

Pseudomorphs of Hæmatite after Iron Pyrites.

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With an Analysis by A. HUTCHINSON, B.A.

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LAST Easter, when I was with Professor Hughes and his geological students at Torquay, I found some very perfectly preserved pseudomorphs of hæmatite after iron pyrites. They occur in the calcareous red shale in the most northerly part of Saltern Cove, Torquay, where the unconformity of the Trias and the Devonian is well shown.

The crystals vary in size from small to large peas, and are in a band about half-a-foot wide in a nearly horizontal position in the cliff facing the sea, while on the north side of this small promontory they appear in a similar manner, but making an angle of about 120° to the horizontal band.

It is pretty certain from the arrangement of the fossils found at this spot that the two bands were originally in parallel position, and have been brought into their present position by later earth-movements. The form of the crystals is that of a cube striated parallel to the intersection of the $\{100\}$ and $\pi \{210\}$ faces; on some of the crystals the face $\pi \{210\}$ is well developed.

The crystals have a hardness of 4 to 5, and a density 4.5, similar to that of massive hæmatite; streak, reddish-brown; when broken are compact inside; sometimes accompanied with veins of calcite.

The other recorded occurrences of these pseudomorphs are:—

From Rio $\pi \{210\}$, described by vom Rath. *Zeit. geol. Ges. Berl.* XXII. p. 707.

Beresovsk, Siberia $\{100\}$, with quartz in granite. Ullmann, 1814, *Syst. Min.* p. 309.

Piedmont $\{100\}$. *Blum. Pseud.* I. p. 187.

Platten, Bohemia, $\pi \{210\}$ $\{111\}$. *Blum. Pseud.* p. 188.

Quicksilver mine, Potz Int. $\pi \{210\}$. *Blum. Pseud.* II. p. 187.

Stahl, near Moschel, Rhenish Bavaria.

Saalfeld in Thuringia. *Blum.* III. p. 180.

Eibenstock, Saxony. *Blum.* III. p. 180.

Kerrara Sound, Argyllshire. Heddle.

Elba $\pi \{210\}$ $\{100\}$. *Blum.* IV. p. 103.

Sarbalberges, Hungary {100}, Madelung. *Jahrb. geol. Reichs.* XIV. p. 287-8.

Glengavin, Leadhills. Heddle.

S. Joaod' Ypanema, S. Brazil; {100} Rosenbusch. *Ber. nat. Ges. Freiberg* 1870. p. 537.

Berggieshübel, Saxony; British Museum collection.

Ardbarrow Mine, Millom, Cumberland; British Museum collection.

Spitzleite, Schneeberg, Saxony; British Museum collection.

Johann-Georgenstadt, Saxony; {100} Cambridge collection.

The pseudomorphs of brown iron oxide after iron pyrites are much greater in number. Can this be in some way accounted for by the production of red hæmatite taking place subsequently to that of the brown iron oxide, and not directly from the iron pyrites? Such a view is put forward by Bischof.

The crystals from S. Joaod' Ypanema contain a kernel of soft brown iron oxide, and therefore point to such a production. But there is another way of accounting for it. If a piece of calcite or other form of carbonate of lime be placed in a solution of ferric chloride, a deposition of red oxide of iron takes place.

The presence of carbonate of lime in large quantities in the rocks about Torquay has most likely caused the iron in solution percolating through the rock as ferric chloride (from the salt water above) to be deposited as red oxide of iron instead of a brown oxide, and from the same cause the iron pyrites has been changed directly into red oxide of iron instead of into the more common form of brown oxide of iron.

These pseudomorphs should be placed in the division of partial allomorphs. Below is Mr. Hutchinson's account of his analysis:—

“ Before commencing the analysis I determined the specific gravity of these crystals, dividing them for this purpose into two lots.

A. Well developed crystals weighing in all 1·9 grams.

B. Less perfect crystals weighing 4·5 grams. Each crystal was carefully scraped free from adhering matrix, and the following values were obtained:—

A = 4·59 at 15° compared with water at 15° C.

B = 4·52 „ „ „ „

B was then reduced to a fine powder; a portion subjected to a preliminary qualitative analysis was found to contain ferric oxide, alumina, silica, calcium carbonate, water and sulphur.

Dilute acid dissolved out the whole of the calcium carbonate, and all the iron was present in the ferric state.

For the quantitative analysis successive portions were taken; in one of

these the sulphur was determined, the mineral being treated with fuming nitric acid and the sulphur precipitated as BaSO_4 . This sulphur is assumed to be due to the presence of iron pyrites, and the amount of this substance given in the analysis below is calculated on this assumption. In a second portion water and CO_2 were determined.

Three other portions were reduced in hydrogen, and two of them dissolved in dilute sulphuric acid, the iron was then estimated by titration with potassium permanganate.

The third portion was dissolved in hydrochloric acid, and the silica, iron, alumina and calcium carbonate separated gravimetrically by the usual methods; the numbers thus obtained gave the following percentages:—

Fe_2O_3	=	85.29
FeS_2	=	1.78
SiO_2	=	4.29
Al_2O_3	=	3.18
CaCO_3	=	5.37
H_2O	=	.71
		100.62

