The variable composition of cordierite in the Dartmoor granites.

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THE recognition of pronounced varietalism in both the garnet[1] and the basic mica[2] of the Dartmoor granites prompted the authors to inquire whether the cordierite associated with these species was similarly variable in composition.

The inquiry was directed in the first instance to possible variation in the optic axial angle 2V, which is determinable with accuracy on the unaltered parts of cordierite in thin rock sections. Determinations made on the sector-twinned cordierites in the garnetiferous granite of Sweltor[3] gave the following peculiar results, which Mr. Rama Rao verified repeatedly, using a Fedorov microscope in perfect adjustment.

Values of 2V determined on 114 twin units (sectors and lamellae) of cordierite in fourteen thin sections of the Sweltor granite:

(*a*) $2V = 56° - 59°$ in 14 cases.
$= 60° - 69°$,, 80 ,,
$= 70° - 72°$,, 20 ,,

A value $62{\cdot}5° \pm 0{\cdot}5°$, previously determined by Mr. W. Campbell Smith, falls in the middle of this range.[4]

(*b*) The range is sometimes spanned by values determined on a single crystal.

(*c*) With few exceptions, optically continuous sector-pairs give concordant 2V values which, however, differ from those for adjacent sectors by amounts up to $13° - 14°$.

(*d*) All the occurrences examined are optically negative.

Typical examples of the variation scheme are shown in fig. 1, *b–f*.

[1] A. Brammall and S. Bracewell, Min. Mag., 1936, vol. 24 (preceding paper).
[2] A. Brammall and H. F. Harwood, Quart. Journ. Geol. Soc. London, 1932, vol. 88, pp. 184, 217, and fig. 19, p. 215.
[3] Loc. cit., 1932, fig. 6, p. 187.
[4] Loc. cit., 1932, p. 186.

When first observed, this variation was regarded with suspicion by both authors, who, while claiming that the values determined are correct within $\pm 1°$, hesitated to accept its implications and re-examined the case on the assumption that the peculiar scheme of variation might be due to zoning or overlap of twin-units. Neither of these possibilities could be seriously entertained: zoning, though actual, is uncommon and, at best, feeble—no significant variation in 2V occurs within the limits of a single sector; overlap zones are narrow and easily avoided, and no abnormal interference-figures were observed. Still, the foregoing data—considered as evidence for contrasted composition in adjacent sectors—may prove to be equivocal; but the fact of variable composition of fragmental cordierite is placed beyond doubt by the following analytical data:

	FeO %.	MgO %.	Atomic ratio, Fe : Mg.
(*a*) Cordierite aggregate fractionated (six fractions) in the Clerici diffusion column:			
1. Mainly micaceous	6·20	9·3	0·37
2. Mainly pinite	6·36	8·9	0·40
3. Cloudy cordierite	5·85	7·6	0·43
4. Pale lavender-grey cordierite ...	8·18	3·58	1·28
5. Glass-clear lilac-blue cordierite ...	4·00	2·07	1·10
6. Similar to no. 5	7·75	4·36	0·99
(*b*) Cordierite aggregate previously analysed[1]	9·10	3·31	1·51

These results establish the fact of pronounced variation in the Sweltor cordierite; they also show that the composition of cordierite aggregate can vary from sample to sample of the granite.

Values for 2V determined on relict cordierite in the quarry-granites of Pithill (Ivybridge) and Haytor span a similar range. As this inquiry forms part of an attempt to determine whether, and by what criteria, the cordierite in these granites can be genetically linked with the pelitic sediments of the region, 2V values were determined on the small untwinned cordierites in several sections of hornfelsed shale-xenoliths. The results for a typical section are plotted in fig. 1 *a*, which shows the rock-slice in plan and also the sites of the cordierites to which the 2V values severally refer. The distribution of these values is clearly related to banding which, in turn, is doubtless related to the variable texture and composition of layers composing the original sediment. The variation range of 2V in this case is $56° - 82°$.

[1] Loc. cit., 1932. Analysis no. 69.

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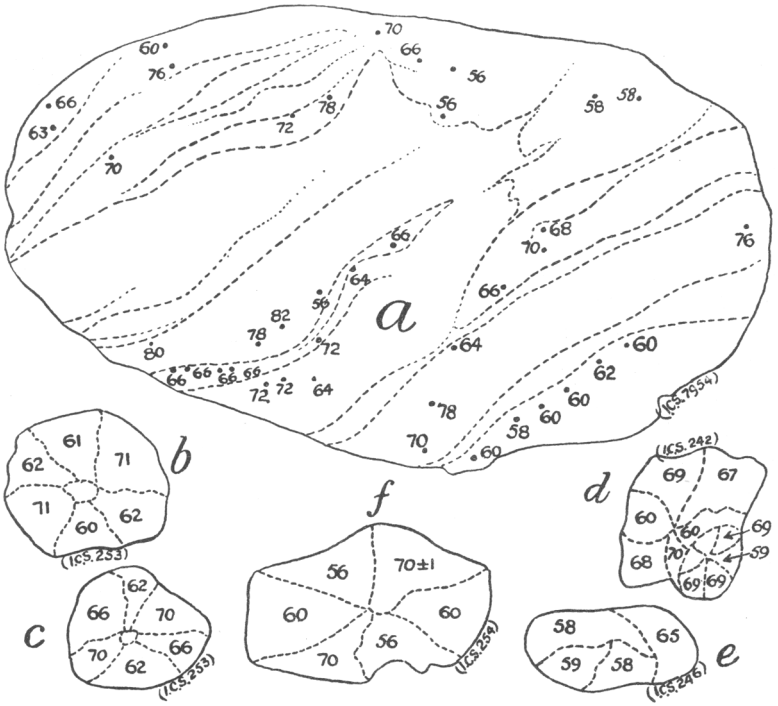

FIG. 1. (*a*) Plan of a thin slice of hornfelsed shale-xenolith from the tor-granite at Tunhill Rocks, east Dartmoor, showing (i) the sites of untwinned cordierite crystals, with the corresponding 2V values, and (ii) the variation of 2V relative to banding in the original sediment. ×5.

(*b–f*) Plans of representative cordierite sections in thin slices of the garnetiferous granite of Sweltor, west Dartmoor, showing the variation of 2V relative to sector-twinning. ×8–18. [I.C.S. number of section in the Geological Department, Imperial College of Science.]