

Fluorite Deposits in the Vicinity of Hsiang-Shan Che-Kiang Province

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1. Wu-shih-shan Fluorite Deposit

Locality and transportation

Wu-shih-shan is a mountain in Hsiang-shan Prefecture, which is in the eastern part of Che-kiang Province. Wu-shih-shan is about 1,500 m south of Mao-yang, about 9 km SSW of the capital of the prefecture. The fluorite deposit is found on the northern slope of Wu-shih-shan. Mao-yang is almost at the center of the Hsiang-shan Peninsula, about 5 km west of the coast of the East China Sea and about 4 km east of Tai-tou, the landing place in Tai-tou Bay. Because Tai-tou Bay is shallow, direct shipping is impossible. The ore is loaded on 70-ton barges at Tai-tou and shipped to Shih-pu¹⁾ at the southern edge of the Hsiang-shan Peninsula, a distance of 27 km, where 3,000 ton freighters put in (Fig. 1).



Fig. 1. Index Map of the Hsiang-Shan Fluorite Deposits.

Editor's Note: This area lies between 29[–30] N Lat., and 121[–122] E Long. Place names were not checked against usage recommended by U.S. Board on Geographic names.

¹⁾ Shih-pu is a small port about 350 km south of Shanghai.

History

In 1931, the fluorite deposit was worked by the Kitada Co., a Japanese company, and about 150 tons of ore were shipped to Shanghai. However, because of its low quality, operations were ceased in 1932 after a five-month period. In its place the higher quality I-wu fluorite were worked. In June 1934 the operations were resumed and about 250 tons of ore were transported to Shanghai before the mining was again abandoned because of financial losses. In 1936, transportation from I-wu became almost impossible because of a long drought and the fluorite stock became low in Shanghai. As a result, working of the Wu-shih-shan deposit was resumed. About 100 tons a month from October 1936 to March 1937, and 300 tons a month for June and July 1937, were transported to Shanghai. However, because the sino-Japanese War spread to Shanghai the work was discontinued again. The total yield up to that time was 2,350 tons. Immediately after the Japanese army occupied the Hsiang-shan Peninsula in June, 1941, the Central China Mining Co. was ordered to begin operations, and in December of the same year about 2,500 tons of ore were shipped to Kawasaki, Japan. In 1942–1943, the ore was transported regularly every month by up to three ships, but transportation difficulties arose in 1944, and the ore was stockpiled at the mine, at Tai-tou, and at Shih-pu port. At the end of World War II, the stockpile and equipment were left behind and nothing is known of what became of them.

Topography and geology

Wu-shih-shan is a steep (20–30° slope) mountain of mature stage, rising to about

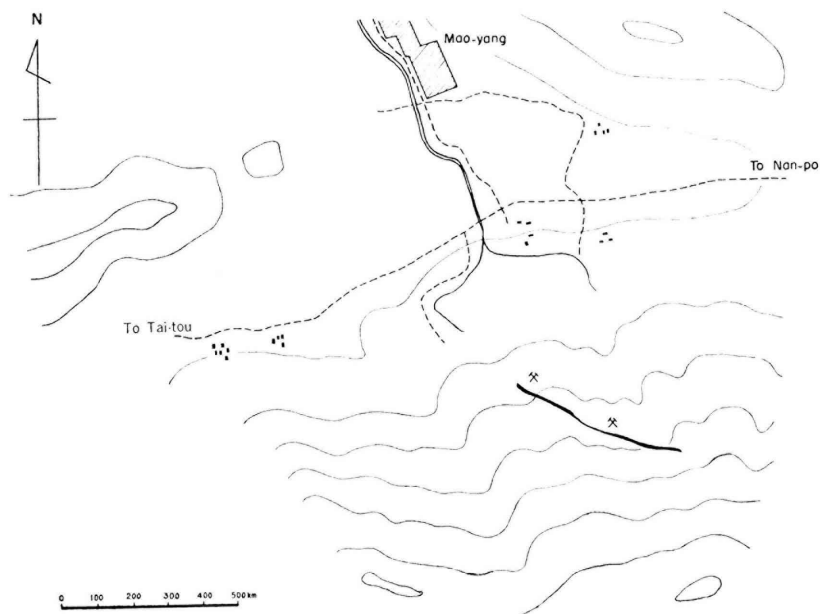


Fig. 2. The Wu-Shih-Shan Fluorite Deposit.

