

FIFTH LIMESTONE.

This limestone is fairly well exposed in the district.

A small exposure occurs in the railway cutting leading to Longland's mine, a quarter of a mile south-east of Woodend Station. The upper light-coloured portion of this limestone is shown in the rail cutting leading into Clints Quarry.

It can be seen in Ainsworth's Opencast near Cleator.

A large but inaccessible quarry occurs at Yeathouse.

The best exposure is at Stockhow Hall, half a mile south-west of Kirkland village, where there is a large disused quarry in both portions of this limestone.

A series of small quarries west of Scalesmoor Farm.

SIXTH LIMESTONE.

Badly exposed, there being only two exposures, one a small quarry at Stockhow Hall, the other a small exposure in railway cutting at Yeathouse Quarry.

SEVENTH LIMESTONE.

The base of this limestone and its connexion with the Basement Conglomerate can only be seen at one place in the district, viz. in the railway cutting about 100 yards south-east of Yeathouse Station. There are two good exposures of this limestone proper, one at Frizington Park quarry on the east side of the railway midway between Frizington and Yeathouse Stations, the other at Moosegill Quarry, Wilton, about 2 miles east of Egremont.

Other exposures are at Thistlegill Quarry, 200 yards west of Kirkland village; Todholes Opencast, 100 yards north of St. Mary's R.C. Church, Cleator; a small quarry south of the Co-operative Society's old flour mill, Cleator Moor; and one or two small surface exposures near Scalesmoor Farm, Lamplugh.

Liquid Inclusions in Glass.

By CHARLES E. BENHAM.

IT is well known that the liquid inclusions commonly found in quartz, fluor-spar, and other minerals resemble in some degree those that occur in crystals of sodium chloride, alum, and many salts. Chloride of sodium in particular shows innumerable cavities of varying size, cubical in form (negative crystals), and generally containing an enclosed bubble, especially if heated gently after the crystals are formed. The smaller cavities show Brownian movement of the enclosed bubble in a very striking manner. (See Fig. 1, which gives a diagrammatic view of a salt crystal as seen through the microscope.)

Yet these cavities are evidently so different in origin from those in such a material as quartz that they can hardly be classed as a parallel phenomenon and they throw little light on the actual problem of quartz inclusions, which are highly suggestive of an origin connected with the enclosure within the mineral when molten of aqueous vapour heated under pressure to a degree above the "critical temperature".

Artificial inclusions which approximate perhaps rather more closely to the cavities in minerals may also be obtained in resins by boiling the resin in water, preferably tinted with a dye of some sort or containing an infusion of gamboge particles. The melted

resin envelops thousands of aqueous globules and permanently shuts in these inclusions so that a fragment of such impregnated resin, if afterwards softened by heat and gently pressed between a glass slip and cover-glass, makes a beautiful microscopic object, showing myriads of liquid spherules each containing (when the gamboge is used) a glittering galaxy of ever-moving particles as seen with dark-ground illumination.

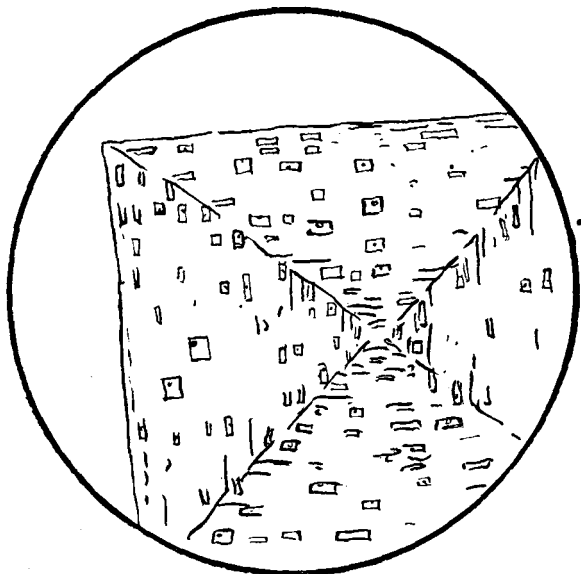


FIG. 1.—Salt crystal with microscopic cavities containing brine and an air bubble, the smallest of which show Brownian movement.

Many of these spherical inclusions, moreover, are not entirely filled with liquid, but show a central air bubble with a diameter about one-third of that of the sphere. Around this is seen a ring of the suspended gamboge particles in rapid movement. The bubbles themselves are generally much too large to show Brownian movement. To ensure their presence the impregnated resin mass should be left a few weeks after the boiling.

The general effect is shown in Fig. 2, which exhibits the various sizes of the spherules, some filled completely with liquid and gamboge particles, others having a central air globule.

An experiment made with a view to imitate much more closely in glass, by artificial means, the liquid inclusions of certain minerals may be worth describing.

