tables 50 and 51). The abnormally high H_2O^+ is so far unexplained, although this order of magnitude has been confirmed. Fluorine has not been determined, but in view of the absence of lithium at more than trace level it is unlikely that fluorine is present in significant quantity (cf. Němec, 1969, pp. 237–8). The closest parallel with the Hanter tourmaline is afforded by Howie's analysis of black tourmaline from Carrick Dhu, Cornwall (A, Table I), which is quoted from Deer et al. (1963, p. 307). The Hanter mineral shows a considerably higher ratio of Mg/Fe (2·62) than the Carrick Dhu tourmaline (0·82), indicating that it is closer to the dravite end of the series. This conclusion is supported by the unit cell dimensions which, plotted on graphs of c/a against a and c/a against c (fig. 1), lie close to the dravite end-member of the series. The unusually high Ca content of the Hanter mineral constitutes a divergence from the schorlite–dravite series but cannot be regarded as supporting Kunitz's (1929) proposal of a 'uvite' molecule $CaMg_4Al_5B_3Si_6O_{27}(OH)_4$ as a component of some tourmalines.

Conclusions. Tourmaline developed in altered gabbro at Hanter Hill lies close to dravite in the dravite–schorlite series, as is shown by its high Mg/Fe ratio, unit cell dimensions, and despite an unusually high Ca content. The tourmalinization appears to have resulted from the localized transformation of a normal olivine-free gabbro under the influence of veining aplogranite, and was succeeded by a general epidotization affecting the rocks of the Stanner–Hanter complex.

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An occurrence of antimony-ochre (stibiconite) as an alteration product of antimonite in Dashkasan, West Iran

AN antimony deposit in Western Iran was worked between 1941 and 1955 in a number of small mines. The mining area is between Dashkasan and Baharlu, 70 km north of Hamadan ($34°45'$N, $48°45'$E). The surrounding area has been geologically mapped on a scale of 1 : 1 000 000

and the immediate vicinity of the mines has been mapped on a scale of 1:55 000 by the Geological Survey of Iran.

Recent work (Golestaneh, 1974) has shown that the country rocks are composed mainly of a series of porphyritic volcanic rocks. These have been classified by modal analyses of the phenocrysts into pheno-alkali-trachytes, pheno-alkali-rhyolites, and pheno-andesites. In addition, there are small amounts of schist and metamorphosed limestone.

(a)   (b)
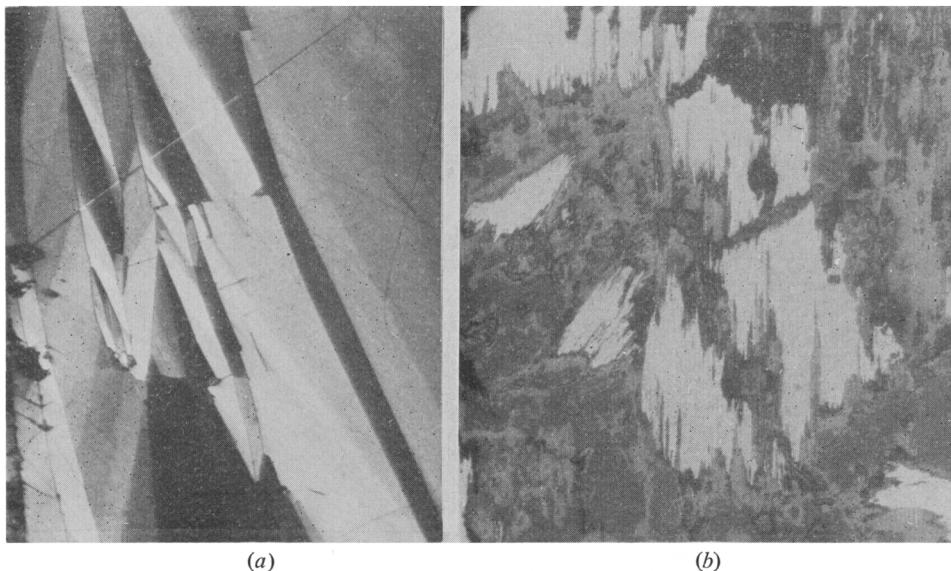
FIG. 1. a (left), Cataclastic texture and twin laminations in antimonite: reflected light, crossed polars. ×180. b (right), Alteration of antimonite: plane polarized, reflected light. Antimonite—white, stibiconite—light grey. (Dark grey is epoxy resin filling pores in the specimen). ×110.

