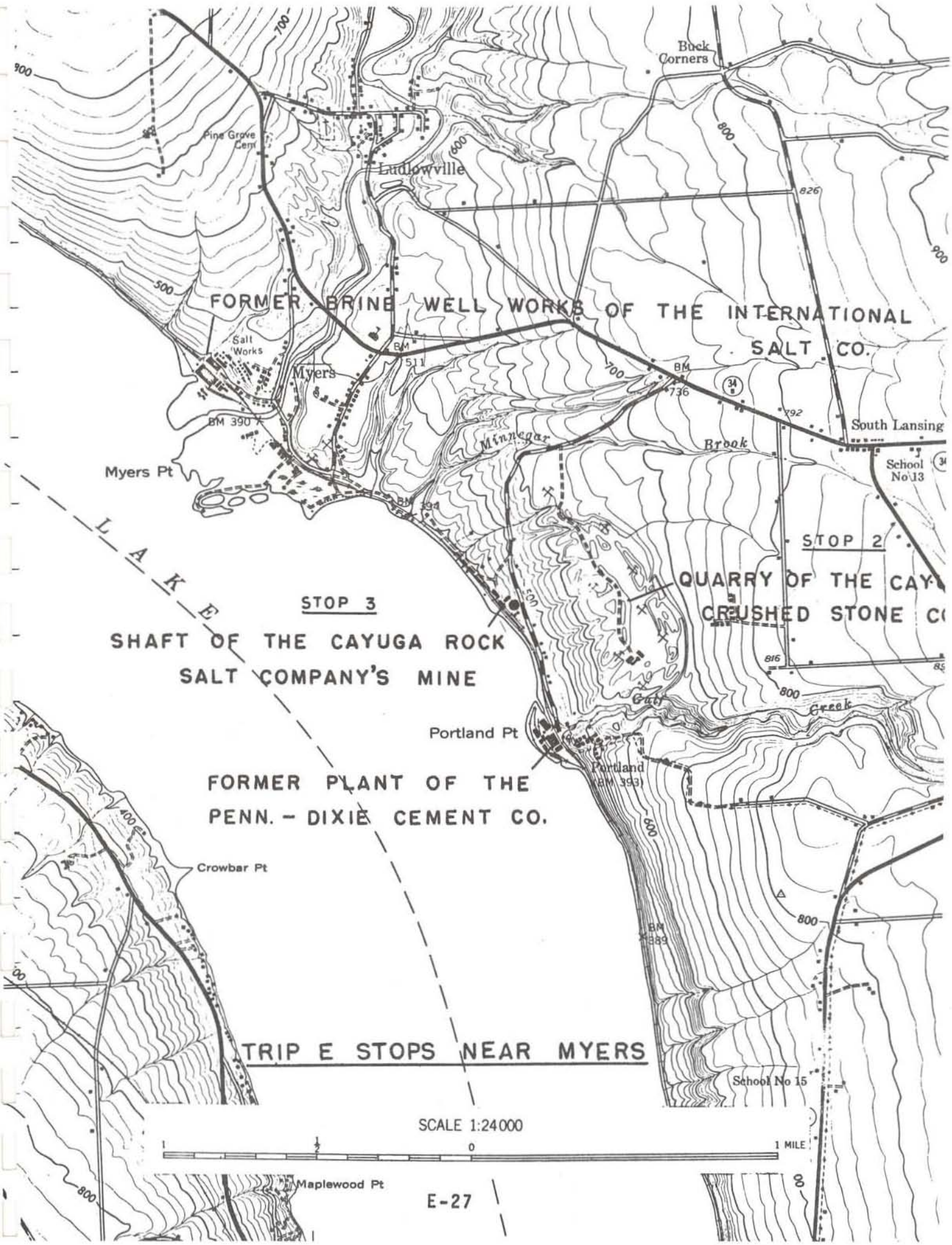


LOCATIONS OF STOPS OF TRIPS E & I BETWEEN ITHACA AND SYRACUSE, STOPS 8, 9, 10, & 11 NORTHWEST OF SYRACUSE ARE SHOWN ON A SEPARATE MAP

⇒ Major routes of gravel to the valley of the West Branch of the Tioughnioga River between Tully and Cortland

▨▨▨▨▨ Valley Heads moraine in main valleys

Scale 1" = 4 miles



FORMER BRINE WELL WORKS OF THE INTERNATIONAL SALT CO.

STOP 3
SHAFT OF THE CAYUGA ROCK SALT COMPANY'S MINE

STOP 2
QUARRY OF THE CAYUGA CRUSHED STONE CO.

FORMER PLANT OF THE PENN. - DIXIE CEMENT CO.

TRIP E STOPS NEAR MYERS

SCALE 1:24000

1 MILE

E-27

