The identification of dumortierite as grains; dumortierite in Cornish granite.

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THE following notes are intended to bring to the notice of workers on heavy mineral grains the possible confusion between blue tourmaline, purple tourmaline, glaucophane, lepidolite, andalusite, pleochroic sillimanite, and dumortierite. Dumortierite (when blue) is very liable to be passed over as the more common mineral glaucophane, the optical properties of the cleavage-flakes of these minerals being similar in several respects.

Having seen a grain of dumortierite from the Wealden of Surrey, kindly lent me by Mr. H. A. Hayward, I was impressed by the remarkable nature of its pleochroism. A day or so later, while examining some concentrates of the Blackheath Beds of Shirley, Surrey, belonging to Mr. G. M. Davies, I came across a single grain which he had described as glaucophane.[1] The pleochroism seemed too intense for a grain of glaucophane of that thickness, and it occurred to me that the tint observed, when the grain was in the position of maximum absorption, was exactly that of the dumortierite grain. On testing with a quartz-wedge, it was found that the pleochroic scheme was wrong for glaucophane and agreed with that of dumortierite. Shortly afterwards a further grain of what had quite naturally been taken to be glaucophane, in the Bagshot Beds of Bournemouth, displayed an identical range of pleochroism and pleochroic scheme. Both of the 'glaucophane' grains referred to satisfy all the optical properties—as far as can be determined in a permanent mount—of a (100) cleavage flake of dumortierite showing traces of the less perfect (110) cleavage. As both the grains are small (about 0·2 mm.) it has been thought advisable to await the discovery of further grains of the mineral before confirmation of the determination is undertaken by means of refractive index liquids and chemical tests.

[1] Trans. Croydon Nat. Hist. Sci. Soc., 1916, vol. 8, p. 91.

For purposes of comparison, figs. 1–3 have been prepared to show diagrammatically the optical properties displayed by grains of dumortierite, glaucophane, and andalusite. It will be seen that, provided the grain is elongated parallel to the vertical crystallographic axis, there need be no confusion between dumortierite and tourmaline, for the former shows maximum absorption for rays vibrating parallel to the length and the latter for rays vibrating in a direction perpendicular to the length of

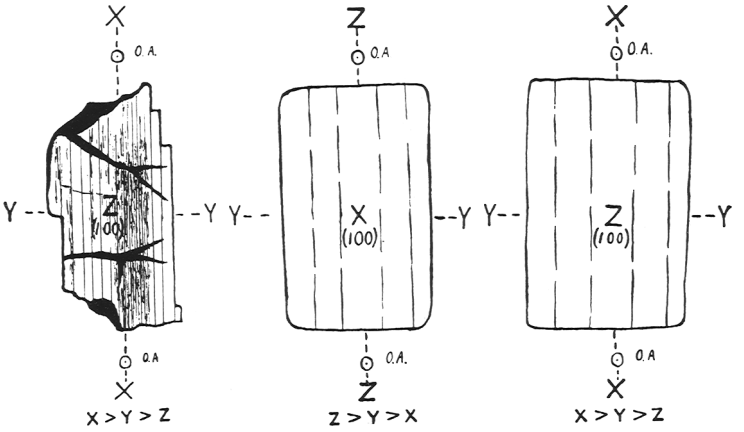

Fig. 1. Fig. 2. Fig. 3.

Fig. 1. Dumortierite from the 'coarse' granite at Trevella, Cornwall. Length of crystal fragment, 0·5 mm.

Fig. 2. Glaucophane, diagram of optical orientation.

Fig. 3. Andalusite, diagram of optical orientation.

the crystal. However, when prismatic form is lacking, a dumortierite grain may be readily passed over as a blue tourmaline. It therefore behoves us to examine blue tourmaline more carefully and to obtain the interference figure or determine the pleochroic scheme in all doubtful cases. Curiously enough, in Mr. Hayward's slide and in Mr. Davies's slides the supposed dumortierite is accompanied by plentiful blue tourmaline frequently showing pleochroism, like that of blue dumortierite, from nearly colourless to a very intense blue. Dumortierite also occurs with a number of other ranges of pleochroism and, when not showing its prismatic form, may be mistaken for brown or purple tourmaline. When showing pleochroism from about colourless to rose-purple it may be confused with andalusite. When dealing with glaucophane it should be possible

in many cases to show that the extinction is not quite straight. It will be appreciated from the diagram that the most ready method of distinction between glaucophane and dumortierite is the determination of the pleochroic scheme. My experience with dumortierite shows that the absorption is very variable, and that while it is usually quite as strong as in tourmaline, in some cases it is very much less. This may possibly be connected with a variable boron content.

