BULLETIN

OF THE

IMPERIAL GEOLOGICAL SURVEY OF JAPAN

VOL. XXV, NO. 4.

CONTENTS

The Yoshioka Mine

By Tsutomu Ogura

The Yoshioka Mine

BY TSUTOMU OGURA

Situation and Output

The Yoshioka mine is in Fukiya in the province of Bitchu and is the property of the Mitsubishi Mining Company. It is stated that the mine was discovered in the 2nd year of Daidō, 807 A. D., and at the beginning of mining operations mainly silver was extracted, but later copper ore came to be mined.

The output of copper ore has been as follows:

	Copper ore	Copper in ore		Copper ore	Copper in ore
	Tons	Tons		Tons	Tons
1900	43,487	513.3	1915	112,991	725.8
1905	80,796	854.3	1916	100,905	830.2
1910	101,551	778.7	1917	93,178	795.1
1911	128,824	1042.6	1918	87,398	547.7
1912	110,223	756.4	1919	92,764	672.8
1913	126,000	738.3	1920	95,023	573.4
1914	131,670	772.9			

Geology

Phyllitic slate with intercalated schalstein trends E. N. E. to W. S. W. forming an anticline on the west of the Funashiki fault and is complicated in the east of the fault which runs N. S. with the inclination 70° toward W. Peridotite occurs in phyllitic slate as intrusive sheets and porphyrite also occurs as dykes.

Deposit

There are about 25 fissure veins in the phyllitic slate, mostly striking N. E. and inclining toward N. W. or S. E. In width the

veins are from 1 to 15 feet, averaging 3 feet.

Gangue minerals are calcite, quartz, hornblende, fluorite, apatite etc. Calcite and quartz are widely distributed; hornblende is only found in the upper parts of the Hompi and Daisen-hi lodes as aggregations of dark greenish fibrous crystals which display remarkable pleochroism; fluorite sparingly occurs in the lower part of the Manzai-hi lode, and apatite is found in the hornblende mass as microscopic crystals. Ores are chalcopyrite, cupriferous pyrrhotite, arsenopyrite, zincblende and galena. Chalcopyrite occurs in veins as veinlets, network, or impregnation and is almost always associated with pyrrhotite. Pyrrhotite is found in masses or crystals and often accompanies chalcopyrite; these two minerals were grown at the same period. Arsenopyrite takes crystal forms and zincblende and galena are not abundant.

Chalcopyrite and cupriferous pyrrhotite are the principal copper ores, the chemical analyses of which give the following percentages:

	Cu	Fe	S	SiO_2	Al_2O_3	CaO	Mg
1st class ore	11.02	36.63	27.62	16.00	4.80	1.22	1.00
2nd class ore	6.06	28.38	17.56	31.00	8.14	2.32	2.49
3rd class ore	2.08	31.52	17.23	29.60	9.37	2.76	2.56

The ore now smelting yields 2 or 3 per cent copper.

The ore contains about 0.0026 per cent silver per 1.00 per cent copper.

Remarks on the principal lodes are as follows:

(1) **Hompi** trends N 59° E with dip 54° toward N. W. and is 3000 feet in stope and 850 feet in pitch. An enriched zone occurring on the west of the Funashiki fault continues from the 2nd level down to the 5th with a length of 30—50 feet and a width of 5 feet. In this

part, the ore is disseminated in hornblende or takes small vein-forms in it; the average value of the ore being 2 or 3 per cent copper. Chalcopyrite is abundant in the upper part of the lode and gradually diminishes in the lower levels while the pyrrhotite increases.

(2) **Hompi-uwaban-hi** lies northwest of the Hompi and parallel to it. In the upper part of the lode, the enriched zone is 150 feet long and from 1 to 6 feet wide, but 100 feet below, it shortens to 30 feet. In the lower part, two rich ore masses were found, measuring 40 feet long, 100 feet deep, and 5 feet wide. Chalcopyrite is abundant in the upper and pyrrhotite and arsenopyrite become rich in the lower part.

(3) **Hompi-shitaban-hi** runs N.60°—70° E. inclining 60°—70° northwestwards. Abundant ore was found in the 2nd level near the Funashiki fault.

(4) **Buzaemon-hi** runs N.10° E. with dip E. S. E. 70° and develops in the upper level. The enriched zone is 7 feet wide and 100 feet long, the ore averaging 12 per cent copper.

(5) **Senga-hi** is situated to the south of the Hompi lode and was worked several years ago. It trends N.75° E. with inclination 50° toward N. W. N. Ores were found in the 2nd and 3rd level and yielded abundantly.

(6) **Taishō-hi** lies parallel to the Hompi on the south, but the lode seems to be a part of Hompi proper. The enriched zone continues to form some lenticular masses, extending over 250 feet in the dip direction. The ore is cupriferous pyrrhotite with a copper content of over 5 per cent.

(7) **Manzai-hi** is the easternmost among the lodes and yielded a large quantity of rich ore. The ore mass is over 100 feet long, 200 feet deep and 1 foot wide, the copper content of the ore being over 8 per

cent. But the rich ore gradually diminishes in the lower levels.

(8) **Gonen-bi** is situated in the east of the Funashiki fault trending N. 80° E. with the inclination 70° toward N. W. N. The enriched zone is located between the 4th and 5th levels, and measures 3 feet in width, 150 feet in stope and over 150 feet in pitch, the ore containing 4 per cent of copper. The ores are cupriferous pyrrhotite and arsenopyrite with calcite and quartz.

