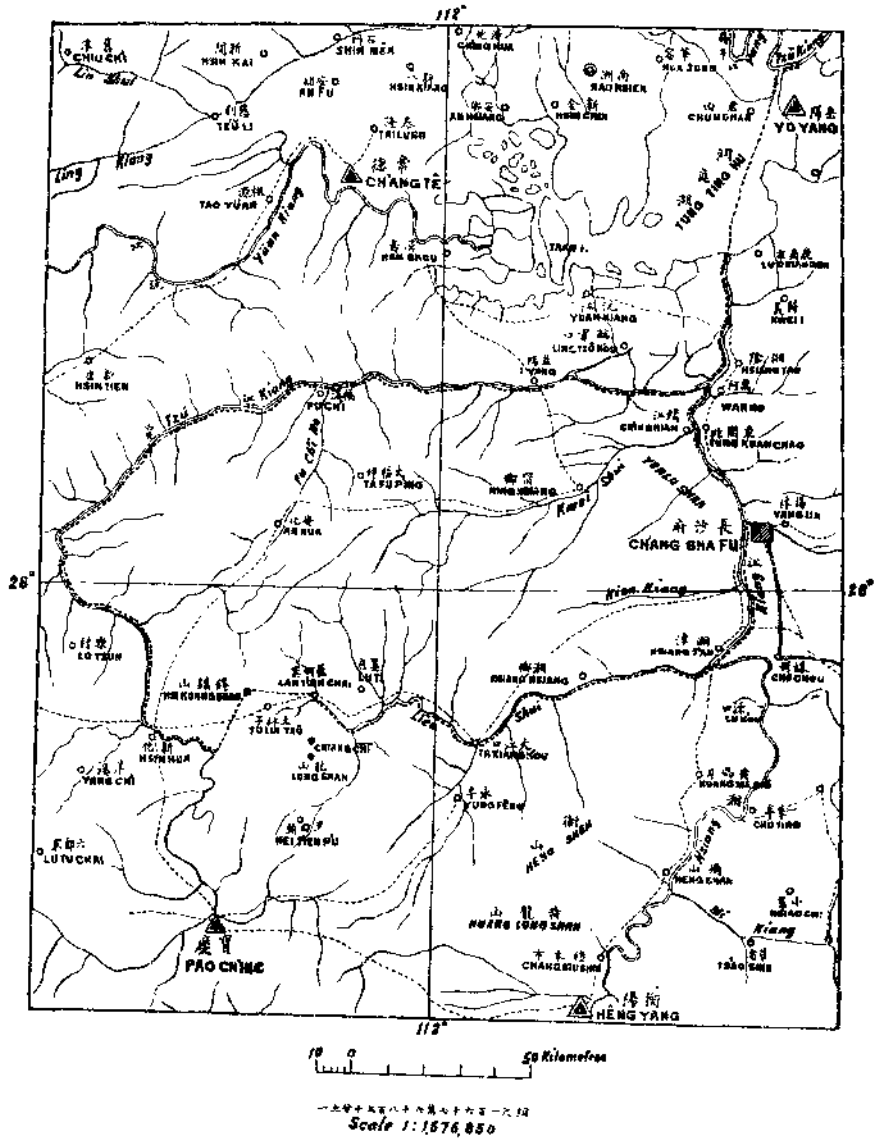
PLATE I

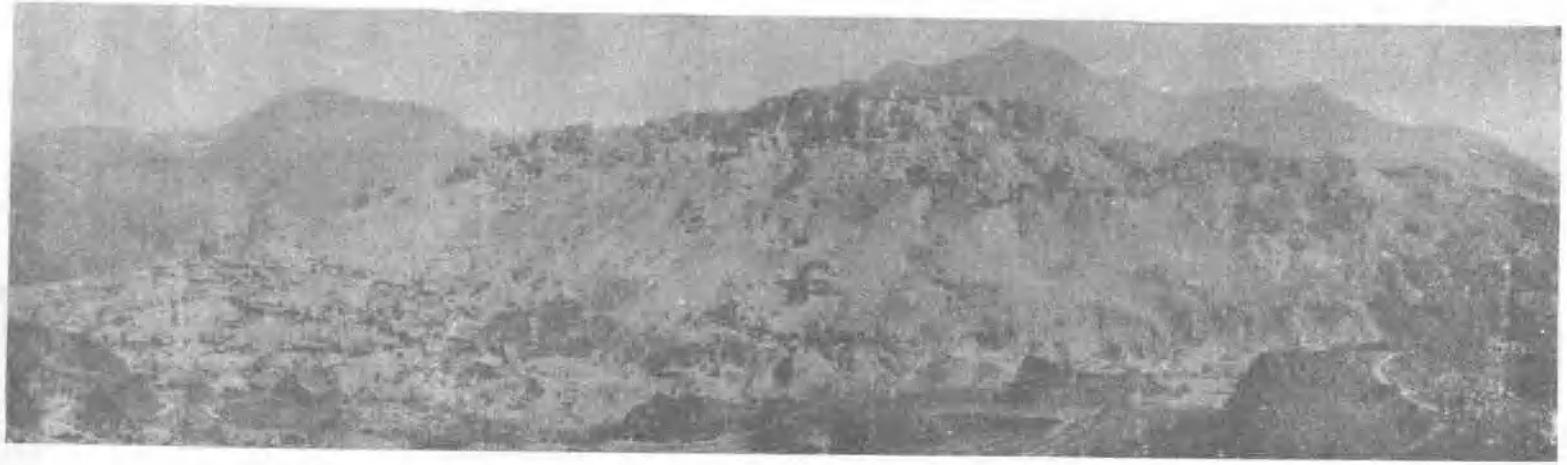



湖南鎢鎈位置圖

MAP OF CENTRAL HUNAN SHOWING THE SITUATION OF THE CHIEF ANTIMONY FIELDS.

