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# GYP SUM AND ANHYDRITE

IN NOVA SCOTIA

*BY G.C. ADAMS*

*Information Circular 16*

**Cover Photo:** Gypsum and anhydrite cliffs,  
Plaister Mines, Victoria County.

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# GYPSUM AND ANHYDRITE

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*Information Circular 16  
Third Edition*

Nova Scotia  
Department of Natural Resources  
Mines and Energy Branches  
Halifax, Nova Scotia 1993





# Gypsum and Anhydrite

## Introduction

The word gypsum is derived from the Greek gypsos, meaning chalk. Anhydrite is merely gypsum without water. These minerals are formed through the evaporation of salt waters and are frequently found interbedded with limestone, dolomite and shale. Deposits of gypsum and anhydrite are found worldwide on all continents with the possible exception of Antarctica.

## Uses of Gypsum and Anhydrite

Approximately 75 per cent of the gypsum used in North America is calcined, meaning that three-quarters of the water has been removed by heating to form stucco or plaster of Paris.

Calcined gypsum is one of the most common building materials in the world. It is used for interior wall partitions and ceilings, either as plaster or in prefabricated products. Regular wallboard and type-x wallboard with its fire-resistant characteristics make up over three-quarters of the market for calcined gypsum. Minor uses for calcined gypsum include dental plaster, modeling casts, moulds, surgical casts and drilling muds.

Uncalcined gypsum and anhydrite are used in much the same way. After crushing and grinding, their principal use is as a set retarder for cement. When a small amount of gypsum or anhydrite is added to Portland cement, the set of the cement is slowed, but the tensile strength is not lessened. Another important use is

in the agriculture industry where gypsum and anhydrite have a beneficial effect on many crops. They can decrease the salinity of salty soils, improve the permeability of clayey soils and provide sulphur, calcium and catalytic support in order to decrease fertilizer use and maximize crop production.

Uncalcined gypsum is also used to a lesser degree as a filler in paints, as a flux in the smelting of certain nickel ores, in the manufacture of crayons, in asbestos packing gaskets and as a sculpture medium when in the form of alabaster.

Anhydrite has been used as a filling and packing material in the coal mining industry in West Germany since the mid 1960s. Natural anhydrite is crushed to less than 7 mm (30 per cent of which is dust), then mixed with water and an accelerator ( $\text{Fe}_2\text{SO}_4$  and  $\text{K}_2\text{SO}_4$ ) to form quick-setting, high strength roadside packs. Aerated anhydrite products may also be used to fill in cavities in mine roofs or spaces above road arches.

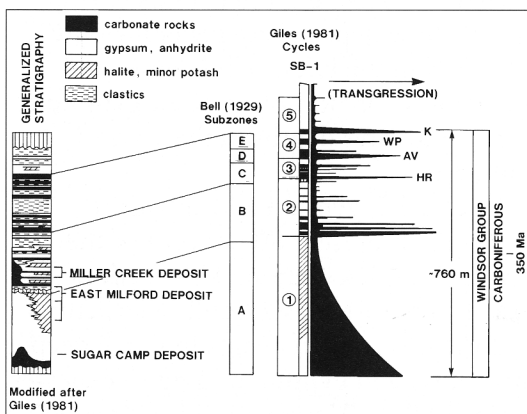
## **Nova Scotia's Resources**

Nova Scotia's gypsum and anhydrite deposits are among the largest workable deposits in Canada. Nova Scotia is the most productive gypsum mining region in the world. Gypsum outcrops throughout the whole of the northern half of the Province's mainland. Cape Breton Island also abounds with gypsum and anhydrite.

Areas in Nova Scotia underlain by gypsum or limestone often display a very rough terrain, having many pits and mounds. This karst topography is common even when the rocks themselves cannot be seen at surface and is a good indication of the presence of gypsum. The

most commonly recognized karst form is the sinkhole. Usually cone shaped and often partially filled with water, these can be seen in many places in Nova Scotia.

Virtually all Nova Scotia gypsum and anhydrite occurrences are of Carboniferous age (approximately 290-350 Ma) and occur almost exclusively within the stratigraphic unit known as the Windsor Group (Bell, 1929). The Windsor Group has five subzones, A, B, C, D and E, and the gypsum and anhydrite are closely associated with limestone and siltstone in all the subzones (Fig. 1).



**Figure 1.** Lithostratigraphy and major depositional cycles in the Windsor Group.

Giles (1981) divided the Windsor Group into five cycles instead of subzones. Each of these cycles is characterized by one or more transgressive-regressive cycles. These cycles roughly correspond to Bell's (1929) subzones.

