Cooksey, T., 1896. Mineralogical notes. 1. Precious opal from White Cliffs, NSW. 2. Basic sulphate of iron from Mount Morgan. *Records of the Australian Museum* 2(7): 111–112. [31 January 1896].

doi:10.3853/j.0067-1975.2.1896.1213

ISSN 0067-1975

Published by the Australian Museum, Sydney

MINERALOGICAL NOTES.

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1.—Precious Opal from White Cliffs, N.S.W.

On examining a cut and polished specimen of a fossil-bearing ferruginous sandstone boulder from White Cliffs, N.S. Wales, I was struck by the appearance of the precious opal which had replaced the carbonate of lime of the shells. The rock is permeated with the opal, and particularly when polished has a very beautiful appearance. The minute surfaces in the interior of the opal which produce the play of color; when viewed with a lens, appear to be quite flat and terminated by perfectly straight edges often parallel. On a closer examination under the microscope with reflected light, the appearance in many places was strikingly similar to that of a section of crystalline marble viewed with crossed nicols. The light and dark banded appearance due to twinning in the marble was perfectly imitated in the opal and on rotating the specimen on the stage the bands became alternately coloured.

As the play of colour in the opal is produced by minute cracks in its substance, the planes of colour seen by reflected light are therefore produced by cracks which apparently occupy the same position as the cleavages of the calcite displaced by the opal; occasionally the traces of cleavages could be seen distinctly on one of the bright surfaces and the angles formed by their intersection were approximately those found in calcite. Other portions again showed a somewhat fibrous structure. In many places on focussing into the substance of the opal these cleavage planes could be distinctly seen, and the rhombic forms produced by them were so exactly similar to those obtained by cleavage in calcite that a doubt as to their origin seemed out of the question.

From the above observations it is evident that the carbonate of lime of which the shells were originally composed had first been converted into crystalline calcite (by which all shell structure had necessarily been lost), and then the calcite replaced by opal. The latter had also reproduced the cleavages of the former, and it is these that cause the play of colour which gives to the opal its precious character. Cracks or fractures of a conchoidal form are also present and also produce colour by reflected light but the brilliancy of the specimen for the most part results from the presence of these characteristic cleavages.

2.—Basic Sulphate of Iron from Mount Morgan.

A specimen supposed to have been a fossil bone was sent to this Museum for examination and identification by Mr. R. L. Jack, Government Geologist for Queensland, he having received it from Mount Morgan.

Mr. Gibb Maitland, Assistant Government Geologist for Queensland, writes me that this and similar specimens were found in Number 11 Floor, Freehold South Stopes, thirty-eight feet below the surface of the ground. They occur in a matrix of oxide of iron, the latter forming a dyke, eighteen feet in width, dipping to the north-east, and consist of nodules of all conceivable shapes and sizes, surrounded by iridescent oxide of iron, manganese, and other auriferous clayey matter.

Mr. Jack expressed the opinion that their origin was not organic, which was subsequently confirmed by the Curator of the Australian Museum. A superficial examination of the specimen in question supported this view, and determined it to be a concretion of a basic sulphate of iron containing alkalies. On the strength of this result, Mr. W. R. Hall presented to the Trustees of this Museum the specimen already received. It seemed to me that a more exact determination of the nature of the body would be of interest.

Properties.—To the naked eye the specimen appears a compact mass of a dull brown colour weathered slightly on the outside to a yellow powder. The powdered substance itself has a yellow colour, and under the microscope is seen to consist of minute crystals. It is but very slightly soluble in water, but completely soluble on boiling for a short time with hydrochloric acid. Heating in a tube causes a liberation of acid water and the substance on cooling turns red. Before the blowpipe it turns black, becoming highly magnetic, and slightly fuses on the edges. Its specific gravity is 3·107.

An analysis gave the following percentage composition—

$$\begin{array}{lr} H_2O & = 9{\cdot}96 \\ Fe_2O_3 & = 49{\cdot}13 \\ Na_2O & = 4{\cdot}43 \\ K_2O & = 3{\cdot}88 \\ SO_3 & = 33{\cdot}31 \\ \hline & 100{\cdot}71 \end{array}$$

No water was given off by heating the powdered substance to 175° C. for two hours. The above percentage for water was obtained by heating a weighed quantity to dull redness for a short time, noting the loss of weight, and then estimating the quantity of SO_3 left in the residue. From these numbers and the known total of SO_3 in the substance the amount of water was calculated.

By extracting twice with boiling water, 0·8% was dissolved, which contained a trace of chloride, probably salt.

The specific gravity and the analysis, with the exception of the proportion of potash to soda, agree very closely with those given by Dana in "A System of Mineralogy," p. 975, for *Jarosite*, but the insolubility in water of the Mount Morgan mineral seems to show that the two bodies cannot be identical. The latter body is, without doubt, derived from the decomposition of pyrites.

January, 1896.