square inch of surface. This burns to a white ash in an open crucible over a Bunsen burner. It is identical with the material which has been described as thucholite but which has been shown by Davidson & Bowie (1951) to be a mixture of hydrocarbons enclosing pitchblende or uraninite.

In addition to these minerals, monazite, zircon, galena and chalcopyrite have been identified.

ACKNOWLEDGMENTS

Mr. Franc Joubin, President of Algom Uranium Mines, kindly made available the material for this study. I am also indebted to the Research Council of Ontario for a grant in aid of research.

REFERENCES

DAVIDSON, C. F. & BOWIE, S. U. (1951): On thucholite and related hydrocarbon-uraninite complexes, *Geol. Surv. Great Britain*, No. 3, 1.

PABST, A. (1954): Brannerite from California, *Am. Mineral.*, **39**, 109.

## A MAGNESIUM BORATE FROM ISÈRE, FRANCE, AND SWIFT RIVER, YUKON TERRITORY, WITH *X*-RAY POWDER DATA FOR SOME ANHYDROUS BORATES

R. M. THOMPSON AND J. A. GOWER, *University of British Columbia, Vancouver, Canada.*

During a study of the minor element content of sphalerite (Warren & Thompson, *Ec. Geol.*, **40**, 318, 1945) the relatively high (0.15 per cent) tin content of marmatite from the St. Christoph Mine, Isère, France, was noted, This sample is a compact crystalline aggregate showing an adamantine lustre and an almost jet black color. On a sawn surface, the sphalerite groundmass shows many small ill-defined greenish-white prismatic crystals of diopside, and small (2 mm.) irregular areas of an unknown, fairly hard, black, finely fibrous mineral.

In polished section, the sphalerite shows exsolved chalcopyrite and a lesser amount of stannite in the form of minute dots and blebs. The unknown fibrous mineral is distinctly pleochroic in dull gray to light blue gray, and highly anisotropic in light orange, blue, and fiery red. In places it is intergrown with diopside. The hardness was estimated as E and the mineral is negative to all etch-reactions.

Thin sections show coarse masses of sphalerite intergrown with diopside, chlorite, and small areas of the black fibrous opaque mineral. The fibrous mineral also occurs as capillary divergent bursts, or as unoriented needles in diopside or chlorite.

In 1945 an *x*-ray powder photograph was taken at the University of Toronto, but as the mineral could not be identified, no further work

TABLE 1. *X*-RAY POWDER DATA FOR SOME ANHYDROUS BORATES
Iron radiation ($\lambda = 1.937$ Å), manganese oxide filter

