

5.—CONTRIBUTIONS TO THE MINERALOGY OF WESTERN AUSTRALIA.

Series iii.

(With two figures, 1 and 2.)

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CONTENTS.

	Page
(1.) Tanteuxenite (Sp. nov.), Pilbara Goldfield	45
(2.) Microlite, Strelley	48
(3.) Andalusite, Toodyay	50
(4.) Grossularite, Mt. Francisco	51
(5.) Spessartite, Tabba and Stannum	51
(6.) Andradite, Melville and Weelhamby Lake	52
(7.) Spodumene, Wodgina	54
(8.) Cumingtonite, Warriedar	54
(9.) Corundum, Abydos, Burbanks and Balbarrup	54
(10.) Octahedrite, Kunjin	56

(1.) TANTEUXENITE (Sp. nov.), PILBARA GOLDFIELD, N.W. DIV.

Two minerals resembling euxenite in appearance have been observed on several of the tinfields of the Pilbara goldfield. One of these has now been sufficiently investigated to show that it is a new mineral species, and to enable a systematic physical and chemical description of it to be given.

Whilst normal euxenite—which has been described from Norway, Sweden, Greenland, Ontario, Brazil, Transvaal, and Madagascar—is a titanoniobate of yttrium, the mineral here described differs from it in being essentially a titanotantalate of yttrium. This substitution of tantalum for niobium is evidenced in the higher specific gravity, that for euxenite being 4.6 to 5.1, whilst for the Pilbara minerals it is 5.4 to 5.9. A new name being required for the species, Tanteuxenite is suggested. The derivation of the name is obvious.

Tanteuxenite was first detected at *Cooglegong* in some angular boulders shed from a pegmatite vein. In these it was found in masses up to 200 grammes in weight associated with grey quartz. It exhibited traces of a flattened prismatic structure, and on a fresh fracture, which was conchoidal to subconchoidal, had a brownish black colour with brilliant resinous lustre. Most of the surface, and some approximately parallel fractures, were coated with a very thin film of grey decomposition products.

In mass the Cooglegong mineral is opaque and nearly black in colour, but thin splinters are translucent up to a thickness of 0.5 mm., and transmit a pale to dark amber light according to thickness. The fine powder is of a tawny olive (17"i) colour, and under the microscope is transparent and isotropic, with an amber colour. When a fragment is heated in a closed tube it decrepitates slightly, gives off water and becomes much paler in colour, approximating that of the powdered mineral.

An analysis is given in column (1) below. A second similar specimen had a specific gravity of 5.64 with 16.1 per cent. of TiO_2 . It was found to be easily broken up by fusion with potassium carbonate or potassium hydroxide, or by heating with a mixture of HF and H_2SO_4 .

The mineral here described must not be confused with that from the same locality referred to by the writer as euxenite in the "Transactions of the Australasian Association" for 1907 (Vol. XI., p. 446). This mineral, which is the second one referred to in the first paragraph above, apparently occurs also at Leeds tin find on Abydos Station. It is somewhat different in appearance, and contains much more titanium oxide than tanteuxenite, and is being further investigated. It is probably the tantalum mineral corresponding to polyerase or blomstrandine, according to the latest convention.

From a pegmatite in granite a few miles S.E. of Cunnagunna Trig. (B4) on *Woodstock Station*, a few pounds of less typical tanteuxenite have been obtained. During a brief inspection the writer could find no more beyond the small pocket originally discovered in 1926. The mineral from this place is similar in appearance to that from Cooglegong. It has a hardness of 5.5 to 6.0, is devoid of crystalline form or cleavage, has a subconchoidal fracture, is brownish black in colour, and opaque in mass, with a resinous lustre. The powder is tawny olive in colour, and under the microscope transparent, brownish-amber, and isotropic.

Titanium determinations on various fragments gave from 20 to 21 per cent. of TiO_2 , the specific gravity ranging from 5.5 to 5.6. Two complete analyses were made, and are given in columns (2) and (3) below. The mean figures indicate a much smaller excess of tantalum over niobium than is the case with the Cooglegong mineral. The definite detection of bismuth in the mineral is of interest, as it has never previously been observed in a mineral of this type. Failure to recognise it and separate it from the associated lead in such minerals would vitiate any calculation regarding their age. The geological age calculated from the Woodstock mineral is excessive, and it is evident that either lead has been added to the mineral, or uranium leached out by weathering, or, like the plumboniobite of East Africa, it contains primary lead.

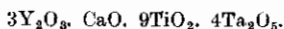
Tanteuxenite, Cooglegong and Woodstock.

	Cooglegong.	Woodstock, A.	Woodstock, B.
	0.11	0.0	0.0
Ta ₂ O ₅	47.31	22.95	24.84
Nb ₂ O ₅	3.83	15.27	13.40
TiO ₂	14.17	21.05	20.71
SnO ₂ ... ..	.14	.44	.42
ThO ₂	trace	2.86	3.16
Y ₂ O ₃ .Er ₂ O ₃	17.48	16.36*	16.62†
Ce ₂ O ₃	} 7.22 {	9.40	9.04
La ₂ O ₃ .Di ₂ O ₃ ... ..		.14	.34
UO ₃	3.35	4.16	4.04
PbO	traces	1.71	1.64
Fe ₂ O ₃	1.18	1.53	1.48
MnO ... ..	.35	.28	.28
CaO	2.22	.97	.97
Al ₂ O ₃	Nil	.31	.61
Bi ₂ O ₃	Nil	.04	.04
SiO ₂ ... ..	.90	.13	.56
Na ₂ O	trace	Nil	Nil
Ign.	2.40	2.24	2.16
Total	100.55	99.94	100.31
Sp. Gr.	5.77	5.55	5.55
Analyst	E.S.S.	D. G. Murray	D.G.M.

