THE ECONOMIC GEOLOGIC SETTING OF WESTERN NEW YORK

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Introduction

The geologic setting of western New York State does not support a diversified production of economic minerals. The somewhat austere local setting is not conducive to the production of large quantities of metallic minerals although such species as sphalerite, galena, cerussite and pyrite are known in the local stratigraphic column. Just a few miles to the north and across the international border a distinguished list of produced metallic minerals can be compiled, but these minerals occur in the crystalline rocks of the Canadian Shield. Nevertheless, western New York is a producer of some natural mineral and rock products and is a major consumer of a wealth of natural mineral products from throughout the world. It is the intent of this paper to point up some of these considerations.

Production

Excluding natural gas, petroleum and sand and gravel, mineral products which have been and are being commercially exploited in the eight counties of western New York include: dolomite and limestone, gypsum, salt, building stone (sandstone and bluestone) and silica. Gypsum is considered in another article in this guidebook.

STONE PRODUCTS

Crushed limestone-Crushed limestone is produced for use as concrete aggregate, road metal, asphaltic cement, railroad ballast, riprap and roofing material. Erie County in 1962 was the fourth largest producer of broken and crushed stone in the state. In 1965 the estimated production of crushed stone by the three major producers in Erie County is somewhat over one and three quarter million tons. At the current production rate, the largest producer estimates a reserve of material sufficient for 350 years. All production in Erie County is from the Onondaga limestone, the silica content of which ranges from 25-30%. Niagara County has three commercial producers of crushed stone who produce from the Lockport dolostone and Genesee County also has three commercial producers.

At one time natural cement rock was both quarried and mined in the Buffalo area, but this is no longer an active industry. Natural cement rocks or waterlimes are those which when burned, finely ground

and mixed with water yield cement. Recovery from natural cement rocks was the major source of cement until about 1918 when use of manufactured Portland cement became dominant. In 1926 a natural cement rock quarry was activated near Akron, New York and produced for several years. Natural cement rock for this operation came from the upper Salina (Bertie) formation (Newland, 1939).

Shale-Erie County lead the state in shale production until 1962 when it fell to second place. Most of the produced shale is used in the cement manufacturing industry but some is also used in the manufacture of building bricks and specialty products.

Dimension Stone- Although this commodity once supported a flourishing industry in western New York State, its importance has largely been replaced by the development of manufactured products including cement and asphalt.

Sandstone curbing blocks from quarries located near Albion and Medina and situated in the Medina sandstone were in common use throughout this area and also were shipped throughout the state and to such places as Cleveland and Cincinnati, Ohio and Indianapolis, Indiana. Around the turn of the century the quarries at Albion employed hundreds of men. Some of the Medina sandstone has been used in the construction of buildings and the Asbury Delaware Methodist Church at the corner of Delaware Avenue and Tupper Streets in downtown Buffalo is constructed of Red Medina sandstone from a quarry at Hulberton in Orleans County. This quarry is still in operation and supplies replacement curbstone for the City of Buffalo.

The term "bluestone" was originally applied to the blue colored dimension stone which occurs in Ulster county in eastern New York, but it gradually evolved to cover most of the flagstone used in building which was produced in New York State irrespective of its color. At one time the counties of western New York had many bluestone quarries the greatest number of which were situated in Wyoming and Allegany Counties. Wyoming County had the only large operations and these were located near Warsaw and produced from the West Falls Group. Actually bluestone for use on the St. Joseph's School on Main Street in Buffalo as well as the lower portion of the National Guard Armory on Delaware Avenue in the City of Tonawanda are products of the Warsaw quarries. Some bluestone operations were located in Cattaraugus and Chautauqua counties, but similar to the operations in Allegany County, they were quite small and often supported the efforts of only one or two men.

Through the years the demand for this type of building material has gradually declined to the point where sources in this area are now almost non-existent. It is interesting to note, however that in 1962 a small operation near Portageville was still actively quarrying bluestone for use in buildings and monuments. Part of that year's production was used in facing of a hospital in New York City and some was used for monuments in Arlington National Cemetery.

Limestone was at one time quarried as a building stone, but quantitatively was of limited significance primarily because of the varying quality of the Onondaga limestone. Among other things, the locally high chert content of this formation makes the material difficult to process. At one time the Buffalo area had several active limestone quarries however which supplied local construction as well as some export. Hayes Hall, the administration building on the Main Street campus of the State University was constructed from native stone taken from a quarry which was located at the northeast corner of the campus near the intersection of Main Street and Bailey Avenue. Many of the other older buildings on the campus are also constructed of Onondaga limestone.

SALT

Salt holds the distinction of being one of the earliest commercially produced minerals in the State of New York. Although the first recorded recovery of usable salt from brine was in the vicinity of Syracuse, the quantitative center of salt production moved toward the west with the discovery in the 1860's that rock salt was present in the stratigraphic column. This discovery was made first in a well drilled at Vincent, New York and later in the drilling of a wild cat oil well at Wyoming in Wyoming county. The recorded thickness in the Wyoming well was 70' at a depth of 1270'. Several years following this discovery the first shaft was sunk to the salt horizon at Retsof, New York in Livingston County. Other shafts were opened to the salt horizon in the period from 1885 to 1900, but most of these did not survive. The Retsof mine is still producing and is alleged to be the largest producer of rock salt in the world.