Way of transport for Antimony

Antimony field



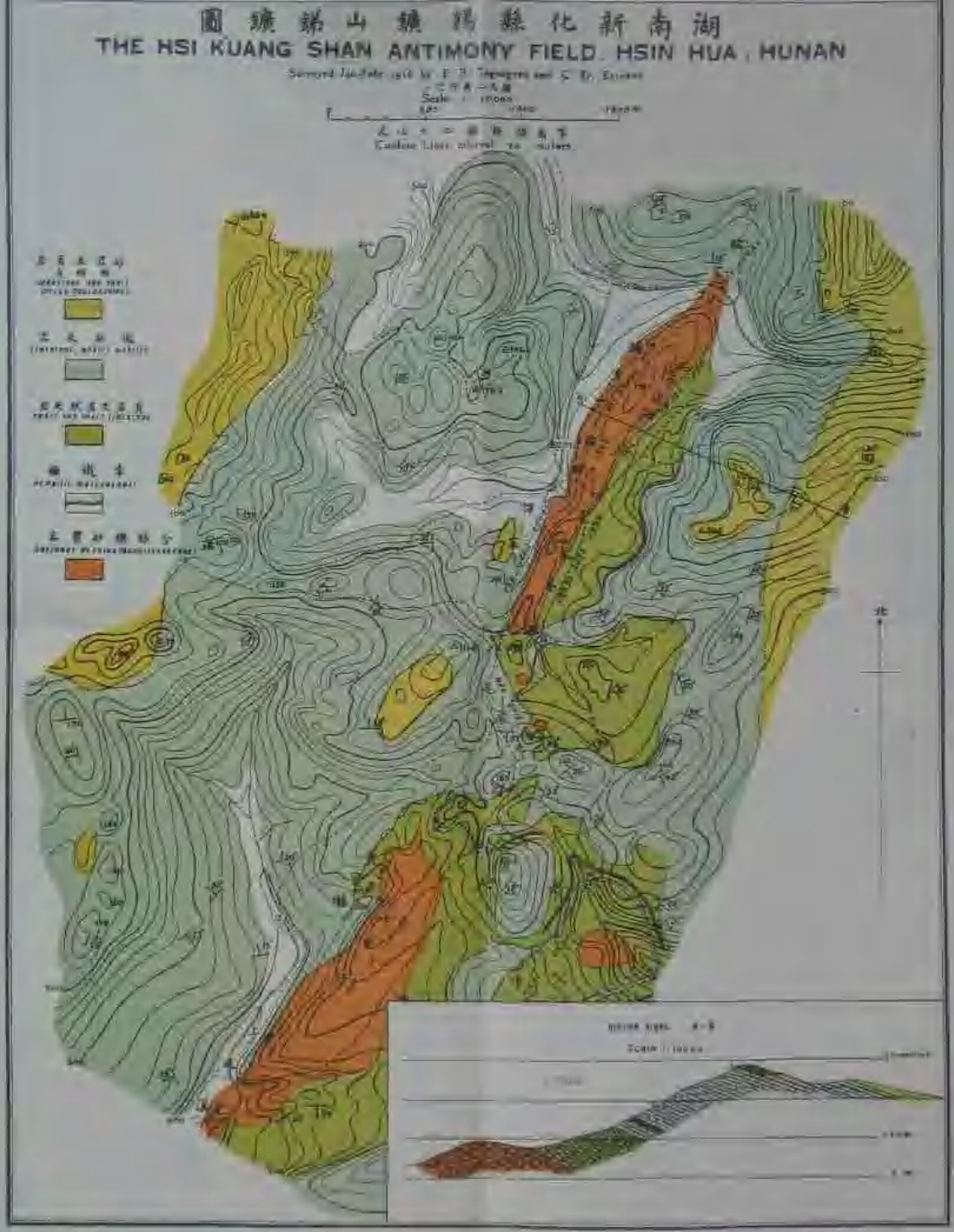
Panorama of the Hsi-K'uang-Shan Antimony ridge, view from the west.

