

北京西山
山地質誌

LIST OF ILLUSTRATIONS

PLATES

- I. A. Five li NE of Chin-Yü-Kou, showing the middle limestone between the red soft sandstones of the lower Sinian (Cambrian) formation.
B. View of Niu-Hsin-T'ö looking north, showing from the base to the top upper Sinian limestone (Ordovician), Carboniferous coal series and Permo-Triassic sandstones.
- II. A. View of Hsiang-Yü showing the Mên-Tou-Kou and Kiu-Lung-Shan series.
B. West of Tieu-Chia-Chuang, Cambrian limestone on the left in contact with the Jurassic conglomerate on the right by a fault.
- III. A. View showing the alternate bedding of the hard and soft conglomerate and porphyry sheets of Tiao-Chi-Shau looking south from Liu-Kung-Kou.
B. North of T'ö-Li showing Tiao-Chi-Shan formation dipping east.
- IV. View of the granite of Yang-Fang looking north.
- V. Sections of rocks and minerals under the microscope.
- VI. Sections of rocks and minerals under the microscope.
- VII. Map showing the general altitude of the Western Hills 1/250,000
- VIII. A. granite of Ching-Ling.
B. View of Hun-Ho north of Ching-Pai-Kou.
- IX. A. View of Ching-Shui-Ho looking north from Chun-Hsiang.
B. View of Ching-Shui-Ho looking west from Ching-Pai-Kou.
- X. A. The east-west pass between Shih-Chiug-Shan and diabase hill.
B. The marble formation of Shih-Wo.
- XI. A. The slate quarry of Shih-Pau-Tang.
B. Limestone kilns in Chow-Kou-T'ien.
- XII. Four diagrams showing the historical changes in the cause of Hun-Ho.
- XIII. Geological map of Hsi-Shan 1/100,000.
- XIV. General sections of Hsi-Shan.
- XV. Geological map of the environs of Peking 1/1,000,000

FIGURES,

1. Generalized section of sedimentary rocks of the Western Hills.
2. Section 2 li NE of Chin-Yü-Kou.
3. Section north of Hun-Ho and opposite of Chin-Yü-Kou.
4. Section south of Ching-Shui-Ho near Ching-Pai-Kou.
5. Section on NE side of the valley Liu-Kung-Kou, south of Fu-Chia-Tai.
6. Section north of Chai-Tang.
7. Section of Yen-Li-Kou.
8. Section near Tih-Shui-Yai.
9. Section of Yü-Chuan-Shan.
10. Section of Kiu-Lung-Shan north of Mên-Tou-Kou.
11. and 12. Boring sections of the Tung-Hsin colliery, Mên-Tou-Kou.
13. Section between Pan-Chiao and Pai-Tao-Tzŭ.
14. Section of the well at Yü Wang-Fu, Peking.
15. Map of Mên-Tou-Kou mining district.
16. Ideal section of the structure of the Chang-Kou-Yü coal field.

PREFACE.

The origin and nature of the work summarised in this memoir has been carefully explained by Mr. Yih in his introduction and very little needs to be added. From his remarks it is evident that the fragmentary material thus put together differs in detail and in accuracy, as the work was done by a number of graduating students unaided. It was therefore not without hesitation that I decided upon its publication. The final factor that helped me to arrive at the decision was that there seemed very little chance of revision in the near future, for all of us are busily occupied with the enormous task of preparing the projected 1:1,000,000 maps and the surveying of mineral resources. It is hoped that in spite of its imperfections the memoir may still be useful to all students of Chinese geology.

Some explanation has also to be given for the repetition in the chapter on economic geology. It was written by Mr. Yih at my suggestion when the part on stratigraphy was already in the press. Consequently some overlapping was inevitable. After Mr. Yih's departure for America more up-to-date information was kindly supplied by numerous mining friends especially Mr. K. S. Chen, assistant engineer to the Lung-Yen Co., who went specially to Mo-Shih-K'ou and Yang-Kia-T'un at my request, and a thorough revision was undertaken.

A word of apology must be offered for the poor quality of many of the illustrations which have been made entirely in Peking. In almost all cases it is due to inefficient printing. Any one who has tried to set up a new standard in printing in a place where this kind of work is very rare, will certainly realize our difficulties and excuse our shortcomings.