The Salina formation of Silurian age yields all of the salt produced in western New York. Salt horizons within the Salina are found below the Camillus and apparently thicken to the east (Newland, 1919). All of the accumulated data on the salt beds comes from either drill cores or mines and much still remains to be learned of its total organization.

The salt horizons thin and terminate toward Lake Erie and subsurface data indicate that any recovery of salt in Erie County is not likely. Alling (1928) indicated his belief that the salt beds of New York State were probably continuous with those of Ohio, but that the Salina salt of Michigan comes from a different basin. He thus hypothesized at least two major basins of accumulation for the salt and related the genesis of the salt to an upwarping which isolated portions of a shallow saline sea. Recharge of water was believed to be from intermittent contact with the sea and by stream drainage into the saline basin. Evaporation of water from the basin took place under desert conditions but it was never evaporation to completion and Alling appeals to a number of interrupted cycles. Whether accumulation in each of these major areas occurred in a single basin or in numerous isolated basins cannot be defined without further subsurface data. In a later more detailed study, Alling and Briggs (1961) define three distinct evaporite basins separated totally or in part by a massive reef complex which physically isolated them from the sea but allowed saline recharge through intermittent connection with the sea according to the reflux hypotehsis.

The rock salt recovered from the New York mines is dark whitish gray and makes up about 95% of the recovery. It is interlayered with and contains isolated pieces of shale, limestone and calcium sulphate which total about 5% of the recovered volume. Although halite is the dominant salt, Alling (1928) indicates occurrences of sylvanite, carnallite, and polyhalite in the overlying and underlying rock units.

Mining at Retsof follows the room and pillar method with the pillars about 30' x 30' in size and spaced about 30' apart. This allows 75% or more removal from the desired horizon. The thickness of individual horizons in the Livingston County area are reported to be from six to twelve feet (Newland, 1919).

Salt has many obvious uses in its natural or purified state and everyone recognizes the importance of household salt, the salt used in agriculture and that used in refrigeration and curing. The use of salt as a raw material in the manufacture of chemical products such as sodium hydroxide, sodium carbonate, sodium and chlorine to mention but a few, and as a chemical in manufacturing processes is often lost sight of however, Much of the rock salt produced at Retsof is shipped directly to the chemical producing plants of the Niagara Frontier.

Mineral Consumption

Although the counties of western New York State have long contributed to the economic community in production, the geographic environment of this portion of the state has allowed it to burgeon in the use of mineral products from throughout the world. The Niagara Frontier is that somewhat loosely defined area in western New York which supports so much of the state's industrial wealth.

A complete tabulation of consumption data would be most revealing, but there are certain limitations to such a compilation, the greatest of which is the reluctance of consumers to publicly divulge their annual consumption figures. Over and above this, in addition to the most obvious consumers, the largest industries, there are a great number of local smaller consumers the evaluation of which would take a great deal of time. Therefore, only some of the more interesting and significant statistics are considered here.

Any industrial area requires a great amount of coal and the total annual consumption of coal in the Niagara Frontier must be extremely large. The Huntley Station of the Niagara Mohawk Power Corporation located on the Niagara River just opposite the south end of Grand Island was put into operation in 1916. At that time it was the largest steam generating plant in the United States and it is still the largest of four steam generating plants operated by Niagara Mohawk. Coal is brought to this station by train and lake freighter. In 1964 the consumption of coal at this plant was in excess of 1 1/4 million tons. Power generated at this plant is fed into a giant system and is disseminated throughout the state by the use of computers.

The Niagara Frontier supports several steel manufacturing companies among which the largest are the Bethlehem Steel Corporation's Lackawanna plant and the plant of the Republic Steel Corporation. The Bethlehem plant is the third largest steel manufacturing operation in the world and as such is a major consumer of raw materials. These two companies consumed in excess of 4 million tons of coal in 1964 and Bethlehem's 1965 estimated tonnage of coal consumption is over 3 1/2 million tons.

In addition to this, the steel companies use great quantitites of iron ore and the major producer in this area used over 5 1/2 million tons of ore in 1964 with 1965 tonnage estimated to be nearly 1 million tons over this. Limestone and dolomite consumption by Bethlehem is in excess of 1 1/2 million tons annually and fluorite ranges between 7,000 and 10,000 tons, all of which are impressive figures.

The Niagara Frontier supports a large abrasive production industry and in 1964 the tonnage of bauxite consumed was 269,360 tons. This was used in the local production of abrasive alumina grain. Approximately 99% of the tonnage of abrasive grade bauxite coming into the United States is shipped into the Niagara Frontier for processing. Over and above this, large quantitites of emery, garnet (mostly from Gore Mountain, New York) and natural abrasive diamonds are brought into this area each year to support producing consumers.

Silicon carbide is another abrasive which has long been manufactured locally. This hard crystalline material has the distinction of being the first man-made abrasive and its occurrence in nature is still debated. It is manufactured in huge electric furnaces from 40' to 50' long which are charged with coke and sand along with some sawdust and salt. These furnaces are brought to 2000°C and held for approximately 36 hours to allow the crystallization of silicon carbide.

Although the above considers some of the major contributions to the consumption of naturally occurring mineral and rock products in this area, it is far from complete. These considerations could be further developed but what is presented here should emphasize the importance of the western New York setting in the total evaluation of certain aspects of economic geology.

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