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A RE-APPRAISAL OF JOHNSTONOTITE

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(With one plate and one text figure.)

ABSTRACT

Johnstonotite is a mixture of spessartite and grossularite.

INTRODUCTION

In 1899 McLeod and White described a manganiferous garnet from Port Cygnet. This was considered to be a new species and named johnstonotite. The locality was not described accurately, as a result of which A. B. Edwards (1947) indicated an incorrect site for the mineral. Johnstonotite has now been found to occur as phenocrysts in a dyke which outcrops on the western shore of Port Cygnet approximately 200 yards north of the site of the old Lymington deep water jetty (Fig. 1). This was recognised as a result of the discovery of the type specimen of johnstonotite in the collection of the Tasmanian Museum (Spec. No. X1435), by Mr. R. Both. The present investigation stems from a general investigation of Tasmanian minerals by modern methods together with the obvious incompatability of the original analysis with that required for a garnet.

METHODS OF INVESTIGATION

A chemical analysis was performed by the Tasmanian Department of Mines and X-ray data have been obtained from a Philips diffractometer calibrated with powdered silicon, using a 1° divergence slit, 0.1° receiving slit, 1° scatter slit and CuKα radiation filtered with nickel. A xenon proportional counter with pulse height analyser was used as a detector. Larger slits were used for the back reflection region but intensities were recalculated for the smaller slit system.

ANALYTICAL RESULTS

	New Analysis	Original Analysis
SiO_2	36.60	36.87
Al_2O_3	20.50	7.28
Fe_2O_3	0.70	....
FeO	2.70	17.12
MnO	26.00	13.68
TiO_2	0.34	....
P_2O_5	0.14	....
CaO	13.10	11.98
MgO	0.00	12.49
Ig. Loss	n.d.	00.29
	100.08 Tas. Mines Dept. 1966	99.71 McLeod and White 1899

Formula on the basis of 96 Oxygen atoms per unit cell:

$$\left(Mn^{2+}_{13.496}Ca_{9.036}Fe^{2+}_{1.468}\right) \quad \left(Al_{15.116}Mn^{3+}_{0.424}Fe^{3+}_{0.344}Ti_{0.156}\right)$$

$$\left(Si_{23.516}Al_{0.408}P_{0.076}\right) O_{96.000}$$

This formula corresponds with the following molecular percentages: spessartite 53.30, grossular 35.50, almandine 6.12, blythite 2.65, and andradite 2.43. Clearly andradite is not a dominant molecule, as implied in the Chemical Index of Minerals (Hey, 1950). The most interesting feature of the analysis is the apparent excess of manganese oxide in the divalent position thus indicating the possibility of the presence of Mn^{3+} in the structure.

DIFFRACTION RESULTS

Line No.	I	d(obs.)	d(calc.)	hkl
1	4	4.770	4.773	211
2	4	3.120	3.124	321
3	41	2.923	2.923	400
4	100	2.613	2.614	420
5	5	2.493	2.492	332
6	18	2.386	2.386	422
7	12	2.293	2.293	431
8	14	2.134	2.134	521
9	3	2.065	2.067	440
10	19	1.896	1.896	532
11	12	1.687	1.687	444
12	22	1.621	1.621	640
13	25	1.562	1.562	642
14	7	1.460	1.461	800
15	5	1.307	1.307	840
16	8	1.275	1.275	842
17	4	1.246	1.246	664
18	6	1.085	1.085	10.40
19	4	1.067	1.067	10.42
20	3	1.033	1.033	880
21	<1	0.9743	0.9742	12, 0.0, 884
22	<1	0.9609	0.9609	12.2.0
23	2	0.9482	0.9482	12.2.2,10.6.4
24	<1	0.9071	0.9073	9.9.2
25	<1	0.8767	0.8762	9.9.4
26	<1	0.8713	0.8713	12.6.0,10.8.4.
27	<1	0.8436	0.8436	888

Unit cell edge = 11.690 A.U. Second moment deviation = ± 0.005

Density (calc) = 4.026 gm/cc

Density (obs) = 3.910 gm/cc.
Refractive index = 1.779 ± 0.001 23°C Na light.

The experimental results are consistent with the determinative table of Winchell as presented by Deer, Howie and Zussman (1962).