| Ludwigite, Phillipsburg, Montana | | Paigeite, Crestmore, California | | Pinakiolite, Langban, Sweden | | Warwickite, Edenville, New York | | Hulsite, Brooks Mtn., Alaska | | St. Christoph, Isére, France | | Swift River, Yukon Territory | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *I* | *d* | *I* | *d* | *I* | *d* | *I* | *d* | *I* | *d* | *I* | *d* | *I* | *d* |
| 2 | 7.37 | 4 | 7.42 | 1 | 5.81 | 4 | 6.55 | 5 | 5.37 | 1 | 5.90 | 5 | 7.32 |
| 2 | 6.16 | 2 | 6.16 | 8 | 5.42 | 4 | 4.20 | 1 | 4.99 | 9 | 5.34 | 1 | 5.87 |
| 1 | 5.69 | 1 | 5.63 | 1 | 4.97 | 2 | 3.73 | 4 | 4.49 | 1 | 4.88 | 8 | 5.31 |
| 7 | 5.12 | 7 | 5.12 | 1 | 4.70 | 3 | 2.97 | 5 | 3.87 | 2 | 4.19 | 2 | 4.92 |
| 3 | 3.00 | 1 | 4.70 | 1 | 3.64 | ½ | 2.84 | ½ | 3.09 | 2 | 3.56 | 3 | 3.61 |
| ½ | 2.92 | 1 | 3.74 | 3 | 2.99 | 5 | 2.75 | 4 | 2.96 | 2 | 3.08 | ½ | 3.09 |
| 2 | 2.81 | 4 | 3.04 | ½ | 2.88 | 10 | 2.57 | ½ | 2.75 | 3 | 2.95 | 1 | 2.96 |
| 2 | 2.74 | 1 | 2.92 | 9 | 2.70 | 1 | 2.48 | 5 | 2.67 | 10 | 2.67 | 10 | 2.66 |
| 10 | 2.56 | 5 | 2.83 | 10 | 2.51 | 1 | 2.24 | 2 | 2.59 | 4 | 2.60 | 2 | 2.60 |
| 1 | 2.52 | 3 | 2.75 | ½ | 2.40 | ½ | 2.20 | 10 | 2.53 | ½ | 2.54 | 2 | 2.50 |
| ½ | 2.34 | 10 | 2.56 | 3 | 2.30 | 1 | 2.13 | ½ | 2.49 | ½ | 2.48 | 1 | 2.43 |
| ½ | 2.31 | 5 | 2.36 | ½ | 2.24 | 2 | 2.08 | 1 | 2.35 | ½ | 2.35 | 1 | 2.36 |
| 5 | 2.17 | ½ | 2.33 | 4 | 2.16 | 3 | 1.979 | ½ | 2.24 | ½ | 2.25 | ½ | 2.28 |
| 1 | 2.12 | ½ | 2.27 | ½ | 2.07 | 1 | 1.867 | ½ | 2.18 | 5 | 2.13 | ½ | 2.25 |
| 4 | 2.03 | 6 | 2.17 | 6 | 1.986 | ½ | 1.838 | ½ | 2.13 | 7 | 2.03 | ½ | 2.18 |
| 3 | 2.00 | 4 | 2.14 | ½ | 1.917 | ½ | 1.813 | ½ | 2.09 | 2 | 1.776 | 5 | 2.13 |
| ½ | 1.955 | 7 | 2.05 | 2 | 1.836 | 1 | 1.791 | 4 | 2.04 | 1 | 1.753 | 7 | 2.04 |
| 2 | 1.917 | 2 | 1.998 | ½ | 1.805 | 3 | 1.721 | ½ | 1.973 | ½ | 1.721 | 2 | 1.779 |
| 1 | 1.873 | ½ | 1.961 | 4 | 1.623 | 1 | 1.632 | ½ | 1.937 | ½ | 1.699 | 3 | 1.568 |
| 3 | 1.767 | 7 | 1.926 | 2 | 1.548 | 2 | 1.595 | ½ | 1.859 | 3 | 1.558 | 5 | 1.541 |
| ½ | 1.728 | 1 | 1.878 | 5 | 1.518 | 1 | 1.553 | ½ | 1.779 | 7 | 1.541 | ½ | 1.509 |
| ½ | 1.706 | ½ | 1.857 | 4 | 1.496 | 3 | 1.501 | 1 | 1.732 | ½ | 1.524 | 1 | 1.487 |
| 2 | 1.668 | 4 | 1.776 | ½ | 1.430 | 1 | 1.471 | ½ | 1.702 | ½ | 1.484 | 1 | 1.441 |
| ½ | 1.595 | 1 | 1.670 | ½ | 1.416 | 2 | 1.380 | ½ | 1.640 | ½ | 1.388 | ½ | 1.398 |
| 4 | 1.577 | 5 | 1.586 | ½ | 1.386 | 1 | 1.338 | 1 | 1.610 | ½ | 1.366 | 3 | 1.362 |
| 3 | 1.539 | 1 | 1.538 | ½ | 1.352 | 1 | 1.327 | 1 | 1.580 | 2 | 1.355 | 3 | 1.332 |
| ½ | 1.529 | 6 | 1.528 | ½ | 1.328 | ½ | 1.284 | ½ | 1.559 | 4 | 1.332 | ½ | 1.300 |
| 3 | 1.513 | 5 | 1.505 | 2 | 1.307 | 1 | 1.272 | ½ | 1.546 | ½ | 1.288 | ½ | 1.246 |
| 4 | 1.501 | 4 | 1.487 | 1 | 1.283 | ½ | 1.243 | ½ | 1.507 | ½ | 1.249 | ½ | 1.227 |
| 4 | 1.477 | ½ | 1.466 | ½ | 1.227 | ½ | 1.226 | 4 | 1.479 | ½ | 1.239 | ½ | 1.198 |
| 5 | 1.380 | 5 | 1.388 | 1 | 1.150 | 1 | 1.184 | 1 | 1.434 | 1 | 1.220 | 2 | 1.180 |
| ½ | 1.358 | ½ | 1.366 | ½ | 1.121 | 2 | 1.152 | ½ | 1.353 | 1 | 1.176 | ½ | 1.116 |
| ½ | 1.316 | ½ | 1.352 | 4 | 1.080 | | | ½ | 1.333 | 4 | 1.067 | 2 | 1.067 |
| 2 | 1.301 | ½ | 1.339 | 1 | 1.032 | | | 1 | 1.314 | 1 | 1.049 | 1 | 1.050 |
| 1 | 1.293 | 6 | 1.315 | 2 | 1.015 | | | ½ | 1.291 | 3 | 1.017 | 3 | 1.019 |
| 2 | 1.282 | ½ | 1.300 | 2 | 1.002 | | | | | 4 | 1.008 | 2 | 1.008 |
| 1 | 1.252 | 3 | 1.283 | | | | | | | | | | |
| 1 | 1.205 | 2 | 1.251 | | | | | | | | | | |
| ½ | 1.190 | 2 | 1.217 | | | | | | | | | | |
| 1 | 1.181 | 1 | 1.200 | | | | | | | | | | |
| 4 | 1.158 | 2 | 1.183 | | | | | | | | | | |
| 1 | 1.142 | 3 | 1.166 | | | | | | | | | | |
| 4 | 1.087 | ½ | 1.144 | | | | | | | | | | |
| ½ | 1.080 | ½ | 1.131 | | | | | | | | | | |
| ½ | 1.070 | ½ | 1.105 | | | | | | | | | | |
| ½ | 1.061 | 4 | 1.087 | | | | | | | | | | |
| 2 | 1.043 | 1 | 1.068 | | | | | | | | | | |
| 2 | 1.024 | ½ | 1.052 | | | | | | | | | | |
| 5 | 1.020 | 2 | 1.044 | | | | | | | | | | |
| 1 | 1.002 | 6 | 1.028 | | | | | | | | | | |
| 5 | 0.998 | 3 | 1.003 | | | | | | | | | | |
| | | 3 | 0.997 | | | | | | | | | | |
| | | 1 | 0.992 | | | | | | | | | | |
| | | 4 | 0.983 | | | | | | | | | | |

