# GYPSUM AND ANHYDRITE

FRANK A. WILDER, *North Holston, Virginia.*

On account of its importance in the building industry gypsum ranks as one of the most important non-metallic minerals. The output in 1926 was 5,635,441 tons[1]. Included with the mineral reported as gypsum was a small amount, perhaps 200,000 tons, of anhydrite.

Although there are extensive bibliographies dealing with gypsum and anhydrite[2], little has been said about the fact that many important gypsum deposits were originally anhydrite[3].

The growing importance of the gypsum beds of Nova Scotia, from which large quantities of the mineral are shipped to cities on the Atlantic seaboard, has led to careful study of these deposits and to considerable core drilling, and it seems safe to make certain generalizations based on the data thus derived. The relationships existing between gypsum and anhydrite in Nova Scotia seem to characterize also the deposits in New Brunswick, Newfoundland, and Prince Edward Island.

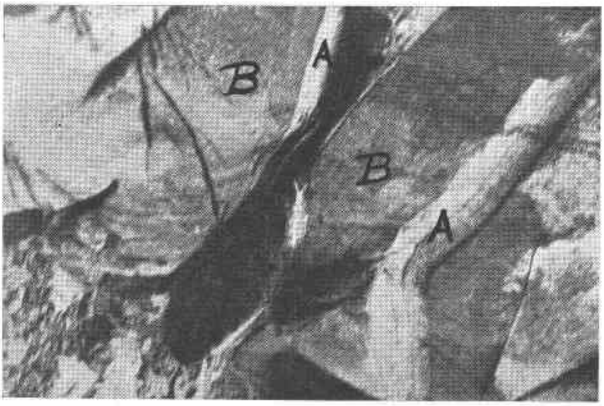


FIG. 1. Gypsum veins (A) in anhydrite (B) at cliff near mouth of Grand Codroy River, Newfoundland.

[1] Statistics of *Bureau of Mines*, quoted in article on Gypsum in *Mineral Industry*, Vol. XXXV, 335, 1927.

[2] The writer in a monograph on gypsum published by *Iowa Geological Survey* (Vol. **37**, pp. 44-536), lists 900 titles, and the Department of Gypsum and Lime, *Bureau of Standards*, has a card index of nearly 5000 titles.

[3] The possibility of a change from anhydrite to gypsum has recently been mentioned by Oliver Bowles and Marie Farnsworth, *Economic Geology*, Vol. **20**, No. 8, Dec. 1925.

In Nova Scotia anhydrite is generally found underlying the gypsum and very often the gypsum merely forms a veneer varying in thickness from a few inches to a few feet, over the anyhdrite. At times the gypsum extends to a considerable depth and the anhydrite rises in dyke-like bodies through the gypsum. More rarely the anhydrite is cut by veins of gypsum which run irregularly through the anhydrite which may be quite free from bedding planes. Figure 1 shows a portion of a natural exposure of gypsum and anhydrite that occurs near sea level at the mouth of the Grand Codroy river in Newfoundland. The greater part of the exposure consists of practically pure anhydrite. Running through this mineral are irregular veins of gypsum varying in thickness from two to six inches. It seems to be a fair inference that the whole mass was originally anhydrite and that water following along cracks has converted a limited portion of the anhydrite into gypsum. The conditions shown in figure 1 which characterize the entire exposure seem to make any other explanation difficult.

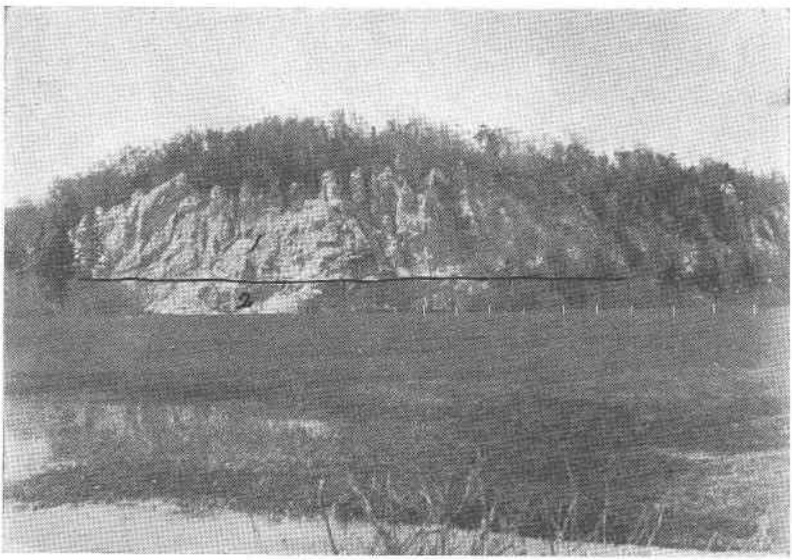


FIG. 2. Cliff at Cape North, Cape Breton, Nova Scotia, showing gypsum (1) and anhydrite (2).