I take this occasion to express my deep regret that the World War and its consequence have prevented Dr. F. Solger from continuing his pioneer work in the Western Hills to which this memoir owes a grateful debt.

V. K. TING

Peking, September, 1920.

CONTENTS

	Page
Preface...	1
Introduction	1

CHAPTER I STRATIGRAPHY

Neo-Proterozoic	1
Siliceous limestone	1
Hsia-Ma-Ling formation	3
Palaeozoic	7
Cambrian-Lower Siuian	7
Ordovician—Upper Sinian	8
Carboniferous—Yang-Chia-T'un coal series	11
Transition from Palaeozoic to Mesozoic	15
Permo-Triassic—Hung-Miao-Ling sandstone	15
Mesozoic	17
Lower Jurassic—Mên-Tou-Kou coal series	17
—Kiu-Lung-Sban series	24
Upper Jurassic—Tiao-Cbi-Shan formation	27
Cenozoic	31

CHAPTER II IGNEOUS PETROGRAPHY

Granite	33
Granite of Yang-Fang	33
Granite of Chow-Kou-Tien	34
Age and mode of the granite intrusion	36
Diabase	38
Porphyry	42
Porphyry of the Ch'ai-Tang basin	43
Porphyry of Ching-Shui-Chien and Miao-Fêng-Sban	46
Minor masses of igneous rocks	48
Summary and conclusion	49

CHAPTER III STRUCTURAL GEOLOGY

Folding	...	...	...	...	...	...	...	...	...	51
Faulting	...	...	...	...	...	...	...	...	...	53
Structural relation of Hsi-Shan and its neighbouring mountains	...	...	...	...	...	...	...	...	...	54
Date and effect of movements	...	...	...	...	...	...	...	...	...	57

CHAPTER IV PHYSIOGRAPHY

Hills and mountains	...	...	...	...	...	...	...	...	...	60
Plain or "Bay of Peking"	...	...	...	...	...	...	...	...	...	61
Rivers and streams	...	...	...	...	...	...	...	...	...	64
Physiographic stages—T'ang-Hsien landsurface	...	...	...	...	...	...	...	...	...	66
—Feng-Ho erosion	...	...	...	...	...	...	...	...	...	68
—Ma-Lan terraces	...	...	...	...	...	...	...	...	...	69
—Pan-Chiao erosion	...	...	...	...	...	...	...	...	...	70
Loess problem and physiographic stages	...	...	...	...	...	...	...	...	...	73
Summary of the physiographic epochs	...	...	...	...	...	...	...	...	...	75
Correlation of dates of deformations and epochs of physiographic stages	...	...	...	...	...	...	...	...	...	76

CHAPTER V ECONOMIC GEOLOGY

Coal fields...	...	...	...	...	...	...	...	...	...	78
Mên-Tou-Kou	...	...	...	...	...	...	...	...	...	81
Liu-Li-Chu, Liu-Chia-Ling, Ch'iang-Fêng-P'o etc.	...	...	...	...	...	...	...	...	...	85
Yang-Chia-T'un, Hui-Yü etc.	...	...	...	...	...	...	...	...	...	86
T'an-Yü	...	...	...	...	...	...	...	...	...	87
Mo-Shi-Kou and Pa-Ta-Chu	...	...	...	...	...	...	...	...	...	89
Hsiang-Yü; Yü-Ch'uan-Shan and Pai-Chia-T'un; Wang-Ping-Ts'nn, An-Chia-T'an and Wang-Ping-Kou	...	...	...	...	...	...	...	...	...	90
Pai-Tao-Tze, Shih-Tzu-Tao, Chao-Chia-Tai, Wang-Chia-Chuang, T'an-Chê-Ssu, Sang-Yü, T'ung-Tsun, Lo-Hou-Ling, Chieh-Tai-Ssu, Wang-Chia-Chuang etc.; Mei-Ling, Po-Men-Kou, etc.	...	...	...	...	...	...	...	...	...	91