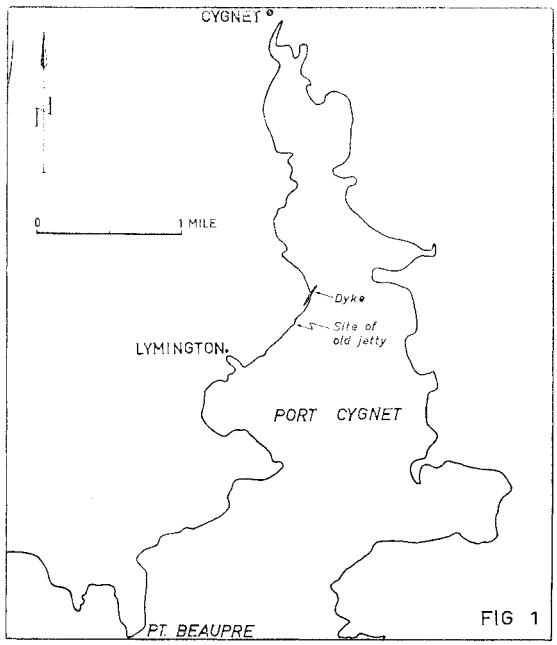

FIG 1

PETROLOGY

Macroscopically, johnstonotite occurs as round reddish-brown phenocrysts varying from 0.5 mm. to 10 mm. in diameter, in a dense fine-grained grey dyke about 50 cm. wide dipping steeply west and striking 015° E magnetic which has caused baking and hornfelsing of the intruded Permian rocks. The dyke has a chilled margin. Often associated with the garnet are crystals of pyrite, up to 5 mm. in diameter. Small crystals of galena, arsenopyrite, and possibly sphalerite are also occasionally visible in the rock. Aggregates of epidote, sometimes comparable in size with those of the garnet also occur.

Microscopically the rock consists of a fine-grained groundmass of lath-shaped simply twinned crystals of sanidine approximately 0.05 mm. x 0.005 mm. showing a characteristic flow structure with occasional porphyritic euhedral crystals of feldspar, predominantly sanidine, having a grainsize of about 2 mm. x 0.5 mm. The groundmass also contains flecks of a greenish-brown weakly pleochroic micaceous mineral. The phenocrysts of garnet have a high relief, are weakly anisotropic, show strong zoning and twinning, and have cracks in which prehnite and epidote have crystallized at a late stage of crystallization (rather than by reaction with the garnet because they do not have the properties of manganiferous varieties). Epidote appears near the rim of the garnet and occasionally in the groundmass. The garnet appears zoned due to the presence of small flakes of mica and epidote which have apparently crystallized in cracks formed at an earlier stage of the growth of the host (Plate I). The texture of the rock suggests crystallization of the garnets as the first mineral at a high temperature, these then acting as centres of crystallization for later formed feldspars and epidote which appear to have grown off the garnet thus giving the appearance of a white rim to the mineral (Plate I). In thin section the rock is best described as a garnet-sanidine porphyry.

ACKNOWLEDGMENTS

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CONCLUSIONS

Johnstonotite is not a valid species and should therefore be removed from the mineralogical record. It is a spessartite garnet containing a proportion of grossularite plus accessory molecules.

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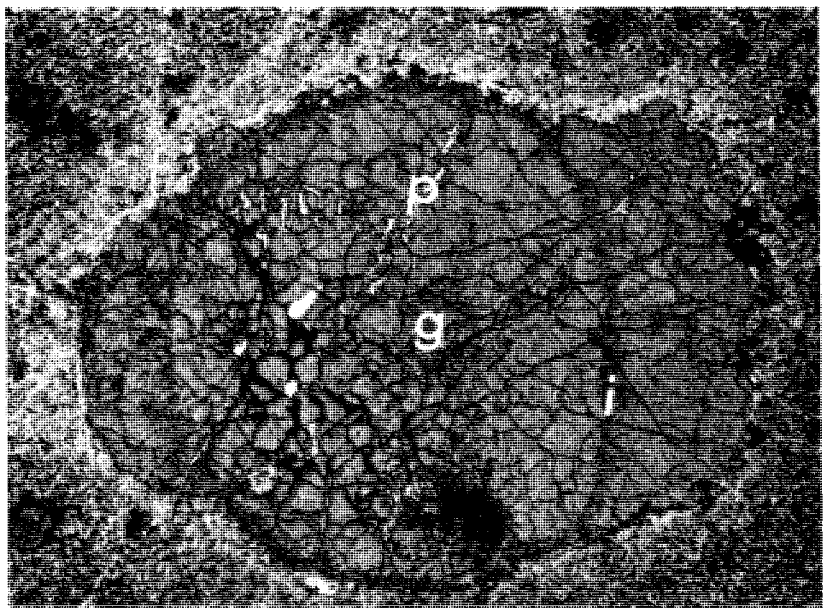

Plate I.—Garnet phenocryst (g) showing rim of feldspar crystals (f), inclusions (i), and prehnite (p). x 7.