Browsing of *Patella*

DURING a recent investigation of *Gigartina stellata* which has been carried out at Millport, Isle of Cumbræ, I have been struck with the relationship between the limpet (*Patella vulgata*) and the seaweed, and have observed effects very comparable with those described by Mr. N. S. Jones[1]. This work is being described in more detail elsewhere, and will, I think, confirm the observations of Jones, Orton, Eslich and others that *Patella* is able to browse on young algal growths, and, by the 'glades' that it forms in an algal community, may considerably lessen the algal covering on that part of the shore.

As Mr. Jones points out, this is a point of foreshore ecology that may be worthy of more attention than it has hitherto received.

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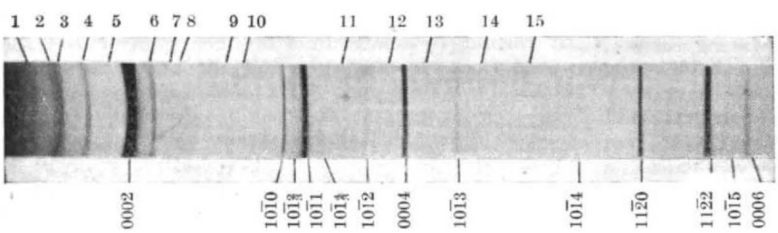
[1] *Nature*, **158**, 557 (1946).

Structure of Graphite

Laidler and Taylor[1] directed attention to the presence of lines in the X-ray diffraction photographs of graphite which could not be explained by the structure proposed by Bernal[2], and by Hassel and Mark[3]: these lines are given by graphites from many different sources, natural and artificial. Similar extra lines on electron diffraction photographs of graphite had been observed by Finch and Wilman[4]. Edwards and Lipson[5] thought that they may be caused by anomalies in the structure of graphite similar to those found in cobalt[6], but occurring at regular intervals, and proposed a new structure which would



account for these extra lines[7]. In this, the flat, honeycomb net planes are stacked parallel to each other, but instead of having the *ababab* sequence of the Bernal structure, they have an *abcabc* sequence: this gives a unit cell with a *c*-axis one and a half times the usual one. From intensity data they calculated that this new structure represented about 14 per cent of the graphite, the remainder being made up of 80 per cent of the ordinary structure and 6 per cent of a disordered structure. It is interesting to note that this new structure was the first structure suggested for graphite, by Debye and Scherrer[8] in 1917.

The structure of graphite, however, does not yet appear to be fully elucidated. Powder photographs of graphite have been obtained containing a number of lines which cannot be explained on either of the two structures mentioned. These lines are fainter than those observed by Taylor and Laidler, but their occurrence is as general; all the natural and artificial graphites so far examined give these lines. The illustration shows a typical photograph, obtained by doubling the normal exposure time; the background scatter was reduced by passing pure, dry hydrogen through the powder camera and placing a thin sheet of aluminium foil between the specimen and the photographic film. The sample from which the photograph was obtained had been purified as follows. It was extracted exhaustively with hydrochloric acid followed by hydrofluoric acid (final ash content 0·07 per cent) and then heated *in vacuo* to 2,300° C. and maintained at that temperature for half an hour. An extruded specimen 0·5 mm. diameter was photographed in a 19-cm. diameter powder camera using cobalt $K\alpha$ radiation. A list of $\sin^2\theta$ values for the extra lines on this film is given below. The lines were much weaker than the normal graphite lines, so that no attempt has been made to assess their relative intensities. Their positions were measured with a measuring instrument[9] specially designed for the purpose. A number of very pure artificial graphites (ash content $< 0·05$ per cent) have also been examined and all show these extra lines.

Line No.	θ	Sin² θ	Line No.	θ	Sin² θ
*1	9·38	0·0266	9	21·32	0·1322
*2	10·66	0·0342	*10	22·44	0·1456
*3	10·98	0·0363	11	28·41	0·2263
*4	12·68	0·0482	12	31·39	0·2713
*5	13·96	0·0582	13	33·71	0·3080
*6	16·79	0·0834	14	36·82	0·3591
7	17·81	0·0935	15	39·72	0·4082
8	18·40	0·0996	16	67·30	0·8511

* Double lines: mean values given.

The lines marked with an asterisk are double and each consists of two well-defined separate lines. In every case the angular separation is 0·20°, which makes it unlikely that they are separate reflexions. Furthermore, they were examined on a photograph taken in a camera of different diameter (9 cm.): in this case, taken as separate lines, their diffraction angles differed slightly, but definitely, from those of the same lines on the film from a 19-cm. diameter camera; taken as pairs, the mean values were exactly the same. The 0002, 0004 and 0006 lines of the ordinary graphite structure were also double, and this has been explained by Nelson and Riley[10] as being due to preferred orientation of crystals in the specimen. This seems to suggest that the extra lines are due to a structure closely related to the ordinary structure and that the extra double lines may be $000l$ reflexions. The layer-lattice structure of graphite makes it susceptible to modification by alteration of the sequence of layers. A preliminary examination of boron nitride, which has a similar layer-lattice structure, indicates that its spectrum also contains extra lines.

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