Shih-Pan-Chang and Fêng-Tsun ; Ching-Shui-Chien, Ta-Tai, Chuan-Shih-Tai, Tung-Pan-Chiao, Hsi-Pan-Chiao, Chuang -Wu, Chien-Chün-Tai, Ta-Han-Ling, Mei-Wo, Liu-Chia- • Tai etc. 92	92
Mu-Ch'ang-Tzŭ, Ch'an-Fang, etc. 94	94
Ch'ai-Tang 94	94
Ch'ang-Kou-Yü 96	96
Hsi-An-Tzu, Tung-An-Tzu, Pei-An-Tzu, Ying-Shui, Yao-Erh, Hsing-Yuan. etc. 99	99
Chow-Kou-Tien, Ching-Ling, Wan-Fo-T'ang, Ho-Tzu-Chuang, Chun-Chiao, Nan-Chiao, Ch'ang-Liu-Shui etc ; Hung-Mei- Chang, Chin-Chi-Tai, Ta-An-Shan, Chang-T'sao 102	102
Tung-T'ao-Yuan, Ts'ao-Chia-P'u, Liu-Kung-Kou, Yü-Ni-Kêng, Mei-Tai 103	103
Summary 103	103
Metalliferous deposits 105	105
Iron 105	105
Copper 106	106
Lead 106	106
Gold 106	106
Non metallic minerals and stone quarries 106	106
Asbestos 107	107
Talc 107	107
Granite 107	107
Marble 108	108
Slate 109	109
Lime 110	110
Statistics 112	112

APPENDIX

Notes on the records of the historical changes in the lower course of the Hun-Ho 113	113
--	-----

CHAPTER I.

STRATIGRAPHY.

Within the relatively small area to be dealt with in this paper, almost all the important sedimentary formations of northern China can be observed except the Archean and the metamorphic Algonkian. Owing to the existence of successive synclinal and anticlinal foldings and several important faultings, the same formations are often repeated in outcrops. As is the general case in northern China, the sedimentary series do not represent a continuous stratigraphic sequence but are separated by several deceptive conformities. They may be systematically treated as follows.

NEO-PROTEROZOIC

Siliceous Limestone.

Occurrence.—The siliceous limestone is exposed in a semi-dome-like mass extending from north of Kao-Yai-Kou (高崖口) Fang-Liang-Tsun (方梁村) and Ta-Tsun (大村) southwestward to Ching-Pai-Kou (青白口) thence northwestward to Hsiang-Yang-Kou (向陽口), dipping toward SSE and SW at varying angles of 10° to 60° . Farther west and north from Ching-Pai-Kou and northeast from Kao-Yai-Kou it extends to Pei-Yü (柏峪) and Nan-Kou (南口) respectively. (see plate XIII.) Besides this extensive mass, it crops out at an isolated hill near Liang-Hsiang (良鄉) station of Peking-Hankow railway in the far southeast corner of the surveyed area. About 32 li north of this hill occurs another exposure of the same formation.

Characters.—This limestone is either blue or light gray, or less often, dark gray in color. It may be either thick or thin-bedded. It is characterised by abundance of chert, either in nodules or in thin lenticular bands. In some parts, however, the limestone may be quite free from chert. Thin black shales interbedded in the limestone have been recognised on the route from Ta-Tsun to Hsiang-Yang-Kou. The base of this formation has not been seen within the limit of the mapped area, but in other localities, Nan-Kou, Hsuan-Hua (宣化), etc., it is underlain by a quartzite. According to the northwestern exposure it has a probable thickness of about 1000 meters.

Period	Formation	Metres	Present land surface
			Variagated clay, stratified gravel and loess.
Upper Jurassic	Unconformity	1500	Porphyry lava, porphyry conglomerate, green and red shale, yellow sandy shale with lenses of coal, and conglomerate of porphyry, limestone and marble pebbles.
	Tiao-Chi-Shan Formation		
Lower Jurassic	Unconformity	700	Violet and green shale, sandstone, and conglomerate.
	Kiu-Lung-Shan Series		
	Men-Tou-Kou Coal Series	550	Conglomerate, coal-bearing sandstone and shale.
Permo-Triassic	Unconformity Hung-Miao-Ling Sandstone	130	Quartzose sandstone.
Carboniferous	Yang-Chia-T'un Coal Series	310	Shale, sandstone, coal & conglomerate.
Ordovician	Unconformity	750	Massive, dark blue Actinoceras limestone. Only the upper part is thin-bedded.
	Upper Sinian		
Cambrian	Lower Sinian	900	Wurmkalk, oolitic limestone, reddish and greenish shale in which a bed of dolomitic limestone is intercalated.
Pre-Cambrian	Unconformity	570±	Sandstone, carbonaceous shale and slate.
	Hsia-Ma-Ling Formation		
	Siliceous Limestone	1000±	Siliceous limestone interbedded with thin bands of chert and black shale.