The majority of the sulphate evaporites were deposited in Cycle 1 which represents a single rapid marine invasion followed by a slow regression of the sea. Cycle 2 also represents extensive

evaporite deposition, but consists of numerous transgressive-regressive sequences, all similar, but on a much smaller scale than Cycle 1. Minor deposits of gypsum and anhydrite also occur throughout the three remaining cycles.

The gypsum and anhydrite deposits of economic importance are confined to the Lower Windsor Group Cycles 1 and 2. Cycle 1 is the most extensive, with up to 300 m thickness of anhydrite.

Mifiable gypsum sections in Cycle 1 appear to have been formed by the hydration of the upper surface of these thick anhydrite bodies. Although sometimes reaching thicknesses of over 50 m, these deposits are generally only 10-30 m in thickness. Fault zones and geological contacts often allow gypsum to form at greater depths in the Cycle 1 anhydrites.

In Cycle 2, gypsum and anhydrite generally represent 80 per cent of the 75-150 m thick section. This section is usually contorted as a result of structural deformation which results in much deeper hydration and gypsum mining thicknesses of over 90 m. Along with this increased thickness, however, are increased volumes of interbedded limestone and siltstone, which must be removed from the gypsum ore before it leaves the mine site.

Several noteworthy occurrences of native sulphur have been found in the sulphates of the Windsor Group at Hilden, Colchester County, Pugwash, Cumberland County, and Dingwall, Victoria County. Little effort has ever been made to search for sulphur in the Province.

## **History of Gypsum and Anhydrite Mining in Nova Scotia**

The first mining of gypsum in North America was in Nova Scotia about the year 1770. Since that time, Nova Scotia has become the most productive gypsum mining region in the world. The early producers were almost all farmers from the Hants County area who owned land where gypsum occurred. They quarried the rock and took it via horse and wagon to the nearest shipping terminal. There, the gypsum would be sold to local traders and shipped to the Eastern Seaboard of the United States for use as fertilizer (*Photo 1*).

Realizing there was a good financial return to be made in the gypsum trade, the farmers became more serious about developing the business into more than just a part-time operation. By the early 1800s production in Nova Scotia had reached over 100 000 t per annum and stayed between 100 000 and 200 000 t for quite some time, fluctuating with the demand from the United States. The largest portion of Nova Scotia's gypsum was sent to the United States, so that country's gypsum requirements controlled Nova Scotia's industry.

The development of quarries in Cape Breton began in 1856 as newcomers to the trade were forced to establish quarries outside of Hants County in the hopes of finding new sources of rock. They were also successful in finding a new market and began shipping their product mostly to Quebec and Prince Edward Island. Hants County, however, continued to be the mainstay of Nova Scotia's production with 90 per cent of the Province's gypsum



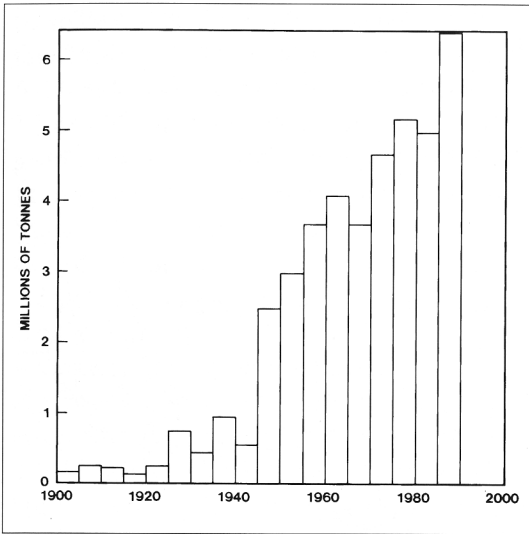


**Photo 1.** Gypsum production in the Cheticamp, Inverness County area, circa 1929.

still being exported from that area in the late 1800s.

Small mining companies cropped up during this time and mills to manufacture finished gypsum products were established in the Province. The establishment of processing mills was the result of new-found uses for gypsum. Until 1900 gypsum was used principally as a land plaster (fertilizer) and as a filler in paints. After 1900 it was used for plaster of Paris in architectural and decorative work, because it was superior to the awkward lime plaster previously used. Another new market for gypsum was as a cement retarder to slow down the set of cement. However, a poor local demand for such products and a tariff imposed by the United States government on finished material entering that country forced the closure of these mills.

