A METAMORPHIC ORIGIN OF SELENITE.

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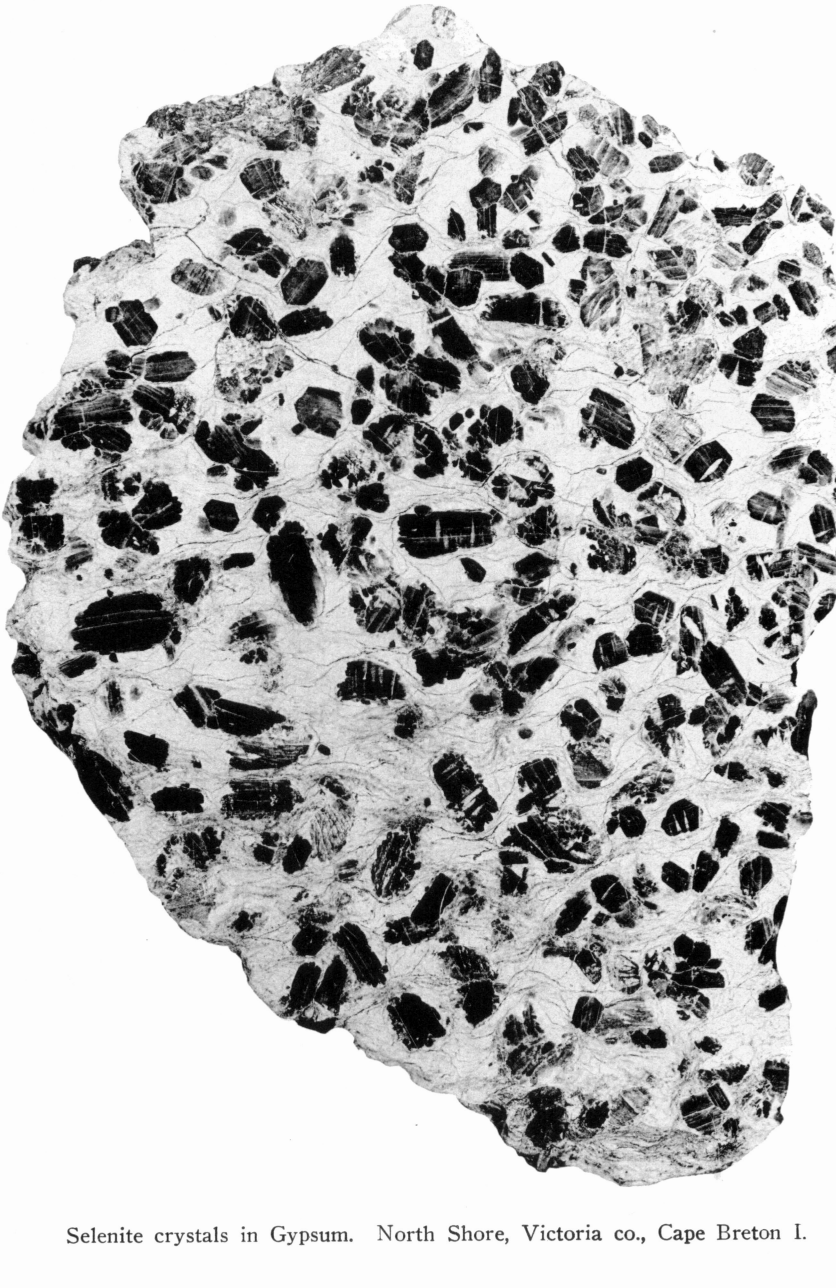
ABSTRACT. This paper describes the development of selenite crystals in gypsum beds that have been subjected to shearing stresses.

DURING the summer of 1940 the writer, working on Cape Breton Island for the Geological Survey of Canada, observed an interesting occurrence of selenite forming from gypsum by metamorphic processes. As he has been able to find little in the literature on such an origin of selenite, the occurrence seems worthy of brief description.

The locality is on the east shore of the northern part of the island, just east of North Shore post office, about 17 miles south of Ingonish village. On old maps North Shore is called Plaster Cove. There gypsum beds, which elsewhere are horizontal or nearly so, are locally folded into a tight syncline so that they have very steep dips and strike nearly due north. Thus they are successively beveled by the shoreline which runs north-northeast, and are excellently exposed on the faces of the sea cliffs which rise here to heights of 20 to 40 feet. At least five gypsum bands are visible.

The gypsum, a part of the Windsor series of Mississippian age, is interbedded with ordinary sediments—gravelly conglomerate and sandstone mainly, with a little shale and impure limestone. The drag of these sediments on the gypsum, in the adjustments necessitated by the folding movements, have sheared the gypsum over greater or lesser widths; and it is in the sheared parts that the selenite has developed.