Total approximate thickness...6600 m.

Fig. 1. Generalized section of sedimentary rocks of the Western Hills, Peking

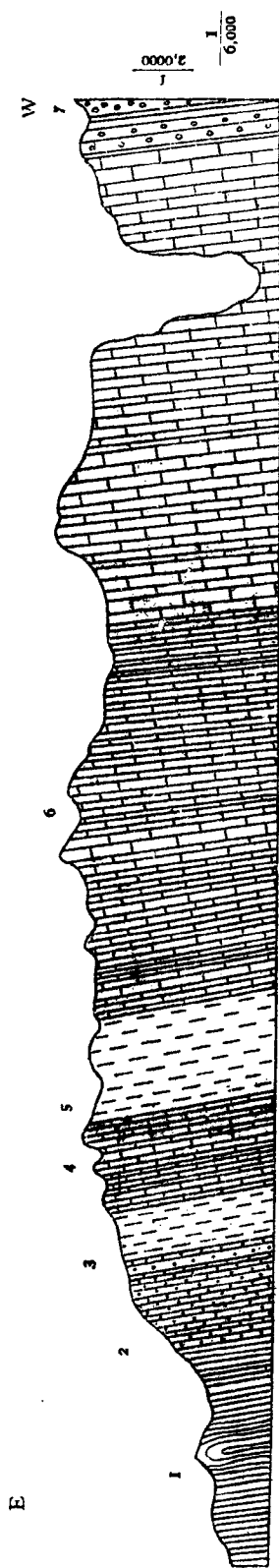


Fig. 4 Section South of Ching-Shui-Ho (白水河) near Ching-Pai-K'ou (清白寺)

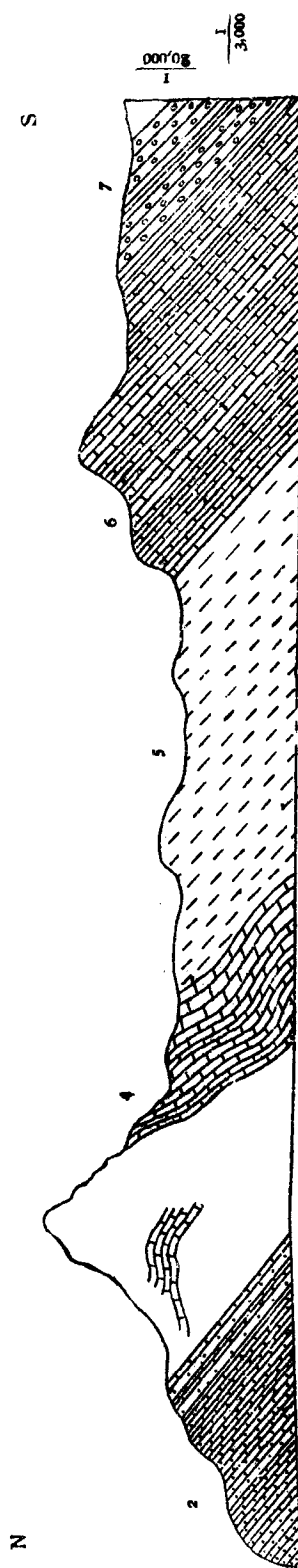


Fig. 5 Section on north-east side of the valley, Liu-Kung-Kou (溝公畝) South of Fu-Chia-Tai (余家台)

- Pre-Cambrian :—1. black shale
 2. Sandstone
 Cambrian :—3. lower red and green shale
 4. middle limestone
 5. upper red and green shale
 6. Oolitic limestone and Wurmiaik.
 Jurassic :—7. porphyry conglomerate