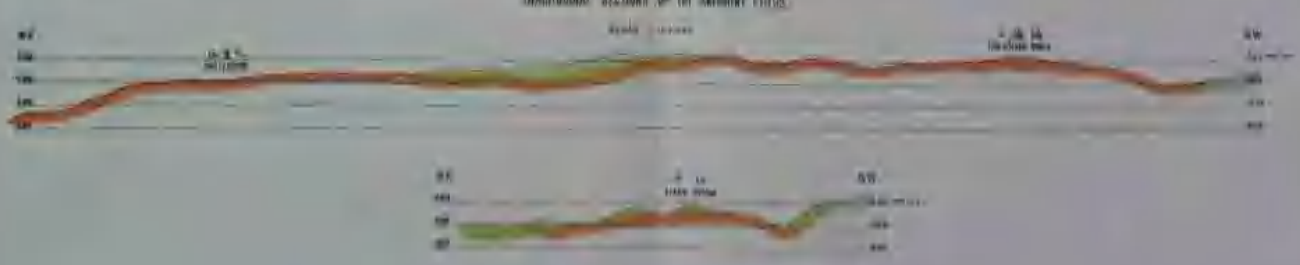
Panorama of the Chih-Li-Kiang ridge, view from the west.

Panorama of the Kiang-Ch'un ridge, view from the north.

