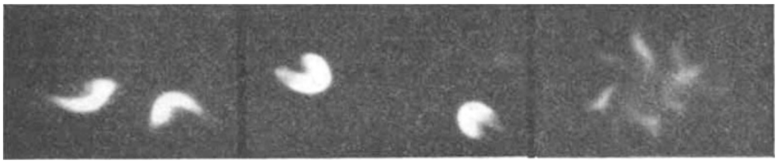

(a) 11 μsec. (b) 1·5 μsec. (c) 5 μsec.

Fig. 3. (a) and (b) show two plasmoids fired across a 4,000-gauss magnetic field at pressures (8 and 18 microns) so great that the plasmoids never come into contact. (c) represents eight plasmoids fired at such a high pressure (6 microns) that the plasmoids remain separate

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[1] *Phys. Rev.* and *Rev. Sci. Instr.* (in the press).
[2] Bostick, W. H., *Phys. Rev.*, **100**, 1007 (1955).

Crystallographic and Geological Factors in the Growth of Garnets from Central Perthshire

IN the process of mineralogical and petrological studies of the metamorphic rocks in the Central Highlands of Scotland, it has been found that in certain minerals, particularly garnets, there is evidence of interplay of crystallographic and geological factors. Such is seen in the sample which has been collected from central Perthshire (National Grid No. NN 913602). It consists of compact impure graphitic limestone studded with numerous dodecohedral garnets, up to 5 mm. in diameter, but normally of the order of 2 mm. In addition to calcite and garnet, the rock contains an appreciable amount of quartz, muscovite, chlorite and ores. Graphitic dust is concentrated in calcite, muscovite and chlorite.

Most of the garnets consist of two zones. The inner zone, in sections cut parallel to 101, normally shows a radial arrangement of six sectors of clear garnet, without inclusions, interspersed by six zones of garnet with numerous inclusions of calcite and occasional quartz. Such inclusions are dimensionally elongated and possess a parallel orientation which does not change from one sector to the other. The outer zone of each garnet is not subdivided into sectors and has many homogeneously distributed inclusions. These are oriented so that on the diametrically opposite sides of the outer zone they show a deflexion in an opposite sense. In other words, together with the inclusions of the inner zone, they form an (inverted) *S*-shaped trend with the central straight part of the *S* situated in the inner zone and the curved parts in the outer zone. The calcite crystals in the matrix, at the margin of the garnets, are often elongated across the trend of the inclusions in the outer zone. Sometimes a selvage of quartz separates the garnet from the matrix.

The grain size of the inclusions of calcite in the outer zone is generally slightly larger than those of the inner zone. The grain size of the crystals of quartz and calcite in the matrix is larger than that of either set of the inclusions.

Distribution of inclusions in the inner zone conforms to the cases described by Karpinsky[1] and Harker[2], who suggested that they are situated on rhombohedral surfaces converging towards the centre. The fact that the inclusions of the inner zone have similar orientations in different sectors suggests that they have been parts of a pre-garnet fabric and that during the growth of the inner zone of the mineral they have not been deflected. Thus the growth of garnet proceeded under static conditions. Evidently, under such conditions, the purely crystallographic factor of velocity of growth determined those sectors where growth was fast and inclusions were preserved, and those where the slowly growing mineral allowed the dissolution of inclusions. The fact that, despite the relative irregularity of the inclusion-bearing sectors the individual grains are not deflected, signifies that they were not 'brushed aside'. The 'velocity of growth' explanation accords with postulates put forward by Seagar[3], who maintains that the combination of fast initiation and growth on the edges leads to rapid growth of a skeletal crystal with relatively retarded growth of the faces.

In the outer zone, the more or less uniform distribution of inclusions implies that the velocity of growth was generally high enough to ensure the preservation of the inclusions. Since the inclusions in the outer zone show an *S*-shaped trend, the growth of the mineral must have proceeded under dynamic conditions happening simultaneously with rotation of the garnet. Thus the dynamic factor of deformation increases the velocity of growth to such an extent that the purely crystallographic effects, seen in the inner zone of the mineral, are completely overshadowed.

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[1] Karpinsky, *Mel. Phys. Chim. St. Petersbourg*, **12**, 639 (1887).
[2] Harker, "Metamorphism", 3rd edit., 41 (1950).
[3] Seagar, *Min. Mag.*, **30**, 1 (1953).

Importance of Calcium and Magnesium Ions in Phototaxis of Motile Green Algæ

DURING the past year phototactic behaviour has been studied in a number of motile green algæ and dinoflagellates at this laboratory and at Hopkins Marine Station of Stanford University, California[1]. These flagellates swim either towards the light or away from it, depending upon their recent past environment in ways that are far from being understood. When any of the organisms examined was transferred to fresh medium, a negative phototaxis resulted immediately. The direction of response was independent of light intensity. When the organisms were kept in the same medium for some time, from hours to days, their reaction became positive, irrespective of the light intensity.

Some experiments have been performed with *Platymonas subcordiformis* (Wille) Hazen (A. Gibor's strain) directed at analysing the chemical factors