

MINERALOGICAL MAGAZINE, JUNE 1972, VOL. 38, PP. 765-7

Calciotantalite confirmed as a mixture

E. S. SIMPSON¹ (1907) described several pebbles composed of a greyish-black, apparently homogeneous mineral from Wodgina in the Pilbara Goldfield region of Western Australia. An analysis (Table I, a) of a half of one of these pebbles indicated a variety of tantalite in which an appreciable quantity of lime replaced ferrous oxide. Simpson named it calciotantalite, but added the reservation that further investigation

TABLE I. *Analyses of calciotantalite and its constituent minerals*

	a	b	c	d	e
Ta ₂ O ₅	73.82	77.00	77.9	61.9	65.1
Nb ₂ O ₅	6.44	3.64	3.4	21.0	9.2
SnO ₂	0.72	0.37	1.1	0.4	8.5
TiO ₂	0.54	0.51	1.1	1.5	4.5
FeO	8.42	0.47	—	9.3	8.6
MnO	1.39	0.11	0.2	5.9	4.7
CaO	7.78	12.78	15.7	—	—
MgO	0.62	—	—	—	—
Na ₂ O	—	1.18	0.7	—	—
	99.73	100.51†	100.1	100.0	100.6

a. Calciotantalite, Wodgina. Simpson (1907).

b. Microlite, Wodgina. Simpson (1929). † Total includes —SiO₂ 0.40,

Fe₂O₃ 0.72, Al₂O₃ 0.55, K₂O 0.15, F 1.09, H₂O⁺ 2.00, less O = F₂ 0.46.

c. Microlite groundmass } B.M. 1931, 546; electron probe determinations, made at 20 kV using
 d. Tantalite inclusions } pure metal standards for all the elements except calcium and sodium,
 e. Tin-rich tantalite } for which chemically analysed wollastonite and jadeite respectively
 were used.

might prove the mineral to be an intimate intergrowth of microlite and tantalite. He obtained further specimens some years later from several localities in Western Australia and an examination of one, also from Wodgina (Simpson, 1929), showed the grey material to consist mainly of microlite (Table I, b) with a few grains of a darker opaque mineral, probably tantalite. According to the present Head of the Mineral Division of the Government Chemical Laboratories (G. H. Payne, 1970), Simpson subsequently classified all his specimens as microlite and discarded the name calciotantalite. However, shortly afterwards, calciotantalite found its way into Spencer's (1931) list of new mineral names and has remained in the literature ever since.

To clear up this matter, an examination has recently been made of the material labelled calciotantalite in the mineral collection of the British Museum (Natural History). The specimens² (B.M. 1931, 546 and 547) consist of fourteen small water-worn pebbles between one and three centimetres in diameter, the locality being given

¹ E. S. Simpson (1875-1939). Government Mineralogist and Analyst of Western Australia, 1922-39.

² Donated in 1931 by A. O. Watkins, Mining Engineer and Assayer, of Perth, Western Australia.

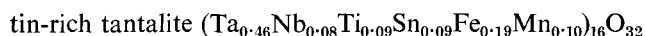
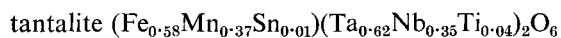
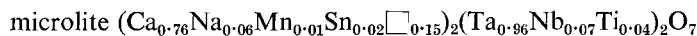
as Pilbara, Western Australia. One pebble had been broken open, showing a grey core and a narrow brown-black rim as described by Simpson. Microscopic examination of a polished mount made from a small piece of this specimen showed the core to be composed of two phases, a medium grey groundmass containing a very large number of small light grey inclusions up to about 50 μm in diameter. The rim of the pebble was seen to be a mineral of similar reflectivity to these inclusions. Electron-probe analyses were made of these phases using a Geoscan microanalyser and it was found that the grey groundmass had a homogeneous microlite composition. The



FIG. 1. X-ray scanning photographs of an area on the calciotantalite specimen containing mainly intergrown microlite and tin-rich tantalite. A few small areas of 'normal' tantalite are visible; these contain iron but no tin. Top, Fe- $K\alpha$; middle, Sn- $L\alpha$; bottom, Ca- $K\alpha$. $\times 40$.

higher reflecting phase generally showed a tantalite composition, but small portions were much richer in tin. This tin-rich phase was optically indistinguishable from the main tantalite phase (fig. 1). Analyses of the three phases are given in Table I, c, d, and e. Despite the large difference in average atomic number between these minerals and rock-forming minerals, the correction procedures tested by Sweatman and Long (1969) were found to hold good and were used in a computer programme (Mason *et al.*, 1969) to convert the measured intensities into oxide concentrations. The mass absorption coefficients used were those of Heinrich (1966).