# 湖南新化縣錫山鑛區圖

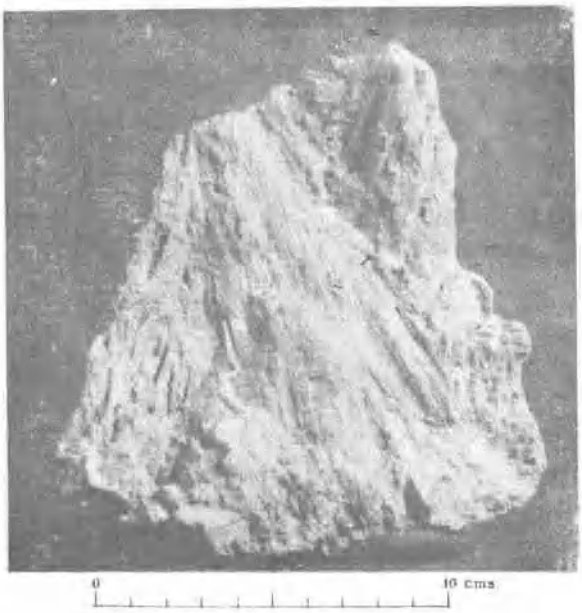
# THE HSI KUANG SHAN ANTIMONY FIELD, HSIN HUA, HUNAN



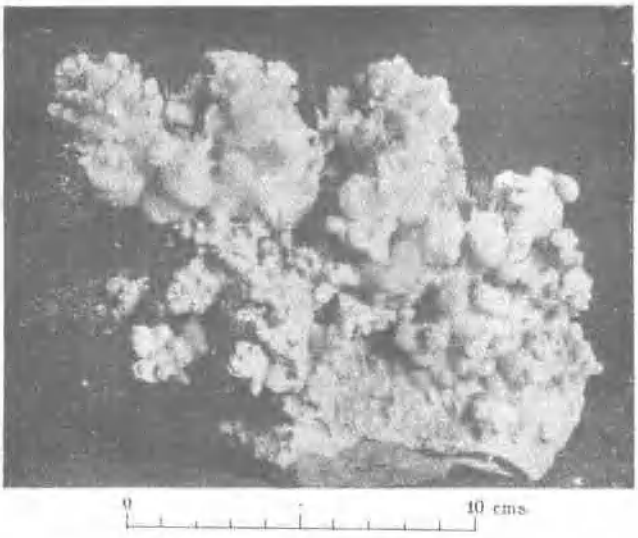


Steep quartzite cliff, West side of Hsi-K'uang-Shan.

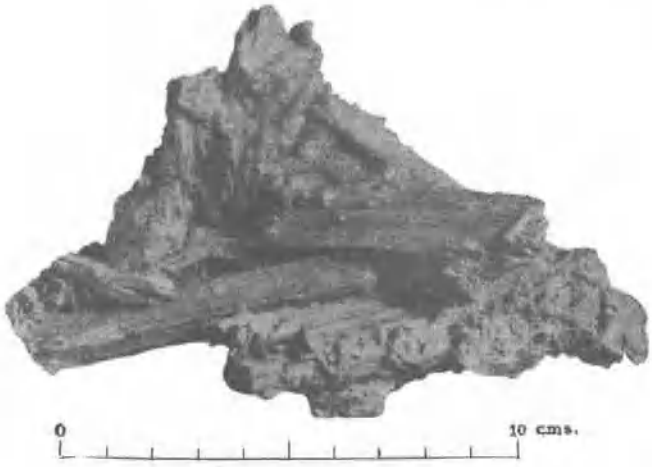
Large native working near the crest of Hsi-K'uang-Shan.



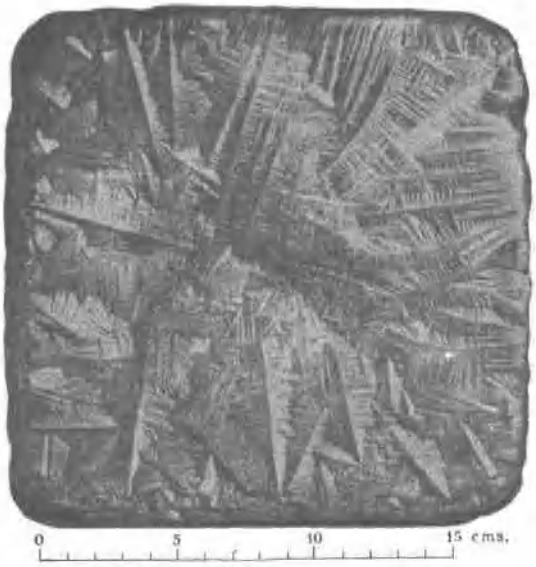

Typical specimen of stibnite.