(9) **Masukane-hi** has been worked in the upper levels. Rich ore was taken in Komankashira where it was located 40 feet above the 1st level and extended over 70 feet in length, 30 feet in depth and 20 feet in width. The ores are chalcopyrite, pyrrhotite and much zincblende, the copper content of the ore being 3 per cent.

(10) **Higashishadō-hi** is an old and long-worked lode situated to the south of the Hompi, and running E. W. for over 2000 feet. The ore is cupriferous pyrrhotite with quartz and calcite.

(11) In the **Chitose-bi** the enriched zone continues over 450 feet from the 2nd to 6th level, swelling notably near the 5th level. The copper content of the ore is over 5 per cent.

(12) **Kamurikae-hi** is situated to the northeast of the Chitose-bi and runs parallel to it. An enriched zone exists between the 4th and 5th levels, extending 100 feet. The copper content of the ore is 4 per cent.

(13) **Seto-bi** trends N. 42° E. and is over 1200 feet long. In 1899, it yielded a large quantity of ore near the Funashiki fault at the 3rd level, where the lode was 12 feet wide and 200 feet long. The ore averaged 10 per cent copper.

(14) **Chiyo-bi** striking E. W. is over 800 feet long and is richest near the 4th level. The enriched zone is over 200 feet long, 300 feet deep and 2–4 feet wide, the copper content of the ore being 5 to 10 per cent.

(15) **Hashirisaki-hi** runs parallel to the Seto-bi, and is over 900 feet long. This enriched zone extends 600 feet from top to bottom with a stope length of 100 feet and a width of 3–4 feet. The ore is pyrrhotite with calcite, the copper content of the ore averaging 6 to 8 per cent.

(16) **Izumishiki-hi, Gofukuya-hi, Daisen-hi** and **Kishiyama-hi** are situated to the northwest of the Hompi, running N. E. to S. W. and are from 1000 to 2000 feet in length. These lodes were mostly worked ten years ago, the ore being richer near the surface, and gradually diminishing below. The enriched zone was of lenticular form, 40 feet long, 30 to 50 feet deep and 4 to 5 feet wide. The ore was cupriferous pyrrhotite averaging 8–12 per cent copper in the 1st level and 2 per cent in the 3rd level. Hornblende occurs only in a part of the 1st level of Daisen-hi but calcite is common.

The first and second class ores are sent directly to the refinery and the lower class ores are crushed and treated by the flotation process. Concentrated ore by the flotation process averages 6.40 per cent copper.

Nature of Deposit.

The Yoshioka deposit belongs to a system of fissure veins mainly striking E. N. E. to W. S. W. High temperature or contact minerals such as arsenopyrite, pyrrhotite and hornblende are abundant, while iron pyrite is sparse. Enriched zones exist largely in the upper part of the lodes and the ores gradually become poorer in the lower; also as a gangue mineral hornblende occurs in the upper part. From these data, the writer came to conclude that the deposit originated in the eruption of an igneous rock now no longer visible such as quartz-porphyrite which probably overlapped the district or is hidden underground.

APPENDIX.

The Kōsei Mine

This mine is situated on the left side of the Sakamoto Valley, south of the Yoshioka mine and is owned by the Mitsubishi Mining Company. The district is composed of Palæozoic clayslate, hornfels and hornstone, striking N. 60° E. with the inclination N. W. 50°. Hornblende porphyrite erupts in the east and pyroxene porphyrite occurs in clayslate as dykes being visible only in the mine underground. Deposits are two long lenticular masses running E. W., and are known as the Kijiya-hi and Ōyake-hi lodes. The Kijiya-hi was worked several years ago and the writer could not examine the mine underground as it was in ruins. The Ōyake-hi trends N. 70°–80° E. with dip 70°–80° toward S., its outcrop extending over 600 feet in length. There are four ore shoots: (1) Dōbera near the Sakamoto fault, extending 70 feet in length, 180 feet in depth and 30–40 feet in width; (2) Kiuhachiuin, which is 150 feet east of Dōbera, and measures 40 feet long, 100 feet deep and 20 feet wide; (3) Tateire, east of Kiuhachinin, extending 50 feet in stope, 150 feet in pitch and 40 feet in width; (4) Ōhigashi, 150 feet east of the former, extending 100 feet in stope, 150 feet in pitch and 40 feet in width. These ore shoots, distributed at 100 or 150 feet horizontal intervals, are now proved to occur above the 320 foot level. The gangue minerals are hornblende and calcite while the ore is chalcopyrite. The ore occurs as veinlets, patches or impregnations in the hornblende mass and averages 2 per cent copper. It yielded 11,942 tons of copper ore in 1917; 29,396 tons in 1918; 37,928 tons in 1919; and 32,136 tons up to August, 1920. The deposit belongs to the fissure vein variety with some

properties of contact deposit. The gangue minerals are largely dark green hornblende which was probably produced by the emanation of gases at the time of the intrusion of hornblende porphyrite.

The Sasaune Mine

This is an old mine of the Mitsubishi Mining Company situated on the north side of Mt. Inotsuji.

The Palæozoic clayslate develops in the district and was partly metamorphosed into pyroxene rock by the eruption of quartz porphyrite which covers the clayslate. The contact plane of clayslate and porphyrite runs E.-W. with dip S. 40°.

The deposit occurs in the contact zone of clayslate and porphyrite and has dimensions of 300 feet in stope, 250 feet in pitch and 15 feet in width, though the pitch length is probably still more elongated. Gangue minerals are hornblende, pyroxene and garnet, and the ores, chalcopyrite and pyrrhotite, are scattered in the hornblende mass as small patches, the copper content averaging about 3 per cent. Garnet crystals, 5 centimeters in diameter are imbedded in the hornblende or chalcopyrite.