On the Colour of Coloured Fluorites

By

Tokutaro Sakao and Mitsuie Hirose

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The cause of the colours of Blue John and other varieties of fluorite has long been a matter of doubt and controversy. Messrs. Blount and Sequeira carried out an interesting investigation on the problem, and the result was briefly described in the Transactions of the Chemical Society.[1]

According to their conclusion there is no substantial difference between a white fluorite and blue, green and amethystine varieties, except the presence of a small amount of organic matter, and the colours are ascribed to this organic matter. But the state of dispersion of the latter is not discussed.

Now it is already ascertained that the blue colour of certain varieties of rock salt is due to a colloidal dispersion of sodium in sodium chloride, and that the blue colours of sodalite and ultramarine are almost certainly due to a similar cause. As was suggested in *Nature*,[2] though the colour of the fluorites is ascribed to the presence of some organic matter, yet the problem is not completely solved. The present writers, under the suggestion of Prof. M. Kimura, attempted an experiment to examine by means of an ultra-microscope the state of the suspected organic matter in the crystal, and a short account of the result obtained will be given below.

In the present experiment the following specimens were selected and examined.

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1 Vol. 115, 705 (1919).

2 *Nature* Sept. 13, 1919.

(1) a piece of a transparent crystal, one half of which was coloured amethystine, while the remaining part exhibits a green colour,

(2) a piece of a green fluorite having a transparent stria,

(3) a piece of perfectly transparent fluorite,

(4) two pieces of green fluorite, one of which is more deeply coloured than the other,

(5) a colourless crystal obtained by baking a piece of a green variety.

Small pieces of the crystal mentioned above were selected from several pieces of the crystal; and they were cut into parallel plates having a thickness about 1 mm., and then the surfaces were polished with emery and then rouge to secure an optical surface. The plates prepared were examined with an ultra-microscope having a cardioid condenser, illuminated by the light from a 20-ampere carbon arc.

In all the coloured specimens mentioned above a uniform distribution of an immense number of particles as is usually seen in the case of coloured glasses and of colloidal solutions could not be detected at all, the only thing observed being a very few bright particles. These particles were distributed very irregularly and their number varied from plane to plane within the crystal, the total number seen in a field of view being not greater than about ten.

In a transparent portion of the crystal such particles were also observed, and their number and mode of distribution did not present a sensible difference even in crossing at the boundaries of a transparent stria in the green fluorite. Moreover, in certain specimens it was ascrtained that a weakly coloured crystal contains a larger number of the bright particles than a highly coloured one.

These facts seem to indicate that the particles under consideration have no relation with the cause of the colour of the fluorite. As to the nature of these particles no definite conclusion can be drawn from the present experiment, but we may considered that the particles might be minute holes or some impurities contained within the crystal.

If the particles were totally taken out of consideration the coloured fluorite is optically clear. This means that if the organic matter found by Blount and Sequeira be in a state of colloidal suspension, it should have the same index of refraction as that of the fluorite, or that the colloidal particles should be too fine to be detected in the present experiment. Otherwise, the organic matter would be scattered into the molecular state in the crystal.