CAPSULAR SILICA

FREDERICK A. BURT, *A. & M. College of Texas.*

OCCURRENCE

Three specimens of capsular silica have been collected by the writer from the Quaternary formations of Brazos County, Texas. Clastic fragments of petrified wood are very common in these formations, and much opal and botryoidal chalcedony is found as veins and incrustations with the wood. The Tertiary and Quaternary formations of the county are exceptionally rich in precipitated silica which occurs as quartz, chalcedony, and opal. These three minerals are found in the forms of petrified wood, veins, rock cement, silica-limonite hardpan, case-hardening, septaria, and melikaria.[1]

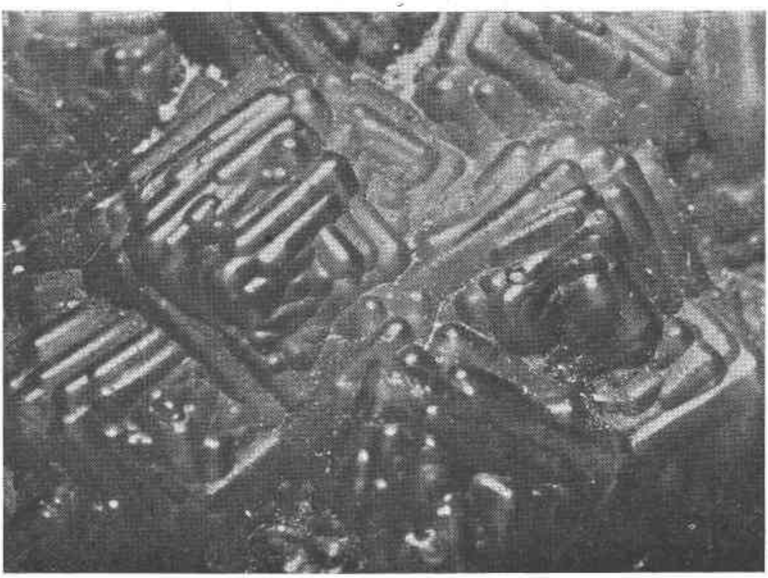

FIG. 1

A portion of the surface of the largest specimen. The photographed area is about 2 centimeters across and shows the whole, or the major part, of 4 cubes and parts of several others. Some of the cubes are complete, but the majority are only partly developed and interlock with the next adjoining cube.

[1] Burt, Frederick A., Melikaria: Vein Complexes Resembling Septaria Veins in Form, *Jour. Geol.*, vol. **36**, p. 539 (1928).

The capsular silica occurs as a layer occupying the position of a replacement of the bark of the wood. The layer averages 4 to 5 millimeters in thickness, with a maximum thickness of 15 millimeters. The appearance of the mineral is that of a group of fully, and partially developed isometric crystals of cubic habit, superimposed upon the free faces of which are regular capsules arranged in two systems at right angles to each other. The cubes are variously oriented, and interlock with one another (Figure 1). The individual cubes vary from 4 to 9 millimeters across, with an average nearer the larger number.

In close association with the capsular silica are found pieces of petrified wood incrusted with very much smaller cubes of quartz. The exposures of the formations containing these various forms of silica show efflorescences of halite and many cubic crystals of pyrite. These cubes of quartz are interpreted as pseudomorphs after one or the other of these minerals.

Physical and Chemical Characters

The mineral is translucent, and nearly colorless to pale blue in small pieces or thin sections. When viewed in mass a light agate blue is pronounced. The luster is similar to that of opal. No cleavage was observed and the fracture is typically conchoidal. Hardness of the capsules is 6.5. Specific gravity 2.63. They are slowly soluble in potassium hydroxide.

The following analysis shows the composition of the mineral.

Analysis of Capsular Silica[2]

SiO_2	98.70 %
Fe_2O_3	1.25
Al_2O_3	0.37
H_2O	0.00
Total	100.32

Optical Characters

Thin sections of the mineral, under crossed nicols, are seen to consist of a compact mosaic of silica units (Figure 2). Higher magnification shows these units to be composed of quartz intermingled with finely fibrous chalcedony. Inclusions of limonite are fairly common, especially along cracks and in contact with

[2] Analysis prepared for this paper by J. P. A. Zeller, Chemist of the Texas Engineering Experiment Station.