600 m above sea level and trending east-west. The ore-bearing vein is on the northern slope and crops out at a height of 80–180 m above the plain.

Wu-shih-shan and vicinity are composed of tuff intercalated by some rhyolite. The rhyolite is considered to be an effusive rock of Cretaceous age.

Ore deposits

The fluorite-bearing veins are fissure-filling, contain gangue of the country rock, and are cut by quartz veins. The vein strikes N 50° W to E-W, but generally N 70–80° S, towards the ridge. The length of the vein is estimated to be about 2,500 m, but the part worth working is in the middle and about 540 m long. There are also some thin parts which branch into east and west veins. The east vein is longer and narrower, higher in quality but smaller in reserves than the west vein. Both veins are described in the following table:

	West Vein	East Vein
Length	150 m	200 m
Width	1–12 m	0.5–6 m
Quality	Brittle and soft, contains clayey gangue of the country rock. CaF ₂ 60–70%	Compact and hard, of good quality. CaF ₂ 80–85%

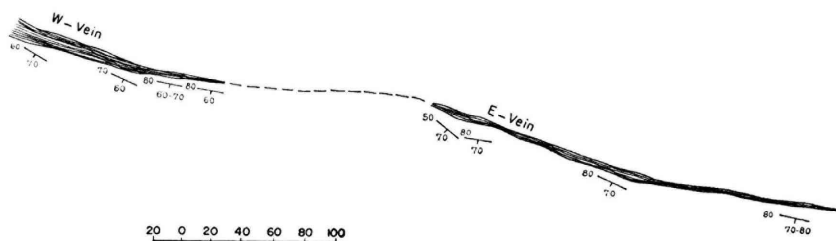


Fig. 3. The Wu-Shih-Shan Fluorite Deposit.

Ore reserves

When the Central China Mining Co. was operating, the calculated ore reserves were 172,400 tons, as shown in the following table. About 150,000 tons of the ore were transported by the end of World War II. At that time, the remaining reserves, estimated at 20,000 tons as proven and 100,000 tons as possible amounts may have existed.

Mining

Because the east and west veins differ, the same method of mining could not be

Ore Reserves			Calculation
			Length \times Depth \times Width \times Sp. Gr.
Proven reserves	Reserves	253,750 t	West vein $150 \times 50 \times 6.5 \times 3.0 = 146,250$ t
			East vein $200 \times 50 \times 3.25 \times 3.0 = 107,500$ t
	Extractable	215,500 t	Extraction ratio, 85%
	Sortable	172,400 t	Efficiency of hand-sorting, 80%
Possible reserves		100,000 t	

used for both. In general, the shrinkage method was used in the east vein, but in places narrower than 1.5 m the ascending step method was used. At first, horizontal plugging was adopted for the west vein, but because of the low quality of the plugging mud and sand and insufficient support, the Mitchel method, square-set stopping methods were adopted. Supports were not easily attainable. The five or six rock drills were worked by a 100 HP air-compressor and two or three were worked by a 50 HP compressor. Some hand work was adopted.

Crude ore was carried from the west and east veins to the sorting plants at the foot of the mountain and separated into lump ore of high grade, common grade, powdered ore, and waste. The rope pulley system and railway were operated between the mine and the sorting plants. The same railway and sorting plant were not used for the east and west veins; the transportation systems varied according to the particular area, as follows:

Mao-yang to Tai-tou: in 1941 and the first half of 1942 ore was transported by ox-cart, in the latter half of 1942 by ox-drawn railway and from 1943 to 1945 by gasoline-driven locomotives.

Tai-tou to Shih-pu port: two 70-ton barges were used.

Shipping from Shih-pu port: the ore was loaded from the barges to freighters two or three times a month. In the port, the rise and fall of the tide was considerable and ocean steamers could not easily be brought alongside the piers.

Estimate of future possibilities

As mentioned, the extractable amount of fixed ore reserves by hand-sorting was calculated to be about 170,000 tons; about 150,000 tons of sorted ore were shipped up to the end of the war, and the remaining reserves are considered to have been only 20,000 tons. It may be expected that some ore exists in the extreme and deeper parts of the worked veins (east and west) but the deposit is apparently considered to have been in a waning stage. As mentioned, the stocks at the mine, Tai-tou and Shih-pu amounted to 50,000 tons and were ready for shipment.