In the mid 1900s production increased dramatically with the invention of wallboard, more commonly known as gyprock. The gypsum industry in the Province continued to grow rapidly and first reached over one million tonnes production in 1939 (*Fig. 2*). Unfortunately for the small producers, this industry success meant the downfall of minor operations. Due to the low profit



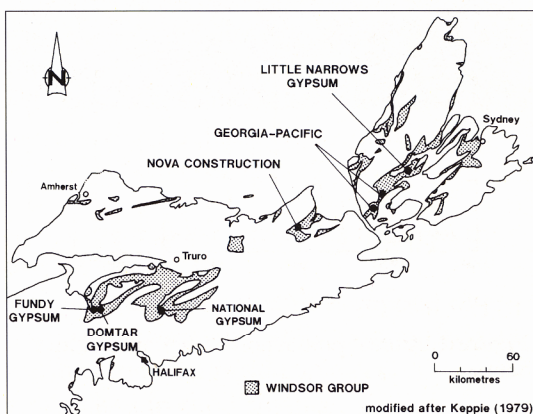
**Figure 2.** Annual production of gypsum in Nova Scotia.

per tonne of gypsum the small companies gave way to the large producers. Also, through time and refined production techniques, employment in the industry has been affected dramatically. Today there are seven companies mining gypsum in Nova Scotia, four less than were operating 75 years ago. The industry is now producing over 5 Mt, more stone than in the 1920s, while employing 200 fewer workers.

## Present Day Operations

Six companies have gypsum and anhydrite quarries in Nova Scotia, the largest being that of National Gypsum (Canada) Limited located at East Milford, Halifax County (*Fig. 3*). National's 1990 production was 3.2 Mt from a single open-pit making it the most productive gypsum quarry in the world (*Photo 2*). Following crushing and screening, the stone is transported by unit train 42 km to port facilities at Wrights Cove near

Halifax. Ocean going ships, generally between 18 000 and 40 000 t capacity, carry gypsum to markets in Central Canada and the Eastern United States from Portsmouth, New Hampshire, to New Orleans, Louisiana.



**Figure 3.** Present day gypsum producers, Nova Scotia.



**Photo 2.** National Gypsum (Canada) Ltd.'s East Milford Quarry.

Fundy Gypsum Company Limited, a subsidiary of U.S. Gypsum, produced 1.5 Mt of stone from its two quarries near Windsor, Hants County, 1990. Although most of their gypsum is wallboard grade stone, they also produce high purity, white gypsum and anhydrite products. Their stone is moved by unit train 16 km

to shipping facilities at Hantsport. These facilities are capable of loading at a rate of 6500 t per hour in order to cope with a 12 m tidal range at the dockside. Ocean-going vessels take gypsum from Hantsport to various ports in the United States from Boston, Massachusetts, to Galena Park, Texas.

Little Narrows Gypsum Company Limited, another subsidiary of U.S. Gypsum, is located on tidewater at Little Narrows, Victoria County, on Cape Breton Island. Their 1990 production of 1.0 Mt is noteworthy since operations are shut down for three months each year due to the freezing of Bras d'Or Lake. Stone is moved by conveyors onto ocean going ships for transport to various ports in Central Canada and along the Eastern Seaboard from Boston, Massachusetts, to Houston, Texas.

Georgia-Pacific Corporation operates two quarries at Big Brook and Sugar Camp, Inverness County on Cape Breton Island. In 1990 they produced just under 1.0 Mt of gypsum which was moved 32 km by unit train from Big Brook and 11 km by truck from Sugar Camp to loading facilities at Port Tupper. A company owned ship carries the stone to Georgia-Pacific plants along the Eastern Seaboard.

Domtar Gypsum operates a quarry and a calcining plant in Windsor, Hants County. In 1990 about 9000 t of stone were shipped from their quarry at McKay Section, 24 km east of Windsor. Fine plaster products are shipped to markets mostly in Central Canada.

Nova Construction has recently developed a small, high purity deposit at Brierly Brook, Antigonish County and produced 16 000 t in 1990.

Louisiana-Pacific Corporation announced in late 1988 that it would construct a \$64.5 million fibre gypsum wallboard plant at Point Tupper, Richmond County. Construction of the plant began in early 1989 and was completed in early 1990 (*Photo 3*). Full production on the first of two parallel lines in the plant was achieved by early 1991. The plant, operated by Louisiana-Pacific Canada Ltd., employs approximately 100 workers and the product is marketed by Louisiana-Pacific Corporation both locally and in the United States.