Beautiful druse of small, acicular quartz crystals formed in a cavity in the antimony bearing quartzite.




Specimen of secondary antimony oxide, crystals pseudomorphous after stibnite.




Antimony regulus pig with the characteristic crystalline surface

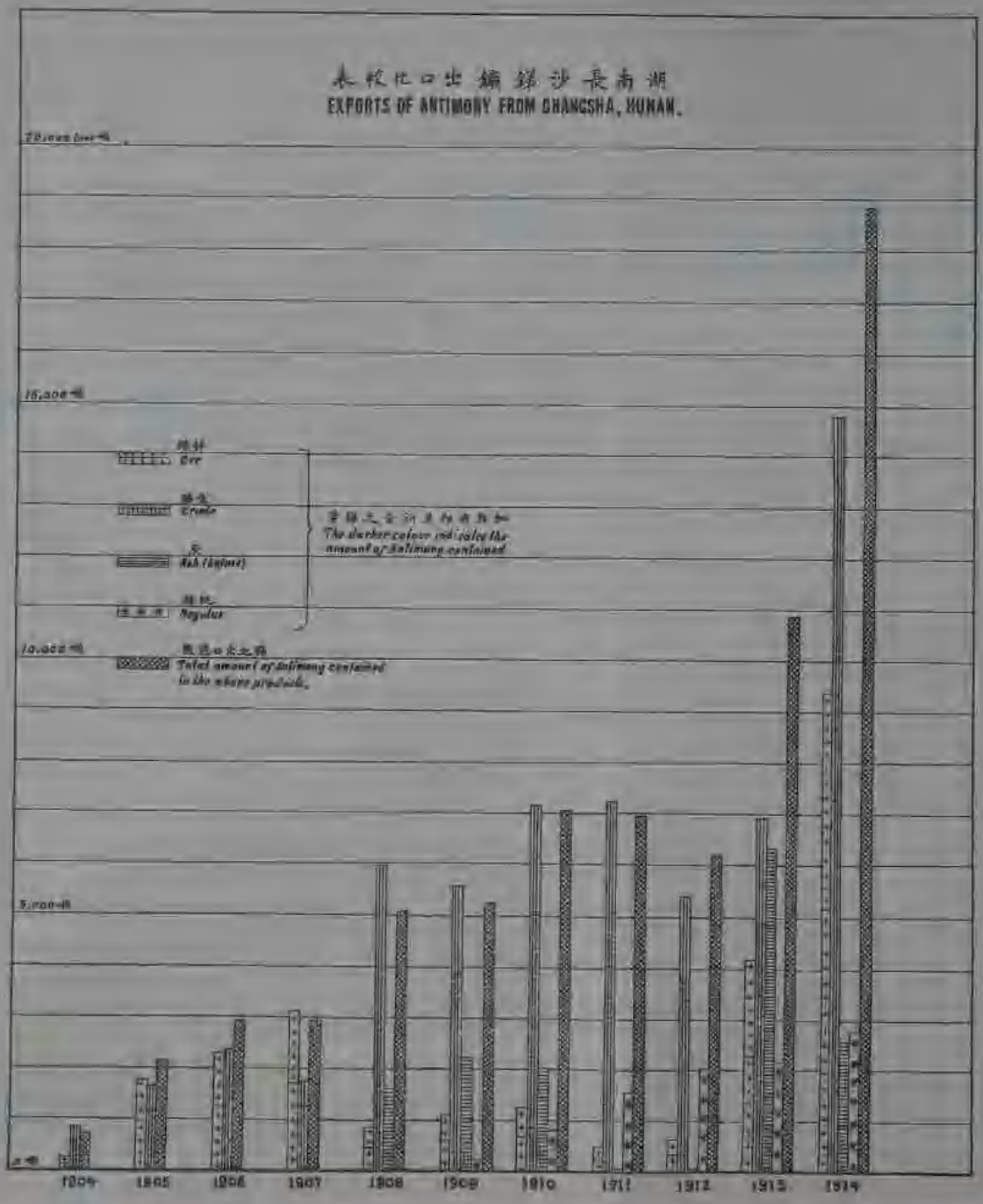

長沙口出鎢錄表
EXPORTS OF ANTIMONY FROM CHANGSHA, HUNAN.
礦砂
Ore
粗製
Crude
灰
Ash (Oxide)
錠
Regulus
The darker colour indicates the amount of Antimony contained
Total amount of Antimony contained in the above products.
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914

PLATE IX

Fig. 1 Trachy-andesite. Parallel Nicols × 9.