FIG. 2
Typical section, under crossed nicols, from the interior of cube. (96X). Sharply outlined quartz crystals, fibrous, and incompletely extinguished areas are visible. The dark areas are of sharply extinguished quartz.

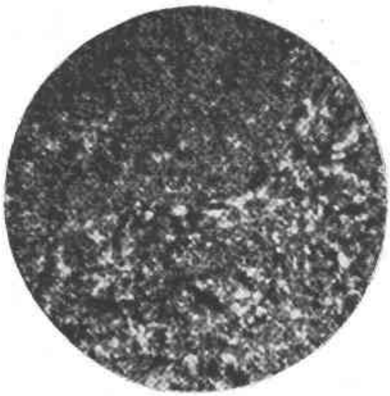

FIG. 3
Low power (20X) view under crossed nicols showing division of the cubes into coarse- and fine-grained sections.

the underlying silicified wood. Spherulitic structures are disseminated throughout the mass.

The extinction of both the quartz and the chalcedony is sharp. Extinction in the chalcedony is parallel to the fibres. Elongation of the fibres is negative.

The cubes are not zoned, but are divided into distinct areas. In some cases these areas are distinguished by differences in the coarseness of crystallization (Figure 3). In other cases they are separated by bands of very coarsely fibrous chalcedony. The coarse- and fine-grained areas cannot be correlated with definite depths within the cubes.

The capsules superimposed upon the cubes are composed of very coarsely fibrous chalcedony which extends inward into the cubes like inverted cones (Figure 4). The fibres of these cones are elongated in planes making angles of from 20° to 25° with the surfaces of the cubes.

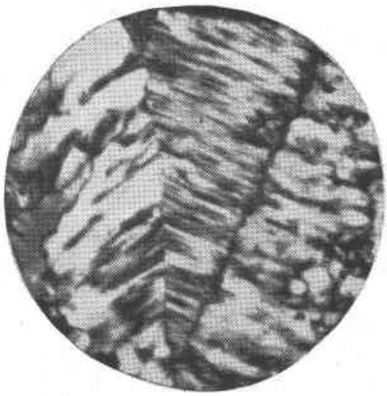

FIG. 4

Vertical section of a cube under crossed nicols (80X). Cone of coarsely fibrous chalcedony extending downward below one of the capsules into the quartz matrix of the cube below.

THEORY OF ORIGIN

The explanation of the origin of the capsular silica involves three problems: (1) the source of the silica, (2) the origin of the cubic form, and (3) the origin of the symmetric system of regular chalcedony capsules superimposed on the free surfaces of the quartz and chalcedony cubes.

The writer advances the following theory to account for these pseudo-crystals.

1. The ground water of the area is known to be carrying silica, much of it presumably in colloidal form as sodium silicate.[3] This

[3] Brayton, H. R.; Personal communication quoted by Frederick A. Burt, *op. cit.*, p. 542.

silica served as the source of silica for the formation of the capsular cubes.

2. The silica was deposited as a replacement, probably of pyrite crystals, thus giving the individual pseudomorphs their cubic forms.

3. The replacement was an intermittent, rather than a continuous process, resulting in an external quasi-zoning. The free edge of each layer, being unrestricted in its growth, developed a rounded surface according to the well known tendency of colloform minerals.

4. The deposition of the silica of the capsules may have been in the form of hydrogel opal, which by subsequent dehydration and devitrification was converted into chalcedony, or it may have been directly as microcrystalline chalcedony. As some microcrystalline minerals occur in colloform,[4] and as strain phenomena which might have been produced by dessication is not conspicuous within the capsules nor in their close proximity, the probabilities are that the silica was originally precipitated as chalcedony.

[4] Rogers, Austin F.; A Review of the Amorphous Minerals, *Jour. Geol.*, vol. 25, p. 518 (1917).