Table 1. Mine Equipment.

1. Diesel generator	150 KVA	1
2. Air Compressor	100 HP	1
" "	50 HP	1
3. Rock drills	15 (7 operated daily)	
4. Workshop equipment	lathe	1
" "	drilling machine	1
5. Hand-sorting plant	2	2
6. Rope pulley system and railway	180 & 240 m	

Table 2. Transportation Equipment.

Mao-yang to Tai-tou	{ about 4 km of railway
	{ 2 gasoline-driven locomotives
Tai-tou Port	2 piers
Shih-pu Port	{ 2 floating piers
	{ 10 barges
	{ 3 tugboats

Table 3. Personnel (Approximate number).

	Staff	Laborers
1941	30	300
1942	50	600
1943	60	700
1944	60	700
1945	55	500

Table 4. Yield; the Total of All the Grades and the Average Quality.

1941	5,200 tons	CaF ₂	85%
1942	40,000 "	"	88%
1943	56,000 "	"	88%
1944	40,000 "	"	87%
1945	10,000 "	"	85%
Total	151,200 tons		

2. Po-hou-shan Fluorite Deposit

Locality and transportation

The deposit is directly southwest of Nan-pu or 3.5 km from Mao-yang and is on the eastern slope of Mt. Po-hou-shan, which is in the southern Tung-chi-ling mountain range. Between this deposit and the Wu-shih-shan deposit is a ridge of the Tung-chi-ling mountain range. The deposit is surrounded on three sides by mountains and transportation is possible only on the side facing Tung-chi-pu, a port on Tai-tou Bay south of Tai-tou. Tung-chi-pu is about 10 km SW from the mine and transportation is inconvenient.

History

The deposit was worked in 1936–1937; work was said to have been done by a foreign miner about 20 years earlier.

Geology and ore deposit

The deposit is small. The vicinity of the ore deposit is composed of rhyolite that

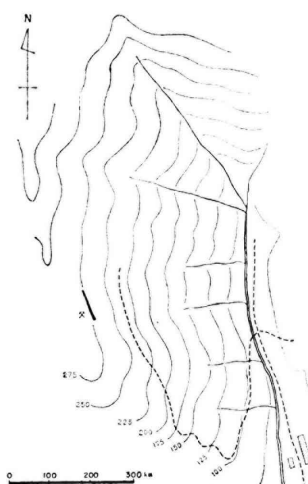


Fig. 4. The Po-Hou-Shan Fluorite Deposit.

is cut by fissure-filling ore veins. The main vein is a vertical one about 100 m long with varying width. There are some lenticular ore bodies. One lenticular ore body is 3–5 m long and locally 2.6 m thick. The average thickness is only 0.6 m. The main vein trends N 20° W but a small branch 5–50 cm thick trends N 60° W, dipping 70° N.

Ore reserves

The ore in the main vein above the level of the valley and the reserve in the deposit below the level may be 9,000 tons. The calculation is:

Length (m)		Depth (m)		Average thickness (m)		Sp. gr.
100	×	50	×	0.60	×	3.0=9,000 (t)

Economic value

Because of the smallness of the deposit and inconvenience of transportation, the deposit was considered to have little economic value unless the market were to improve suddenly. Below the level of the valley, considerable drainage work seemed to be necessary.

3. Fluorite deposit in the eastern coastal region, Hsiang-shan Peninsula

Locality

Several veins are found traversing a promontory (60 m above sea level and 100 m wide across the middle part) which projects eastward from the coast southeast of the town of Hsiang-shan. The veins generally crop out on the southern cliff and a few on the face of the northern cliff.

Geology and ore deposits

The promontory is composed of rhyolite and is cut by fissure-filling ore veins,

which, in the southern part of the promontory, were found to be more than 20 cm wide. They trend N 20° W and dip 70–80° S. In the northern part of the promontory were found one or two veins. The cliff rises directly from the sea and storm waves made the survey difficult.

Economic value

As the ore reserves are small, the deposits were considered to be nearly valueless unless the market price was high.