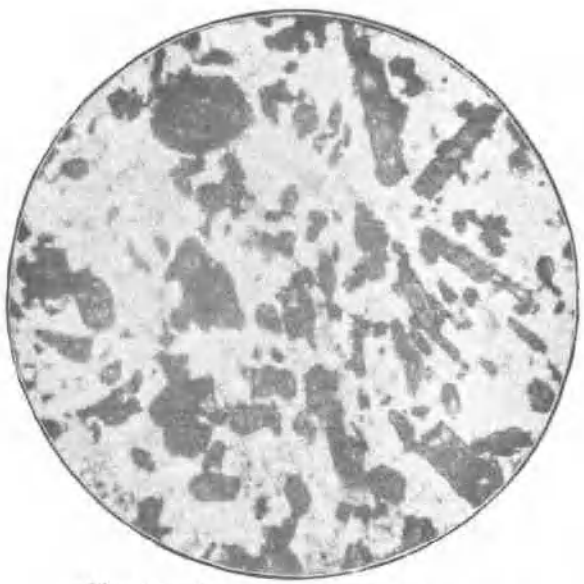


Fig. 2 Augite-syenite. Parallel Nicols × 9.

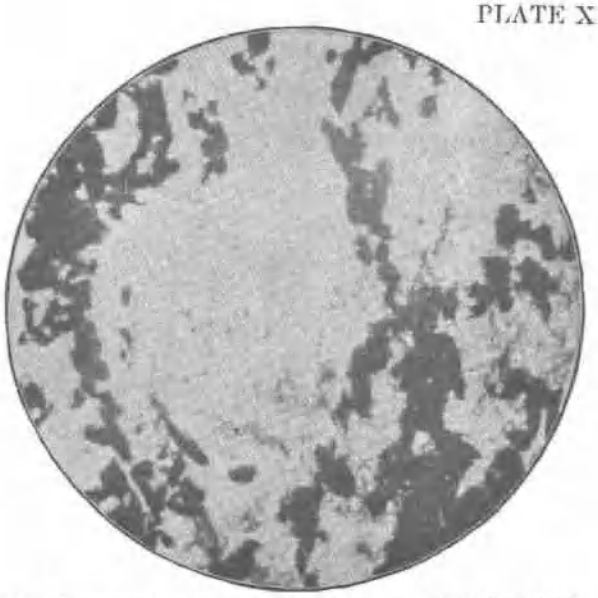


Fig. 1 Intermediary nepheline-Syenite Parallel Nicols × 9.

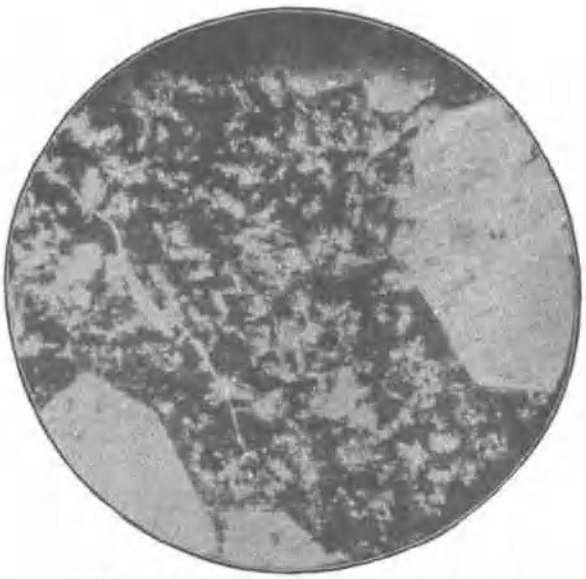


Fig. 2 Leucite-Tinguaite. Parallel Nicols × 9.