Three beds of gypsum have their contacts exposed for study, and of these the central bed, 90 feet in thickness, affords the most typical phenomena. The western edge is well exposed, the eastern covered with drift. At the exposed edge, a width of about two feet is massive gypsum, without selenite crystals, which has obviously flowed under the stresses of folding. It contains numerous narrow discontinuous streaks of colorless selenite, paralleling the direction of shear. These are mostly less than one-tenth of an inch wide, and an inch or two in length, but a few have widths up to one-quarter inch, with correspondingly greater lengths. In the larger it can be seen that the platy selenite cleavage parallels the walls, but this could not be determined for the smaller, though it is presumably true.



Selenite crystals in Gypsum. North Shore, Victoria co., Cape Breton I.

In the next two feet, adjustment to stress seems to have taken place through a multitude of parallel closely spaced fracture planes rather than by flowage. This part contains none of the selenite streaks just described, but does have a beautiful development of selenite crystals. For some unknown reason they tend here to have long thin tabular forms, up to an inch or an inch and a half in length. They have no uniform orientation, but lie in all directions, many of them with their long axes at right angles to the fracture cleavage; hence they were undoubtedly formed after all shearing movement had ceased.

Beyond this zone, for a distance of 10 or 12 feet, the gypsum has not been uniformly sheared, but zones of fracturing surround nodules of relatively unfractured gypsum. These less fractured nodules contain numerous chunky, more or less equidimensional crystals of selenite. The remainder of the exposed part of the 90-foot bed contains no selenite. Presumably there should be some developed near the eastern contact, but this is covered, over a considerable width, by loose materials fallen from the cliff above.

A 5-foot bed of gypsum lies 100 feet or so to the east of the bed described. It has few features worth describing. The material is a crumbly, apparently structureless gypsum, which forms a matrix for chunky selenite crystals one quarter to three quarters of an inch in diameter. Throughout most of the bed the selenite crystals constitute about 25 per cent of the rock but near the eastern edge the proportion rises to about 40 per cent or more. There is a strong tendency for the crystals to form rosettes.

The bed lying to the west of the central 90-foot bed has a thickness of about 60 feet, and has been partly converted into selenite across its entire width. Rather singularly, the marginal phenomena are the reverse of those found in the 90-foot bed. The two-foot zone next to the edge is intensely sheared gypsum that serves as a matrix to crystal-filled nodules while the next two feet is material that has been subjected to flowage and carries thin streaks of selenite. The remainder of the bed is filled with coarse crystals of selenite that range in diameter from one to four inches, affording beautiful specimens for museum or other purposes. When looked at from a little distance, it can be seen that these large crystals fall into aggregates or separate masses several feet in length and three or four feet in width, with the long axes crudely parallel to the general schistosity. In their origin, therefore, they seem essentially the same as the smaller nodules, carrying numerous chunky crystals, that are surrounded by more highly fractured or sheared gypsum.

G. W. H. Norman has described[1] somewhat similar phenomena from the west coast of Cape Breton Island. He states:

> "Large crystals of selenite, in many cases arranged in rosettes, are particularly prevalent in the gypsum where it has been faulted or considerably disturbed. The two most conspicuous examples of this relationship are at the shore along the Inverness fault and in the cove between Beaton and Green points. At the former locality large rosettes of selenite, 1 inch or more in diameter, are developed in the gypsum at the faulted contact of the Windsor strata and Inverness coal measures, but are lacking in the overlying gypsum beds at a distance from the fault. At the latter locality gypsum is converted to a coarse-grained aggregate of selenite crystals, a half inch in size, where it is faulted to the south against conglomerate. Locally, where the gypsum has been subjected to pressure and has flowed, it has developed a banded texture of small parallel plates of selenite and a rude cleavage."

In the district examined by the writer, selenite crystals are confined to beds that have been strongly deformed; other beds lying flat or nearly so contain no selenite whatever. There are also, at North Shore, two thick beds tilted into vertical positions, that carry no selenite, but the cause of this variation in behaviour was not ascertained.

Both Norman's work and that of the writer indicate, therefore, that selenite can and does form from gypsum as an effect of deformation; and that the crystals, at least, did not form until shearing movement had completely ceased, so that pressures were presumably static. To a considerable extent, therefore, the process seems akin to the formation of crystalline limestone from the ordinary variety, though without the fairly high temperatures which the formation of crystalline limestone has commonly seemed to require.

[1] Geol. Surv. Can. Memoir 177, p. 72. 1935.

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