Text-books differ as to the nature of the dispersion in dumortierite, but the majority give $\rho < v$. All the grains mentioned in these notes, as well as a specimem of dumortierite from Dehesa, California, in the collection of the Imperial College, gave $\rho < v$. Generally this is quite marked.

Dumortierite in the Granite of Land's End, Cornwall.

Two specimens from near Trevella, one of the 'coarse' granite and one of the 'fine' granite (as distinguished by H.M. Geological Survey), were crushed and examined for dumortierite, with the result that the mineral was found to be one of the less common accessories in the 'coarse' variety. It occurs as grains of all sizes up to half a millimetre, but owing to the good cleavage this gives no indication of the size of the largest crystals in the rock. The dumortierite of fig. 1 was sketched from this material. The shape of the grains is always prismatic, with strong indications of cleavage. The pleochroism is from colourless to mauve and then intense mauve or purple-brown, which in the larger grains means darkness for rays vibrating parallel to the length This is the same range of colour as displayed by the dumortierite of Dehesa, California. Some of the smallest grains were not unlike sillimanite in outline, being wispy and in some cases bent. The sign of elongation serves to distinguish a pleochroic sillimanite from dumortierite. The twinning on (110) commonly seen in the Californian material was observed in a few of the larger grains. The interference-colours are about the same as in quartz. The mineral was only noted in the non-magnetic portion of the heavy residue.

At first glance it appeared that the 'fine' granite contained a fair amount of dumortierite, but it was soon found that in nearly every case the sign of elongation was positive and that the mineral was lepidolite with very similar pleochroism—from nearly colourless to purple-brown. Similar lepidolite has been noted by Dr. P. K. Ghosh from the Bodmin granite.[1]

[1] P. K. Ghosh, Min. Mag., 1927, vol. 21, p. 296.

Both the purple-brown and blue varieties of dumortierite have been recently found in the Dartmoor granite by Dr. A. Brammall.[1] It is quite probable that it will be found in some of the other granites of the south-west of England; meanwhile the writer hopes that these notes may help in the identification of the mineral both in its primary sources and in sediments.

Dumortierite was first recorded as a British mineral by Dr. William Mackie,[2] who detected it by its characteristic pleochroism in gneiss, pegmatite, and granite from Aberdeenshire and Banffshire, and also in a specimen of Cornish granite (? St. Austell).

The writer is indebted to both Mr. Davies and Mr. Hayward for allowing him to examine their slides (in connexion with other work), otherwise the present notes would not have been written.

Since the above was written, Mr. J. G. C. Leech has found dumortierite, mainly of mauve and brown shades, in the St. Austell granite. The writer has also found a single grain of blue dumortierite in the Bridport Sands, West Bay, Bridport, Dorset. The refractive index of this grain could be seen to be slightly higher than that of the blue tourmaline and glaucophane occurring in the same field under the microscope. Its pleochroism is from very pale blue to deep azure-blue. Another striated grain of dumortierite, with pleochroism from colourless to intense blue-black, has been observed in the non-magnetic portion of a concentrate of the Bagshot Beds from midway between Wimborne and Ringwood, Dorset. A further grain, identical with the last, has been found in the Upper Greensand of Lulworth Cove, Dorset. In the last two cases the mineral suites yield strong evidence of derivation in part from the Dartmoor granite, and, as the dumortierite is of a type so far only recorded in this country from Dartmoor, it seems likely that this granite was its source. The writer's discovery of six grains of dumortierite in the sediments of southern England in two months leads him to suggest that the mineral is not so rare as hitherto supposed, and that a keen watch should be kept for it.

[1] A. Brammall, Dartmoor Detritals. Proc. Geol. Assoc. London, 1928, vol. 39, pp. 43–44.

[2] W. Mackie, Dumortierite in British rocks. Trans. Edinburgh Geol. Soc., 1925, vol. 11, p. 352 [Min. Abstr., vol. 3, p. 205]. The paper was read at a meeting of the Society on December 19, 1923, and a report of it appeared in Geol. Mag., 1924, vol. 61, p. 185.