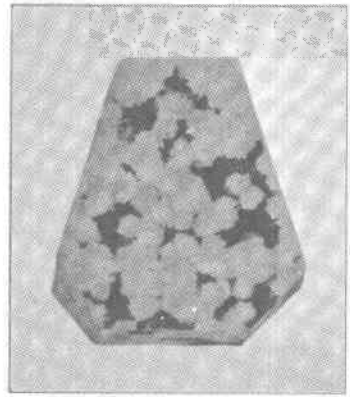
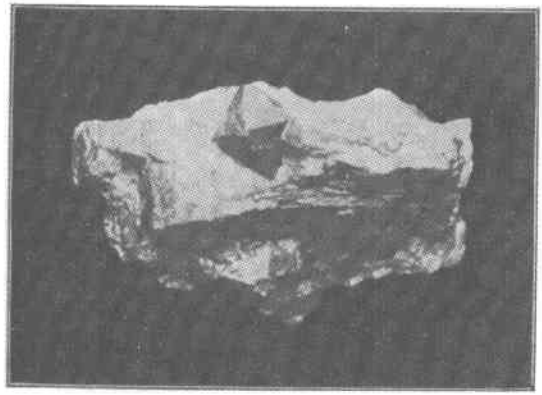
PLATE 7



CRYSTALS OF TRIDYMITE IN GLASS (NATURAL SIZE).
Described on opposite page.



QUARTZ, NEW YORK CITY (NATURAL SIZE)
From "The Minerals of Broadway," Bull. 3, N. Y. Mineralogical Club

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TRIDYMITE CRYSTALS IN GLASS

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In a recent paper, Le Chatelier[1] describes an example of devitrification of glass in which the formation of crystals of tridymite has occurred. The phenomenon took place under very unusual circumstances that were particularly favorable for the formation and growth of crystals. In a glass factory at Baccarat, France, work was interrupted on August 25, 1914, as a result of the occupation of the factory by German troops. The French workmen, with characteristic optimism, did not extinguish their fires but merely turned them low in the expectation of returning shortly. Twenty days elapsed before their hopes were realized and, in the meantime, the glass had been maintained at a temperature in the neighborhood of 800° C. The glass was found to contain crystals in radiating groups of thin plates, that were determined by Le Chatelier as tridymite.

Such exceptionally favorable conditions for the formation of crystals in glass are not likely to be duplicated. It is of interest to note, therefore, that in the mineral collection made by Professor William Nicol at Queen's University, there is a specimen of glass that shows exactly the same phenomenon. The crystals are in spherulite-like forms that are made up of thin plates in radiating groups very similar to those described by Le Chatelier but of smaller dimensions. The specimen had been cut into a conventional shape and polished and it was not desirable to break it, but with a file a small scratch was made on one edge where a group of crystals lay at the surface and the powder so obtained was examined in immersion liquids under the microscope. The crystals were thus found to have the optical properties of tridymite and the refractive index of the glass was found to be 1.56. This index corresponds with that of a light flint

[1] *Bull. soc. franc. min.*, **39**, 150, 1916.

made from the 1–2–3 batch, so called.[1] Thus, not only the crystals, but also the glass, proved to be identical with that described by Le Chatelier. The glass here described is said to have come from the Corning Glass Works, but I am unable to obtain particulars as to the conditions of its formation.

In discussing the significance of the finding of tridymite crystals in glass that had thus been held at an approximately constant temperature for twenty days, Le Chatelier points out that tridymite must be considered the stable form of SiO_2 for the temperature concerned, and rightly so. However, when he goes farther and concludes that tridymite is the stable form at all temperatures above the stability range of quartz, he ignores a great body of evidence that points to the stability of cristobalite at temperatures above 1470° C. Cristobalite cannot, of course, form as a stable phase in ordinary commercial glasses since, at 1470° C., they are all well above the temperature at which crystals of any kind can form in them. As a metastable phase cristobalite frequently appears in ordinary glasses at lower temperatures, but it will change to tridymite if the glass is maintained at these temperatures.[2] In special glasses from which the separation of silica can take place at temperatures above 1470° C., cristobalite is always formed at such temperatures.[3] It grows freely and persists indefinitely under these conditions. It may be repeated, then, that while Le Chatelier's example of devitrification proves the stability of tridymite at the temperature maintained in the glass furnace, no information whatever is given by it concerning other temperatures. The special glasses mentioned furnish information concerning the higher temperatures. They show that his extension of the stability range of tridymite to temperatures above 1470° C. is contrary to fact and that cristobalite is the stable phase at such temperatures.

[1] This designation refers to the proportions of the principal ingredients, one part K_2CO_3 or Na_2CO_3, two parts Pb_3O_4 and three parts sand.

[2] N. L. Bowen, The identification of stones in glass, *J. Am. Ceramic Soc.*, **1**, (9) 594–605, 1918.

[3] See any publication of the Geophysical Laboratory dealing with a system in which silica is one of the components.