A small glass tube, containing water and hermetically sealed, was enclosed in the interior of an unbaked brick, and then submitted (by the kindness of Messrs. H. Everett & Son, of Colchester) to the

usual process of firing in the brick kiln. To avoid any risk of a violent explosion the tube used was only about 3 inches long and $\frac{1}{4}$ in. outside bore. This was nearly filled with water and hermetically sealed in a gas flame at each end. The tube was embedded in the middle of the soft brick so as to ensure a complete sealing in of the liquid contents. The brick, duly marked for identification, was placed amongst the others in the kiln and exposed to the usual period of firing. The idea was to ensure that the glass when molten should come into contact with water vapour above the critical temperature, and that in this way inclusions should be formed in the substance of the glass.

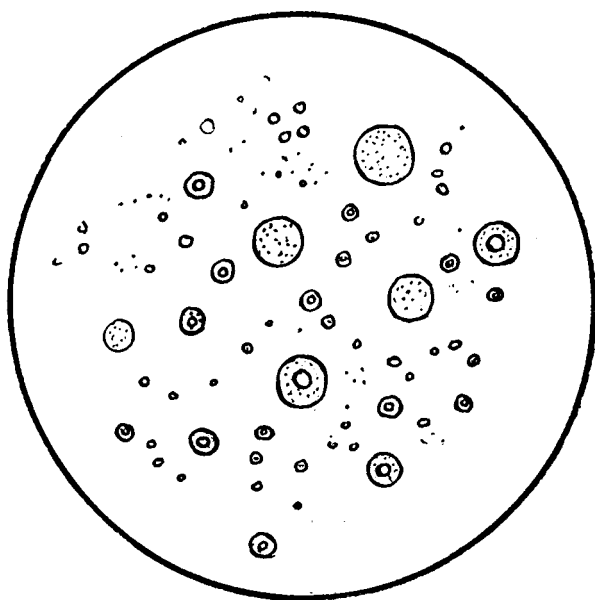
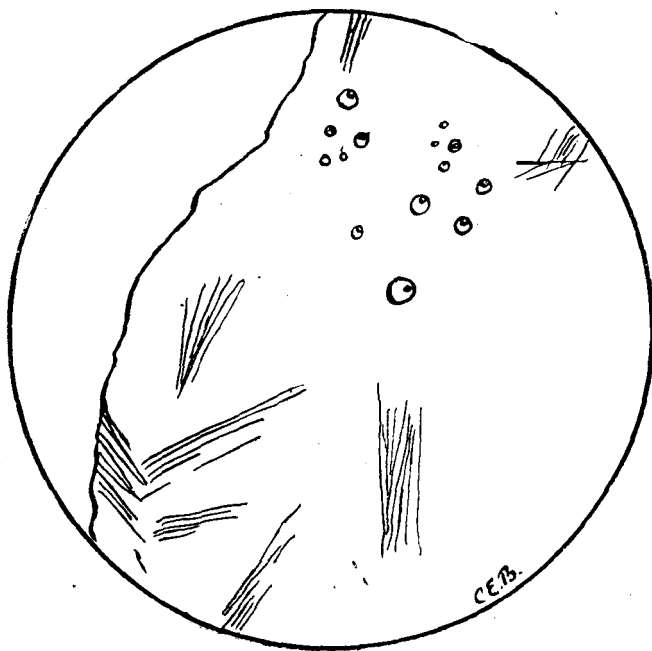


FIG. 2.—Liquid inclusions in resin which had been immersed in boiling water containing suspended gamboge particles. Some of the spherules show a central air bubble, while others are completely filled with the liquid.

The experiment was successful, the glass showing microscopic inclusions, with a bubble of vapour comparable with those found in quartz, affording a possible clue to the formation of inclusions in that mineral.

As will be seen from the drawing (Fig. 3), the glass inclusions were spherical in form. The sketch was made with camera lucida attachment. There were also a good many impurities imprisoned showing as specks and smudgy masses which are not rendered in the drawing as having no special bearing on the experiment, but the fibrous state of much of the glass has been diagrammatically reproduced. This fibrous condition is due to the fact that the heat was

undoubtedly much greater and more prolonged than was actually required for the purposes of the experiment, the temperature of the kiln being not less than 1,200 degrees Cent. The bubbles are too large to show Brownian movement.





 Scale—Thousandths of an Inch.

FIG. 3.—Liquid inclusions obtained in glass by heating a sealed tube containing water beyond the critical temperature.

P.S.—Since writing the above I have repeated the experiment with similar success, and on this occasion some of the numerous inclusions show Brownian movement of the enclosed bubble.
—C. E. B.

The Igneous Complex of Y Foel Fras, Caernarvonshire.

By NORMAN L. SILVESTER, B.Sc., F.R.Met.Soc.

THE area under consideration is a portion of the mountain massif bounded on the east by the Conway River, on the north by the narrow coastal plain between Conway and Bangor, and on the west and south by the popular tourist route through Nant-Francon pass by Llyn Ogwen and down the Afon Llugwy to Bettws y coed.