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ON THE NATURE AND ORIGIN OF HISINGERITE FROM PARRY SOUND, ONTARIO

G. M. SCHWARTZ, *University of Minnesota*

The writer has recently noted the occurrence of hisingerite in specimens in the University of Minnesota collection of copper ores from Parry Sound, Ontario.¹ The mineral is abundant in these ores and as it is comparatively uncommon, and this occurrence seems unlike those formerly described, the material was studied in some detail.

Hisingerite is a hydrous silicate of iron and magnesia with small amounts of other constituents, but apparently of variable or indefinite composition. Larsen² lists it as amorphous or crypto-crystalline with the index of refraction varying from $1.51 \pm$ to $1.59 \pm$, and does not assign a definite formula. Simpson³ assigned the formula $\text{Fe}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$ plus adsorbed water as a result of an analysis of material from a gold mine in Australia. Hawkins and Shannon⁴ have described a new mineral, canbyite, which is believed to be the crystalline equivalent of hisingerite, and they assign the formula $\text{H}_4\text{Fe}'''_2\text{Si}_2\text{O}_9 \cdot 2\text{H}_2\text{O}$ to it.

In the material from Parry Sound the index varies from about 1.50 to 1.56, and this seems to be true of both the isotropic and crystalline varieties. In thin section and powder it has a bright orange or brown color, especially at the edges. Part of the material is anisotropic and gives a biaxial interference figure. The two thin sections available, which show the mineral, indicate a predominance of anisotropic material, but a study of the powder from various specimens indicates that the amorphous material is more abundant. The two types are intimately mixed and can not be

¹ Schwartz, G. M., Primary relationships and unusual chalcopyrite at Parry Sound, Ontario: *Econ. Geol.*, **19**, 206-209, (1924).

² Larsen, E. S., The microscopic determination of the non-opaque minerals: *U. S. Geol. Survey, Bull.* **679**, (1921).

³ Simpson, E. S., *Proc. Roy. Soc. West Australia*, **5**, 95-97, (1920).

⁴ Hawkins, A. C., and Shannon, E. V., Canbyite, a new mineral: *Am. Min.*, **9**, 1-4, (1924).

distinguished in plain light. (Fig. 1.) In thin section the mineral shows numerous irregular fractures. The streak is yellow and

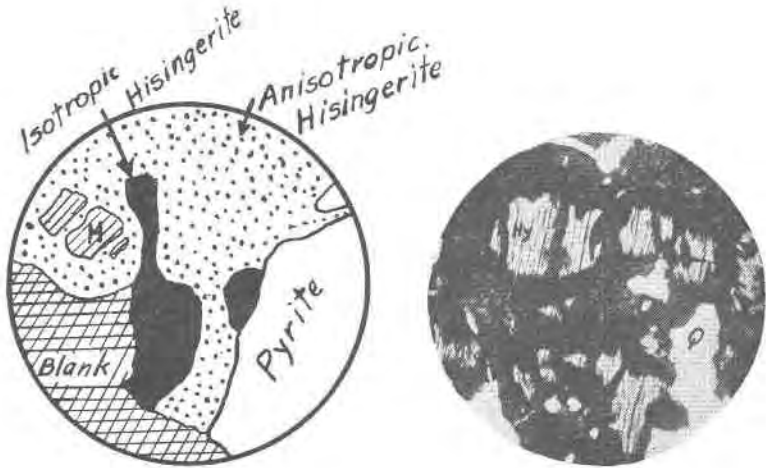


Fig. 1. (Left) Sketch from a thin section showing the relations of isotropic and anisotropic hisingerite in the same field. The two cannot be distinguished in plain light. Hypersthene (H). Wilcox mine. Mag. $\times 30$.

Fig. 2. (Right) Micrograph of a thin section showing remnants of hypersthene (Hy) in hisingerite (dark). Quartz grains (Q). Pyrite-chalcopyrite ore from the Wilcox mine. Mag. $\times 50$.

similar to that of limonite. An analysis by Mr. R. J. Leonard gave the following results.

ANALYSIS OF HISINGERITE

| | |
|--------------------------------|--------|
| SiO ₂ | 35.57 |
| TiO ₂ | .12 |
| Fe ₂ O ₃ | 39.20 |
| FeO | 4.80 |
| Al ₂ O ₃ | .38 |
| CaO | .85 |
| MgO | 1.60 |
| H ₂ O above 110° C | 11.60 |
| H ₂ O below 110° C | 6.00 |
| Total | 100.12 |
| Sp. G | 2.50 |

The material analyzed was examined in powdered form and proved to be about three fourths amorphous and one fourth crystalline. The analysis corresponds very well with that given by Hawkins and Shannon for canbyite, the crystalline equivalent of hisingerite.