(a)   (b)   (c)   (d)
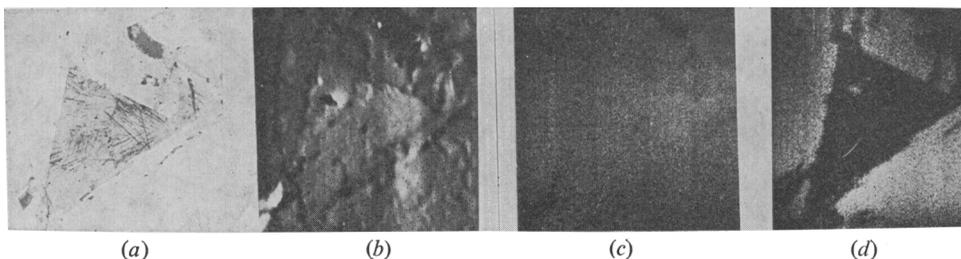
FIG. 2. Optical and electron probe microanalyser pictures of stibiconite in antimonite: a, Triangular stibiconite grain in an antimonite matrix: reflected light. b, Back-scattered electron image of area shown in fig. 2a. This shows that there is only a very slight difference in the mean atomic numbers of the two minerals. c, X-ray image showing distribution of antimony. d, X-ray image showing distribution of sulphur. All ×45.

The antimony deposit is of hydrothermal (teletethermal) origin and occurs in the form of narrow, steeply dipping veins that consist largely of antimonite and quartz. Small amounts of realgar and orpiment also occur in some of the veins. Microscopic study has shown that the antimony is frequently partly altered to antimony-ochre (Ramdohr, 1969). This ochre mineral was found to be a complex mixture of stibiconite with α-quartz: no valentinite or cervantite was detected.

Alteration of antimonite to stibiconite. The ore veins contain up to 80 % antimonite. The antimonite grains range in size up to 3 mm and either show tabular form or occur as radiating,

fine-grained aggregates. Twin laminations and cataclastic structures are common features (fig. 1).

The antimonite shows various degrees of alteration and the process of alteration has sometimes changed the very soft antimonite into a hard crusty aggregate, which is yellow or brown in colour (fig. 2). The alteration proceeds irregularly inwards from the outer portions of the antimonite (fig. 2) along fractures and cleavage cracks and is occasionally complete leaving pseudomorphs of the antimonite grains.

The colour, hardness, and reflectivity of the ochre differ in various parts of the mineral. In transmitted light it is white, grey-yellow, or brown in colour and has a high refractive index. Under crossed polars it is partly isotropic and partly weakly anisotropic.

TABLE I. *X-ray powder diffraction analysis of antimony ochre*

Spacing Å	Intensity	Spacing Å	Intensity	Spacing Å	Intensity
5·92 †	s	2·96†	w.s.	1·72†	w
4·23*	w	2·57†	w	1·54*†	s
3·32*	s	1·97*†	w	1·47†	w
3·08†	s	1·81*†	s	1·34†	vw

† stibiconite lines   * quartz lines

X-ray fluorescence analyses of ochre specimens suggested that they contained between 15 and 30 % of silicon and between 0·5 and 5 % of sulphur. These elements are thought to be due to the presence of antimonite and quartz as fine-grained impurities in the ochre. An electron probe X-ray microanalyser examination confirmed that isolated, pure fragments of stibiconite (fig. 3) did not contain detectable amounts of either sulphur or silicon.

X-ray diffraction analyses of many specimens of the ochre by Debye–Scherrer and diffractometer methods showed that it was distinctly crystalline and consisted of a mixture of stibiconite and α-quartz. No traces of antimonite, valentinite, or cervantite were detected by this technique.

Discussion. Vitaliano and Mason (1952) claimed that stibiconite always contains some proportion of valentinite. The 2·96 Å reflection of stibiconite is normally its strongest reflection whilst the 3·09 Å reflection of stibiconite is almost coincident with the 3·13 Å reflection of valentinite. However, in the presence of about 10 % valentinite the 3·09 Å reflection of stibiconite is enhanced and becomes stronger than its 2·96 Å reflection. No such effect was observed with the Dashkasan stibiconite. Furthermore, a comparison with the diffraction pattern of cervantite from Brasina, Yugoslavia showed that the Dashkasan ochre did not contain any detectable cervantite.

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