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PETTERDITE RE-ANALYSED

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(with one plate)

ABSTRACT

FORD, R.J., and KEMP, N.R., 1980 (31 v): Petterdite re-analysed. *Pap. Proc. R. Soc. Tasm.*, 114: 161-163 (incl. one plate). ISSN 0080-4703. Department of Geology, University of Tasmania, Hobart and Tasmanian Museum and Art Gallery, Hobart, Tasmania, Australia.

Petterdite is mimetite with about 5%-17% pyromorphite in solid solution.

INTRODUCTION AND PREVIOUS WORK

At the beginning of this century, the Government Geologist, W.H. Twelvetrees described and figured a new mineral species, petterdite, named in honour of his friend, W.F. Petterd (Twelvetrees 1902). Classical properties were described and an analysis by E.O. White of Hobart was included. The locality for the specimen analysed was given as the superficial workings of the Britannia mine, Zeehan. The analysis submitted by White was as follows:

PbO	=	74.04
As ₂ O ₅	=	2.60
P ₂ O ₇	=	2.10
Sb ₂ O ₅	=	0.50
Cl	=	<u>10.00</u>
TOTAL		99.24

The mineral was proclaimed on the basis of the analysis which did not conform to any known mineral.

Anderson (1906), using crystallographic measurements, suggested that this mineral was probably a form of mimetite, but, no further analytical work was included in the study. Subsequently Petterd in his compilation of *The Minerals of Tasmania* (Petterd 1910, 118) included petterdite as a variety of mimetite.

Petterd bequeathed his collection of some 2500 specimens to the Royal Society of Tasmania who loaned it to the Trustees of the (then) Tasmanian Museum and Botanical Gardens for a period of 999 years. In the accompanying hand-written catalogue the Trustees received, are included details of four specimens of petterdite:

No. 633 from Zeehan, No. 634 from Mt Read, No. 635 from Mt Read, No. 636 from Zeehan. Only Nos. 633 and 634 are now extant.

X-ray diffraction studies made on specimen No. 633 showed it to be adamite (Department of Mines 1970,9). Presumably on the basis of this result, specimen No. 634 was relabelled "adamite" also. However, No. 634 has now been analysed by x-ray diffraction and is similar to specimen 622.

The "type specimen" of petterdite, recognizable from the excellent photograph (Twelvetrees 1902) was found in the collection of the Museum and Art Gallery labelled as matlockite from Cromford, Derbyshire, England with the number 622. The hand-written 1910 catalogue lists specimen no. 622 as matlockite from that same locality. The source of this confusion can now only be conjecture as the mistake was made more than 70 years ago. Some small crystals from this specimen were removed for chemical

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and x-ray diffraction analysis.

CHEMICAL ANALYSIS

The sample was analysed using atomic absorption flame photometry for lead and arsenic, solution spectrophotometry for phosphorous and fluorine, and ion selective electrodes for chlorine and fluorine. A.R. Pb (NO₃)₂, As₂O₃, NaCl, NaF and U.S. International Standard phosphate (NbS 120b) were used as standards. Standard solutions were prepared with similar element concentrations to that of the sample.

Results:	Pb0 = 76.26
	As ₂ O ₅ = 21.23
	P ₂ O ₅ = 2.02
	Cl = 2.00
	F = 0.08
	V ₂ O ₅ = <u>0.00</u>
	TOTAL 101.59

P. Robinson - analyst.

Atomic proportions

Pb = 0.34055
As = 0.18553
P = 0.02841
Cl = 0.05641
F = 0.00421

Atomic proportions on the basis of Pb₅

Pb = 5.00
As = 2.72
P = 0.42
Cl = 0.83
F = 0.06

Pyromorphite-mimetite = Pb₅ [P,As]₀₄]₃Cl

"Petterdite" this analysis = Pb₅ [(As,P)₀₄]_{3.14}Cl, F_{0.89}

X-RAY DIFFRACTION ANALYSIS

Applying the method of Baker (1966) to specimen 622, "d" spacings for the lines 11.2 and 30.0 were measured with a Philips diffractometer using fluorite as the internal standard and CuK α radiation. These results were then applied to the determinative diagram (op.cit.). "Petterdite" gave d_{11.1} = 3.001 A.U. and d_{30.0} = 2.947 A.U. From the determinative diagram these lead to a proportion between 83%-88% of the mimetite molecule in solid solution with pyromorphite, in good agreement with the analytical results. Specimen No. 634 has d_{11.2} = 3.011 A.U. and d_{30.0} = 2.951 A.U. giving a mimetite proportion ranging from 87% to 95%.

CONCLUSION

Clearly the mineral is part of the pyromorphite-mimetite series. [Pyromorphite - Pb₅(PO₄)₃Cl, Mimetite - Pb₅(AsO₄)₃Cl]. In the analysis the halogen element is deficient while the oxygen anion complex has an excess. These may be related to impurities in the mineral and to the difficulties associated with analysing small samples. There could also be (OH) replacing halogens. On the basis of the analysis the proportion of the mimetite molecule is 86.62%.

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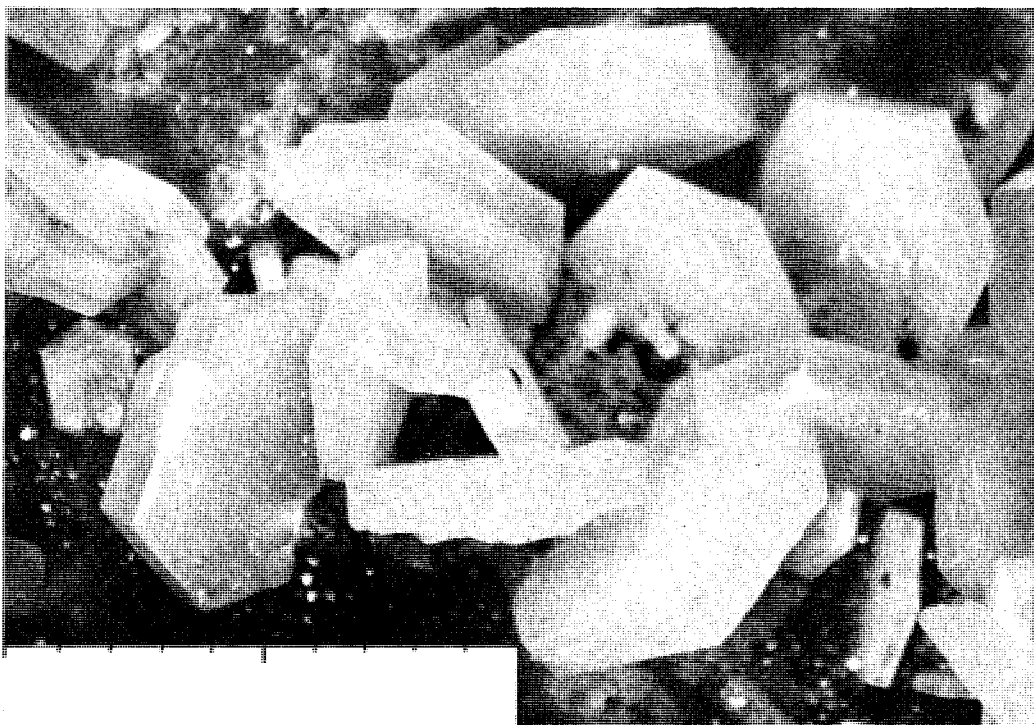


PLATE 1.- Twinned crystals of mimetite, part of specimen 622, holotype of "petterdite."
Scale bar 10 mm.