The mineral occurs intimately associated with pyrite and chalcopyrite ore from the Wilcox mine. Other metallic minerals noted in these ores are: magnetite, pyrrhotite, cubanite, and sphalerite, but hisingerite is found in contact only with pyrite and chalcopyrite. The ores are found as masses and disseminations in pre-Cambrian garnet biotite schists which also contain plagioclase, hypersthene, hornblende, apatite, quartz, etc. Commonly the hisingerite occurs as a matrix to coarse irregular grains or crystals of pyrite, with masses of chalcopyrite more or less abundant, and in some places almost supplanting the hisingerite as a matrix for the pyrite. The hisingerite has a conchoidal fracture and a distinctly purplish cast on fresh surfaces. Examination of thin sections of the material show that the matrix is not entirely hisingerite but that it is filled with residual remnants of hypersthene as shown in Figure 2. The hisingerite is obviously an alteration product of the hypersthene. Several grains of hypersthene have the same orientation as shown by the cleavage in Figure 2. A more notable fact is that most of the hisingerite shown in Fig. 2 also extinguishes as a unit indicating a large crystal. Grains of quartz are scattered here and there in the hisingerite.

As far as known to the writer the derivation of hisingerite from hypersthene has not been previously described. Dana⁵ suggests that it is derived from pyrite in some cases. This is possibly true to a small extent at Parry Sound as polished surfaces of the ores of some specimens show hisingerite projecting into pyrite. Figure 3 is a sketch of a polished surface of pyrite in a matrix of hisingerite. The pyrite fragments are remnants indicating an alteration to, or replacement of, pyrite by hisingerite. The mineral is also commonly found penetrating chalcopyrite along the parting planes which are developed in these specimens to an unusual degree.⁶ This was noted both in thin section and on polished surfaces. Normally the hisingerite is a very narrow band along the parting but in some cases a considerable width is attained, as

⁵ Dana, E. S., System of mineralogy, p. 702, 1911.

⁶ Schwartz, G. M., *op. cit.*

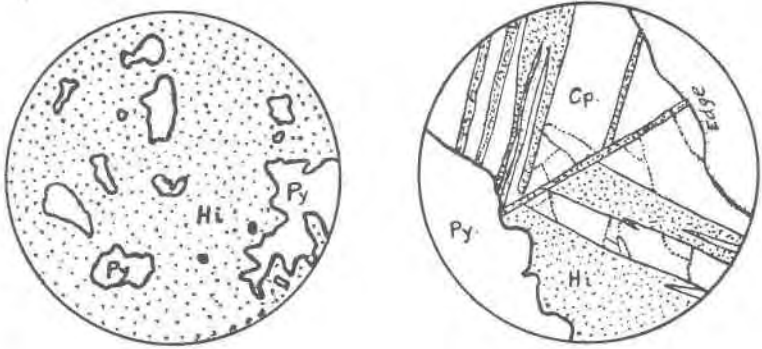


Fig. 3. (Left) Sketch of a polished surface showing residual grains of pyrite (Py) in hisingerite (Hi). Wilcox mine. Mag. $\times 35$.

Fig. 4. (Right) Sketch of a polished surface showing chalcopyrite (Cp) penetrated and altered along parting to hisingerite (Hi). Specks of chalcopyrite are abundant in the hisingerite and the latter mineral cuts across chalcopyrite in veinlets. Wilcox Mine. Mag. $\times 18$.

in Figure 4. These bands show abundant specks of chalcopyrite, and veinlets of hisingerite cross from one band of chalcopyrite to another. This suggests that the hisingerite has replaced the chalcopyrite and possibly the iron from the chalcopyrite entered the hisingerite.

In conclusion, it is believed that most of the hisingerite is derived from the alteration of hypersthene but it is possible that some of it represents an alteration of pyrite and chalcopyrite; but in any event hisingerite replaces these two minerals. As to the nature of the solutions which caused the alteration there may be some doubt. The writer expressed the opinion that the solutions which were responsible for the ores also altered the hypersthene, but more detailed work seems to render this improbable. The degree of oxidation of the iron and the manner in which the hisingerite occurs suggest alteration by meteoric waters. The fact that amorphous and crystalline forms occur together and that they are indistinguishable except with crossed nicols, indicates that this material is, in part, true crystalline hisingerite. Whether or not it is identical with canbyite, is not certain.