# 湖南耒陽東鄉煤田地質圖

# GEOLOGICAL MAP OF THE TUNG HSIANG COAL FIELD, LEI YANG, HUNAN.

# 山西大同煤田地質圖

# GEOLOGICAL MAP OF THE TA TUNG COAL FIELD, SHANSI

# BULLETIN OF

# THE GEOLOGICAL SURVEY OF CHINA.

NUMBER 3 OCTOBER 1921

## CONTENTS

# THE HSI-K'UANG-SHAN ANTIMONY MINING FIELDS, HSIN-HUA DISTRICT, HUNAN.

BY

F. R. TEGENGREN.

## INTRODUCTION.

China's predominating position among the Antimony producing countries of the World is already a well established fact, and it is, likewise, well known that the bulk of the country's supply comes from Hunan Province, although besides there are productive areas also in several other Provinces such as Kuangsi, Kweichow and Yunnan.

Among the Hunan Antimony fields the following are the most important: Hsi-K'uang-Shan (錫鑛山), Pan-Hsi (板溪), Lung-Shan (龍山), Wu-Hsi (烏溪) and Chiang-Hsi-Lung (漿溪壠), of which the Hsi-K'uang-Shan field is by far the largest as well as regards resources and production, in fact it is the biggest known antimony deposit and the largest producer of the Globe.

During a journey in the winter 1915-16, initiated by Mr. V. K. Ting, Director of the Geological Survey, and undertaken by order of His Excellency The Minister of Agriculture and Commerce, to some of the Southern Provinces, an opportunity was afforded to me to study in some detail this gigantic and interesting deposit. In the field work, especially in the survey which had to be executed under very unfavourable weather conditions, I was most skilfully and indefatigably assisted by my countryman and companion Mr. C. F. Erikson. The data on mining and smelting are largely collected by my Chinese assistant Mr. W. P. Lo. To these two gentlemen I herewith acknowledge my obligation.

## SITUATION AND TOPOGRAPHY.

The deposits are situated (Plate I) in the very centre of Hunan at a latitude of 27°48' and a longitude of about 4°53' W of Peking and at an altitude of about 700 metres above sealevel. Their situation (see sketch

map) near to the watershed between the upper part of the Tze-Kiang (資江), emptying into the Hsiang-Kiang not far from its outlet in the Tung-Ting lake, and the Lien-Shui (漣水), a tributary to Hsiang-Kiang, entering the main river at Hsiang-Tan (湘潭), offers two possibilities of water transportation down to Chang-Sha viz. 1) along the Tze-Kiang and up the Hsiang-Kiang, a distance of about 350 kilometres, taking 7 days to cover by boat in the summer and 14 days during the dry season; 2) along the Lien-Shui (漣水) and Hsiang-Kiang (湘江), a distance of 200 kilometres, that can be covered in five days and 10 days respectively according to season. Before reaching the former waterway a distance of 15 kilometres from the mines to the Tze river has to be covered by land to the village of Ping-Shui-Kiang (冰水江), the path descending gradually to the named river; in case of the other way the distance to Lan-T'ien-Shih (藍田石) is 23 kilometres.

As is shown by a glance at the map and photographs (Plates II, III) the country exhibits a very rugged surface, innumerable hills and ridges projecting above deep valleys. The great features of the landscape have a general trend of NE-SW, following the strike of the sedimentary formations.

The climate is humid; rains and fog, and in the winter even snowstorms, are frequent, and the temperature often sinks below zero, whereas the summers are very hot.

The region round the mines is not very populous, in fact there are only a couple of farmer's villages within a distance of 10 kilometres from the mines. Cultivated areas are rather scarce, most of the hills are overgrown by thorny bushes and it is, furthermore, striking that areas being formerly terraced ricefields have years ago been abandoned.