It is of course well known that anhydrite slowly changes to gypsum under ordinary atmospheric conditions and in normal exposures the change is hastened by cracks which permit the penetration of surface waters. The change from anhydrite to gypsum would doubtless be observed frequently were it not for the fact that the solubility of gypsum is considerably greater than that of anhydrite and often the gypsum is carried away in solution as rapidly as it is formed.

Attempts have been made by the non-metallic section of the Bureau of Mines to convert anhydrite into gypsum on a commercial scale. The process involves the fine grinding of anhydrite with subsequent agitation in water and would be successful if gypsum did not exist naturally in large bodies so located that the cost of freight from such locations is less to all important markets than the cost of transforming anhydrite into gypsum.

The following letter from Southern Drilling Company, of Saltville, Virginia, indicates conditions which prevail generally throughout Nova Scotia:

Saltville, Va.
Nov. 3, 1927

*DR. FRANK A. WILDER, Consulting Geologist,*
*Beaver Products Company, Inc.,*
*North Holston, Virginia.*

DEAR DR. WILDER:

Regarding the gypsum drilling done by our company in Nova Scotia during the summer of 1926, and with reference to the anhydrite encountered, I wish to say that on the Cape North property, Victoria County, Cape Breton, the anhydrite was shown to underly the entire area of this deposit.

One drill hole, located at very low elevation, showed, after passing through about twenty-five feet of very fine quality gypsum, two hundred and seventy-five feet of massive anhydrite. The hole was discontined at this depth.

At one point, affected by the action of a small river, a clearly defined contact between the gypsum and anhydrite is shown. (Figure 2). This massive anhydrite flooring, so clearly exposed at this point, connected up by subsequent drilling data, is shown to lie very flat, dipping slightly north west.

Hoping this information may be of some interest, I am,

Yours very truly,

B. A. CHAPPEL

At least half of the gypsum deposits of the United States are associated with anhydrite. As a rule the anhydrite increases with the depth of the deposit. Interesting examples occur at

Centerville, Iowa, and in Smyth County, Virginia. In both of these deposits the original mineral appears to have been anhydrite which in some places has been wholly changed to gypsum while elsewhere it has been only partially altered. Figure 3 furnishes an interesting example from the mines at North Holston, Virginia. In this figure the fine grained background or matrix is anhydrite. The distinct crystals or phenocrysts are most abundant along small cracks in the anhydrite and are often dark in color due to the presence of some carbonaceous material. A block of the mineral that is quite dark becomes almost white when heated to 500°C.

FIG. 3. Phenocrysts of gypsum in fine grained anhydrite matrix. In places along cracks they are darkened by bituminous matter.

Often large masses are found in which the gypsum phenocrysts predominate, the fine grained anhydrite merely filling the spaces between the crystals.

From a practical point of view the association of anhydrite and gypsum is of the utmost importance. Since anhydrite lacks water of crystallization it cannot be changed to the hemi-hydrate by calcination. As is well known most of the gypsum used in building construction is calcined at moderate temperatures (usually 340°F.) after fine grinding. Calcined gypsum is plaster of Paris, though only a limited amount of the whitest material is put on the market under this name.

Most of the gypsum that is calcined is used in the manufacture of interior plasters. For this purpose a retarder is added so that the setting time of the plaster, when mixed with two parts of sand, is about five hours. Anhydrite and gypsum—anhydrite mixtures, are finely ground for use in agriculture, and are acceptable as retarder for cement by most cement mill chemists. Some clinkers high in alumina do not seem to be satisfactorily retarded by pure anhydrite. Gypsum-anhydrite mixtures, however, in which gypsum equals 40 per cent of the total, will satisfactorily retard cements with alumina content as high as 7.5 per cent.

Both gypsum and anhydrite, as well as gypsum-anhydrite mixtures, are useful in agriculture, for redeeming black alkali soils and as a source of sulphate sulphur in soils that may be deficient in this substance. The economic importance of gypsum, however, will probably be found in the future, as at present, in the usefulness of the calcined mineral in building construction, and for this reason a careful study of the relationships between gypsum and anhydrite is of the utmost importance.