Simpson's original analysis of calciotantalite (a) falls reasonably well between the compositions of the groundmass (c) and inclusions (d) and is, without doubt, a determination on inhomogeneous material. The tin-rich phase (e) is not present in sufficiently large amounts to influence the bulk composition significantly. An X-ray powder photograph showed the core of the pebble to be a mixture of minerals of the pyrochlore-microlite and columbite-tantalite groups. A photograph from hand-picked microlite grains yielded a cubic cell dimension of 10.411 ± 0.002 Å. The tin-rich phase is undoubtedly related to the tin bearing varieties of tantalite such as wodginite (Nickel *et al.*, 1963a), tin-tantalite (Matias, 1961), and ixiolite (Nickel *et al.*, 1963b). The distinction between these minerals is far from clear and it was, unfortunately, not possible to separate any of the present tin-rich mineral for X-ray work. The formulae of the three minerals may be written:



The third formula is written in the disordered tantalite form $A_{16}O_{32}$ used by Nickel (1963a) in his description of wodginite. The microlite phase ($A_2B_2O_7$) shows a deficiency of site *A* cations. This has been noted by several workers studying the pyrochlore-microlite series and ascribed to the leaching of Na and Ca ions (van der Veen, 1963). Borodin and Nazarenko (1957) related the deficiencies in a number of pyrochlores to the degree of hydration.

On this evidence and Simpson's (1929) observations, the name calciotantalite should be finally discarded.

Acknowledgements. The author is grateful to Miss E. E. Fejer for the X-ray powder photographs and cell dimension.

Department of Mineralogy,
British Museum (Natural History),
London SW7 5BD.

A. M. CLARK

REFERENCES

- BORODIN (L. S.) and NAZARENKO (I. I.) [Бородин (Л. С.) и Назаренко (И. И.)], 1957. *Geochemistry*, **4**, 330 (transl. of Геохимия).
 HEINRICH (K. F. J.), 1966. *The electron microprobe*. New York, John Wiley, 296.
 MASON (P. K.), FROST (M. T.), and REED (S. J. B.), 1969. *Nat. Phys. Lab. I.M.S. Report 1*.
 MATIAS (V. V.) [Матиас (В. В.)], 1961. *Geol. of Rare Elem. Deposits*, **9**, 30. [Геол. месторожд. редких элементов.]
 NICKEL (E. H.), ROWLAND (J. F.), and McADAM (R. C.), 1963a. *Canad. Min.* **7**, 390.
 ———— 1963b. *Amer. Min.* **48**, 961.
 PAYNE (G. H.), 1970. Private communication.
 SIMPSON (E. S.), 1907. *Aust. Assoc. Adv. Sci., Rep.* **11**, 451.
 ———— 1929. *Journ. Roy. Soc. Western Australia*, **15**, 108.
 SPENCER (L. J.), 1931. *Min. Mag.* **22**, 617.
 SWEATMAN (T. R.) and LONG (J. V. P.), 1969. *Journ. Petrology*, **10**, 332.
 VEEN (A. H. VAN DER), 1963. *Verh. Kon. Ned. Geol. Mijnb. Genootschap*, **22**, 114.

[Manuscript received 28 April 1971]

© Crown copyright reserved.

MINERALOGICAL MAGAZINE, JUNE 1972, VOL. 38, PP. 767-8

Boulangerite from Port Gaverne, north Cornwall

SMALL quantities of boulangerite ($Pb_5Sb_4S_{11}$) have been identified from Port Gaverne (SX002809), in north Cornwall. The *d*-spacings found using X-ray diffraction correspond closely to those given by Berry (1970). Spectrographic examination supported the identification, and showed the mineral to contain major quantities of Pb and Sb plus traces of Fe, Zn, Ag, Mn, and Sn. Study of polished sections showed