SHORT COMMUNICATIONS

BOULANGERITE IN SULPHIDE ORES FROM THE
OBIRA MINE, KYUSHU, JAPAN

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Introduction

In the course of study of mineralization on the Obira tin deposit, the writer found boulangerite $[\text{Pb}_5 \text{Sb}_4 \text{S}_{11}]$ among the other lead antimony iron sulphide minerals (jamesonite and berthierite, etc.).

Two localities of boulangerite have already been reported in Japan, the Toroku Mine, Miyazaki Prefecture,¹⁾ and the Yoshiwara Mine, Fukuoka Prefecture.²⁾ In this paper the writer gives some descriptions of the boulangerite from the new locality, and his considerations on the genetical relation between the pre-existing galena and the later antimony-bearing ore solutions.

An Outline of the ore deposit

The Obira Mine, Ogata-machi, Ono-gun, Oita Prefecture, is situated at about 30 km. south of the Ogata station of Hohi Line. It was worked for tin, zinc, lead, copper and arsenic for long years.

The surrounding district of the mine is geologically composed of the Paleozoic group, the sheared granites of early Mesozoic, the Mitate conglomerate probably of early Tertiary, the Sobosan volcanic rocks, and the younger acid intrusive complex. The ore deposits are genetically related to the acid intrusives that is, granitic rocks of Miocene epoch, and can be classified as follows;

- (1) Contact metasomatic deposits (zinc and lead bearing garnet-

hedenbergite-axinite-datolite-lievrinite skarn masses.

(2) Pneumatolytic ~ hydrothermal tourmaline-fluorite-cassiterite-quartz veins.

(3) Hypothermal~epithermal sulphide veins, in which boulangerite was discovered.

Mode of occurrence

The Boulangerite is found in the antimony ores in the Dohi-myaku (copper arsenic vein). It is commonly accompanied with galena, the latter being usually bordered or cut by the former. In some cases, boulangerite penetrates into pre-existing minerals such as quartz, pyrrhotite and chalcopyrite. It occurs abundantly as fine granular aggregates, or as felted aggregates of small acicular crystals.

Ore-microscopic observations

Under the ore-microscope, the boulangerite shows the following characters.

Polishing: a good polish.

Reflection colour: white, with somewhat bluish green tint compared with galena, and the discrimination of colour is more distinct in oil than in air.

Reflection pleochroism: distinct, especially in oil immersion; parallel to elongation, white; perpendicular to elongation, greenish grey white.

Anisotropism under the crossed nicols: strong, with polarization colours; dark grey, brown, blue or greenish grey.

Hardness: the same as galena, Talmage B.

Etch tests: HNO_3 (1:1), stains black; HCl (1:1), KOH , FeCl_3 , KCN , and HgCl_2 , negative.

Form and texture (Plate I, Figs 1, 2 and 3): fibrous, needle-shaped or acicular; up to 0.1 mm. long; cleavage or twinning, not observed; replaces galena, and sometimes includes various fine minerals such as chalcopyrite, stannite, sphalerite, and pyrrhotite.

Microchemical tests: the lead iodide test and double iodide test³⁾ indicate that Pb, Sb and S are the major constituents of this mineral; tests for Sn, Fe, Ag and As, negative.

Table 1. X-ray powder data for boulangerite. 1 and 2, copper radiation, camera diameter 28.8 mm., 3, after S. C. Robinson⁴⁾, copper radiation.

1		2		3	
Obira Mine		Bohemia		Sullivan Mine, Br. Columbia	
<i>I</i>	<i>d</i> (Å)	<i>I</i>	<i>d</i> (Å)	<i>I</i>	<i>d</i> (Å)
				$\frac{1}{2}$	6.74
				1	6.13
				$\frac{1}{2}$	5.20
				$\frac{1}{2}$	4.86
				$\frac{1}{2}$	4.61
				1	4.36
3	3.92	2	3.95	2	3.89
10	3.73	10	3.72	10	3.71
2	3.40	4	3.45	1	3.43
2	3.28			3	3.32
3	3.19	3	3.23	5	3.21
8	2.99	8	2.94	4	3.02
10	2.80	10	2.81	8	2.815
1	2.69	2	2.69	3	2.691
		1	2.54	1	2.578
				$\frac{1}{2}$	2.515
				1	2.435
5	2.34	4	2.36	5	2.337
				$\frac{1}{2}$	2.303
1	2.18	1	2.24	$\frac{1}{2}$	2.226
4	2.144	2	2.169	4	2.145
1	2.026	1	2.093	2	2.056
5	2.005	1	2.012	1	1.967
2	1.918	2	1.931	2	1.920
8	1.854	7	1.862	7	1.861
		1	1.794	$\frac{1}{2}$	1.829
7	1.761	5	1.765	6	1.757
1	1.725	1	1.725	2	1.726
1	1.662			1	1.668
1	1.637			2	1.657
2	1.586			$\frac{1}{2}$	1.588
2	1.534			$\frac{1}{2}$	1.537
				1	1.504
2	1.464			1	1.465
4	1.409	3	1.409	2	1.408
				1	1.378
5	1.323	4	1.324		
				$\frac{1}{2}$	1.303
2	1.234	3	1.243	1	1.239
		4	1.216		

X-ray examination

The results of measurements of X-ray powder photograph of the boulangerite from the Obira mine is listed in Table 1. It is identical with those of the boulangerites from Bohemia and the Sullivan mine.

Genesis

The Obira tin deposits are of telescoped type. There are two champion veins called Honpi and Dohi-myaku, in which several successive mineralizations have been recognized⁴⁾ as follows;

Fig. 4. Sketch showing the paragenetic relation of cassiterite (Cs), arsenopyrite (As), quartz (Q), chalcopyrite (Ch), stannite (St), sphalerite (Zn), galena (Ga), and boulangerite (Bl).

- (1) deposition of cassiterite, quartz, apatite and tourmaline,
- (2) deposition of cassiterite (large quantity), quartz, wolframite, molybdenite and pyrite,
- (3) deposition of quartz, pyrite and arsenopyrite,
- (4) deposition of sphalerite (marmatite), chalcopyrite, cubanite,

valleriite, pyrrhotite, stannite, native bismuth, bismuthinite and galena,

- (5) deposition of marcasite (germanium-bearing) and quartz, and
- (6) deposition of stibnite, berthierite, jamesonite, boulangerite, quartz, and carbonate minerals,

The Boulangerite and the other antimony sulphide or sulphosalt minerals were the last products of the hypogen metallization. At the time of the last antimony mineralization, the galena and some of the other simple sulphide minerals were not stable against the newly introduced ore-solution. Consequently, they were attacked by it and kinds of new sulphosalts minerals were formed. The paragenetic texture of the boulangerite and the galena suggests that lead in the boulangerite derived from the galena.

In the same manner, the breakdown of simple iron sulphide minerals led to the formation of berthierite [$\text{Fe Sb}_2 \text{S}_4$] or jamesonite [$\text{Pb}_4 \text{Fe Sb}_6 \text{S}_{14}$].

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Fig. 1

2 cm

Fig. 2

Fig. 3

- Fig. 1. Polished surface of brecciated ore, showing relation of earlier sulphides (breccia) to later antimony minerals (matrix).
- Fig. 2. Photomicrograph showing acicular or fibrous aggregates of boulangerite, oil immersion. Polarizer only.
- Fig. 3. Photomicrograph showing the boulangerite (B) which replaces galena (G). Etched with HCl (1:1). Polarizer only.