**Photo 3.** Louisiana-Pacific Canada Ltd.'s fibre gypsum wallboard plant at Point Tupper, Richmond County.

## **Resource Development Potential**

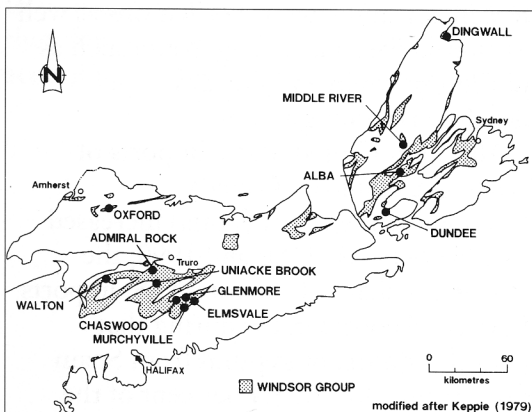
Potential for the development of additional gypsum and anhydrite resources in Nova Scotia is excellent. Investigations carried out by the Nova Scotia Department of Mines and Energy on these minerals, culminated in the publication, *Gypsum and Anhydrite Resources in Nova Scotia, Economic Geology Series 91-1*. The occurrence numbers listed below refer to this publication. This



volume gathers together information from surface exposures as well as subsurface data compiled from the Department's collection of assessment reports, open file reports and theses. A number of promising resource areas were identified by this study. They warrant additional followup work such as detailed surface investigation and diamond drilling to further determine their development potential.

**Gypsum High Potential Areas (Fig. 4):**

	Occurrence Number
Oxford, Cumberland County	0174
Chaswood, Halifax County	0128
Elmsvale, Halifax County	0159
Glenmore, Halifax County	0119
Murchyville, Halifax County	0163
Admiral Rock, Hants County	0144
Uniacke Brook, Hants County	0065
Alba, Inverness County	0031
Dundee, Richmond County	0014
Middle River, Victoria County	0074



**Figure 4.** Nova Scotia gypsum high potential areas.

## **Anhydrite**

Virtually all potential gypsum production sites in Nova Scotia are also potential anhydrite producers. Anhydrite bodies usually underlie the gypsum layers and in some instances are exposed at surface. Several past producing gypsum mine areas now lie inactive with large volumes of exposed, high purity anhydrite in the old quarry floors, in particular the old quarries at Walton, Hants County and Dingwall, Victoria County. At St. Anns-Bevis Bay in Victoria County, just east of the Village of Baddeck, large volumes of high grade anhydrite are present with numerous outcroppings seen throughout the area.

## **The Future of Nova Scotia's Gypsum Industry**

Approximately 90 per cent of the gypsum and anhydrite shipped from Nova Scotia is destined for the United States. This situation remains unchanged after more than two centuries of gypsum production. Due to this reliance on the U.S. market, Nova Scotia's gypsum industry is subject to competition from other nations as well as alternative sources of gypsum such as phosphogypsum and flue gas desulphurization gypsum.

Although United States imports of crude gypsum from Canada (predominantly Nova Scotia) increased steadily between 1980 and 1990, the Province's share of the total U.S. imports fluctuated considerably during that period. Imports of gypsum from Spain grew from a low of 3.4 per cent of the U.S. total in 1980 to a high of 12.6 per cent in 1986. These imports have since declined to 6.3 per cent in 1990. Even in

the face of stiff competition Nova Scotia's gypsum producers continue to do well.

Presently, more interest is being shown in developing the Province's secondary gypsum industry. The construction of Louisiana-Pacific Corporation's fibre gypsum wallboard plant should help to demonstrate to other major secondary manufacturers that similar projects can succeed here. Established infrastructure, assured resources and new initiatives should help to maintain Nova Scotia as a world leader in the gypsum industry.

## **Mineral Rights**

According to the Mineral Resources Act of Nova Scotia (1990) gypsum is not considered to be a mineral, however, a Mining Permit is required to mine gypsum in the Province. In Nova Scotia gypsum is owned by the property owner of the land on which it occurs. In many instances gypsum leases or rights are held by companies.

Gypsum production is subject to a provincial tax under the Gypsum Mining Income Tax Act. Anhydrite is considered to be a Crown mineral in Nova Scotia and therefore is subject to regulation according to the Mineral Resources Act.

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Nova Scotia



## Department of Natural Resources

Honourable Donald R. Downe  
Minister

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