was attempted as more pressing problems were at hand, The problem was tackled later at the University of British Columbia and a qualitative spectrographic analysis showed essential amounts of magnesium and boron, minor amounts of iron and tin, and traces of silicon, manganese and copper.

*X*-ray powder photographs of ludwigite, paigeite, pinakiolite, hulsite, warwickite, sussexite, and camsellite were taken but these photographs showed little resemblance to that of the unknown. The anhydrous borates, jeremejevite and nordenskiöldine, were not available, but seem to be ruled out on the basis of the spectrographic analysis. No agreement was found between the observed spacings given by Takeuchi (*Acta Cryst.*, **5,** 580, 1952) for a possible new borate from the Suan Mine, North Korea, and those of the unknown.

At this time, J. A. Gower was engaged in a study of the Seagull Creek batholith and its metamorphic aureole (unpublished M.A.Sc. thesis, *University of British Columbia*, 1952). This area lies in the southeastern Yukon Territory between latitudes 60° and 60° 15′ N, and longitudes 131° and 131° 30′ W. Swift River control station at mile post 733 on the Alaska Highway is the only settlement in the area.

A magnetite-pyrrhotite deposit in limestone and dolomite outcrops on the east bank of the south fork of Swift River, one mile north of two small lakes that mark its source. In samples of diamond drill core that were left at the outcrop, several sulphides including small amounts of stannite were noted in a gangue of serpentine, diopside, calcite, dolomite, chlorite, and clinohumite. Ludwigite needles about 0.1 by 0.5 mm. occur in intimate association with magnetite. This mineral was identified by its powder photograph.

Present in very small amounts is a black fibrous mineral resembling ludwigite, and intimately intergrown with magnetite, some of which may be pseudomorphous after it. This mineral has a submetallic lustre, is black in color and streak, has hardness 5, specific gravity $3.45 \pm 0.02$, opaque except on thinnest edges, and cleavage was not detected. In polished section, the mineral is similar to ludwigite and the Isère unknown.

A qualitative spectrographic analysis showed essential magnesium, iron, and boron, minor amounts of tin, manganese, and silicon. An *x*-ray powder photograph shows strong similarities to the unknown from Isère, France. Dr. Clifford Frondel kindly compared the powder photographs of rhodizite and kotoite with that of the Swift River mineral, but reports no similarity.

Until further material is available to permit a complete description, it would be premature to claim either unknown as a new mineral species.