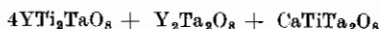
* Approx. Y₂O₃, 11.32 ; Er₂O₃, 5.04.

† Approx. Y₂O₃, 11.50 ; Er₂O₃, 5.12.

Assuming that the UO₃ represents weathered UO₂, and that this and the ThO₂ are isomorphous with the TiO₂, the mean figures for the two Woodstock analyses give approximately the formula—



which is equivalent to an isomorphous cocrystallisation of—



from which the essential constituent of tanteuxenite is considered to be YT₂TaO₈; and of euxenite, YT₂NbO₈. Expanded, these formulae are of the form Y₂O₃.4TiO₂.Ta₂O₅.

Two other localities in the North-West division have yielded specimens of a mineral not yet analysed, but assumed to be tanteuxenite on account of their chemical and physical properties. They are Eleys, 10 miles S. of Cooglegong, and 40 miles E.N.E. of the Woodstock find, and Mt. Francisco, 30 miles N.W. of Woodstock.

At Eleys the mineral is plentiful in alluvial tin rejects from Mineral Claim 15, forming 27 per cent. of a parcel of rejects collected by the writer in 1927. It is in subangular to well rounded pebbles, ranging in weight from 0.5 to 4 grammes. On the exposed surface it is brown or brownish black in colour with dull lustre, but fresh fractures reveal the typical resinous lustre and normal appearance both in mass and under the microscope. A series of specific gravities determined were 5.61, 5.58, 5.56, 5.54, 5.50, 5.36. The pebble with a gravity of 5.58 had 18.07 per cent. of TiO₂.

Several specimens from Eleys are distinctly tabular in structure, and almost certainly orthorhombic, though they are too water-worn to be capable of angular measurement. The commonest forms appear to be (100), (010) and (001). What appear to be the prism faces are vertically striated.

On a tin lease six miles S.E. of the Government well at *Mt. Francisco*, the writer found water-worn pebbles of tautouxenite not uncommon in alluvial tin concentrates. The pebbles collected never had a greater mass than 2 grammes, and were coated with a strongly adherent reddish brown decomposition product with a dull lustre. After removing part of this coating by dipping in and out of hydrofluoric acid, specific gravities of 5.42, 5.59, 5.71, 5.78, and 5.90 were obtained. The pebble with a gravity of 5.78 contained 18.16 per cent. of TiO_2 . On a fresh fracture the mineral had the typical appearance of tautouxenite and indistinct indications of tabular crystallisation were again apparent.

A systematic description of the mineral is as follows:—*Tautouxenite*: Essential composition, a titanotantalate of yttrium, YTi_2TaO_6 ; ($Y_2O_3, 4TiO_2, Ta_2O_5$), a minor part of the tantalum being replaceable by niobium. Other isomorphous replacements of the whole molecule are probably $CaTiTa_2O_6$ and $Y_2Ta_2O_6$, whilst Th and U may partly replace Ti, and Er, Ce, etc., partly replace Y. Orthorhombic; habit tabular parallel to the macropinacoid. Cleavage, none; fracture, conchoidal to subconchoidal. Hardness, 5 to 6; brittle. G, 5.4 to 5.9, the variation mainly due to varying proportions of tantalum and niobium. Colour in mass brownish black to dark brown (see brown, 5''m); apparently opaque, but translucent at about 0.5mm. Powder greyish yellow (typically tawny olive, 17''i), transparent and brownish yellow under the microscope, and abnormally isotropic owing to hydration. Before the blowpipe, infusible, glows not at all or only very slightly, sometimes decrepitates, always yields water, and coarse fragments pale to about the colour of the powdered mineral. Slowly attacked by hot strong hydrochloric or sulphuric acid, but most readily dissolved by a mixture of hydrofluoric and sulphuric acids, or by fusion with potassium carbonate or potassium hydroxide and treatment of the fused mass with hydrochloric acid. The type mineral is that from Cooglegong.

(2) MICROLITE, STRELLEY, N.W. DIV.

The first record of microlite in Australia was that made by the writer in 1907 of this mineral at Green's Well near Wodgina*. In 1917 the writer described tapiolite from Strelley, then known as Tabba Tabba North. The latter deposit is now being reworked and in parcels of ore from $2\frac{1}{2}$ miles north of M.L. 321, there has been detected an occasional intergrowth of tapiolite and microlite.

The mixture is in coarse detrital pebbles weighing up to 100 grammes. In one case only were any crystal faces observed and these appeared to indicate that the whole mass had the form of a complex twin of tapiolite. The other pebbles are well water worn. The major part of each pebble consists of a black iron tantalate, apparently tapiolite. Irregular portions of the surface are composed, however, of a second opaque mineral of a pale buff to

* A.A.A.S. 1907, p. 451, also A.A.A.S. 1909, p. 314.