It may, thus, be said that the soil at present supports a very small population, and if not for its mineral wealth the region would be rather desolate. But owing to the expansion of the mining industry within the last few years a number of villages have grown up like mushrooms in the vicinity of the mines for the accomodation of the mining people, as well as the merchants, shopkeepers and grocers who provide the former with the necessities of life and means of pleasure. The villages at Hsi-K'uang-Shan,

extending almost continuously for the whole length of the deposit, now shelter a population more numerous than that of the district capital itself. The present population is said to exceed 100.000 souls (though this figure may be largely exaggerated), assembled from all the surrounding districts: An-Hui (安化), Pao-King (寶慶) and Hsiu-Hsiang (湘鄉). These villages have been allowed to grow without the slightest general plan, and hovels have clustered pell-mell on the ore hills themselves, among the mines. The sanitary conditions are beyond description: there being no scavenging system waste of every kind is allowed to accumulate indefinitely anywhere.

## GEOLOGY OF THE MINING REGION.

The bedrock is built up exclusively of sedimentary rocks, ranging in age from probably Silurian up to Carboniferous.§ The sequence of strata is made clear by the cross section on the geological map, the only clear one that can be obtained in the neighbourhood. The thickness of the different strata as can be measured from this section is as follows:

| | *metres* |
|---|---|
| Sandstone white, and dark shale (often coalbearing) | >20 |
| Limestone dark grey alternatingly massive and thin bedded (often containing fossils) | 230 |
| Limestone richly fossiliferous carrying nodules of oolitic hematite | 1 |
| Limestone dark grey mostly dense & massive | 40 |
| Thin bedded argillaceous limestone, yellowish grey | 120 |
| Slate, hard and quartzeous | 20 |
| Quartzitic sandstone, Stibnite bearing | >50 |
| Total | >481 |

The lower limit of the quartzitic sandstone is nowhere exposed but from observations during the journey it seems probable that this rock rests on dark gray, sometimes bituminous, sandstone and slate of probably early Palaeozoic or possibly pre-Cambrian age.

§ The fossils found in the limestone have not yet been determined.

The uppermost series of the section (sandstone and shale) is again overlain by limestone which is followed by the red strata of probably mesozoic age.

The original horizontal position of these strata has been disturbed both by folding and faulting.

The chief folding axis, as is evidenced by the map, runs NNE-SSW; along this the strata have been compressed into a series of anti-and cynclines the slopes of which dip some 20-30°. But besides this regular tilting of the strata also a doming has taken place which is most likely due to the intrusion of igneous laccolithic masses at deeper levels. The tectonical conditions are further complicated by faulting, although the lines of disturbance cannot be followed in detail owing to the obscuring soil. The chief line is, however, well marked. Along the whole extension of the hill ranges of Hsi-K'uang-Shan and T'an-Chia-Ch'ung (譚家冲) and from there traceable also across the limestone areas separating this deposit from Chi-Li-Kiang (七理江) it can be followed further along the whole length of the last named ridge. This fault-line is indicated by the steep escarpments on the western side of the hill ranges, (see the Plate V), by the limestone breccia found almost everywhere at the foot of the antimony ridge, and by the occurrence of the limestone down in this valley where otherwise the quartzitic sandstone or shale ought to be met with. The character of this fault, whether it is a normal one or a thrust, cannot be determined on account of the very fault-line being mostly obscured by soil. It is likewise not possible to estimate the extent of the displacement; its vertical component, however, may be somewhere about a hundred metres. Several minor dislocations seem to have taken place west of the main line splitting up the limestone areas there into many detached blocks, as can be noted by the extremely irregular and rapidly changing strike and dip.

## THE ANTIMONY DEPOSITS.

The deposits may be divided into four groups or ranges viz. (cfr the map Plate IV.)

1) The Hsi-K'uang-Shan ridge (Plates II, V) with the miuing sections of Ou-Chia-Ch'ung (歐家冲), T'u-Tze-T'ang (兎子塘), Hsi-K'uang-