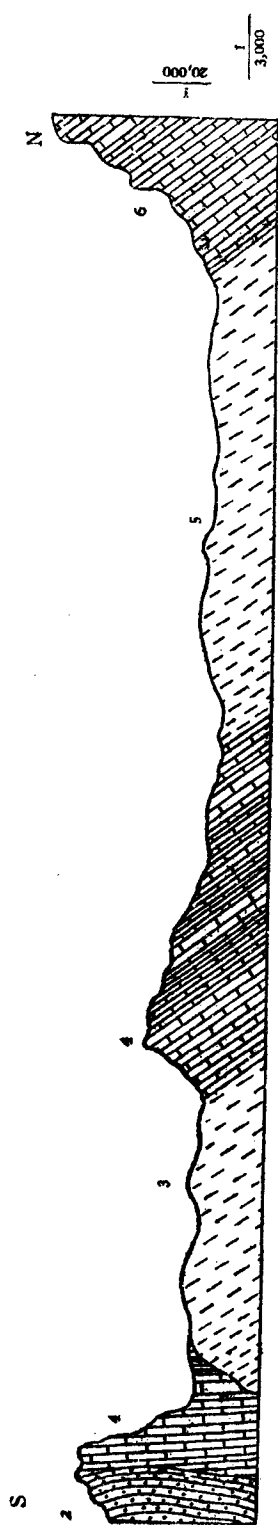


Fig. 2 Section two li NE of Chin-Yü-K'ou (口哈岸).

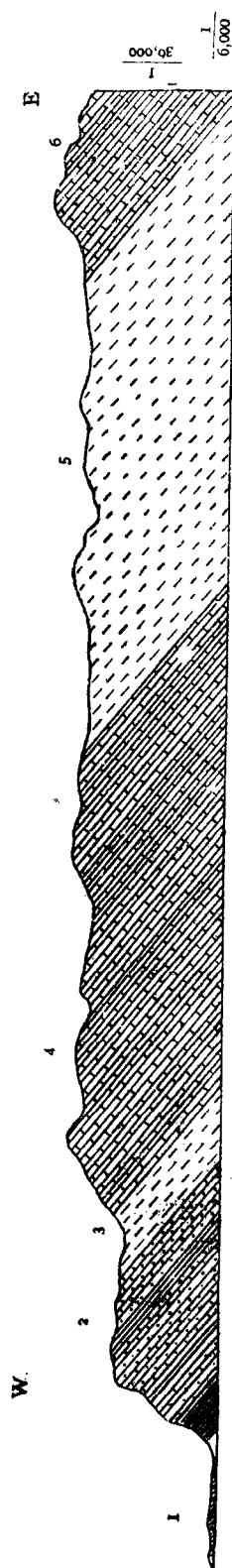


Fig. 3 Section north of Hun-Ho (河灣) and Opposite to Chin-Yü-K'ou.

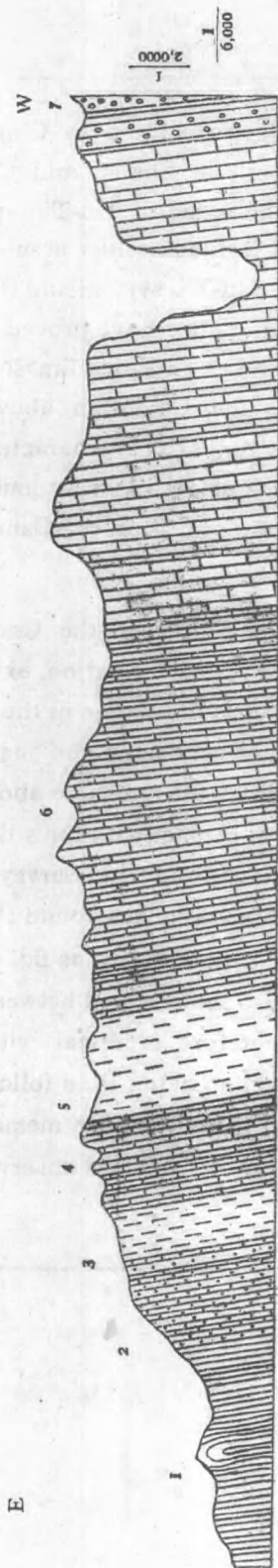


Fig. 4 Section South of Ching-Shui-Ho (河水溝) near Ching-Pai-K'ou (口白霄)

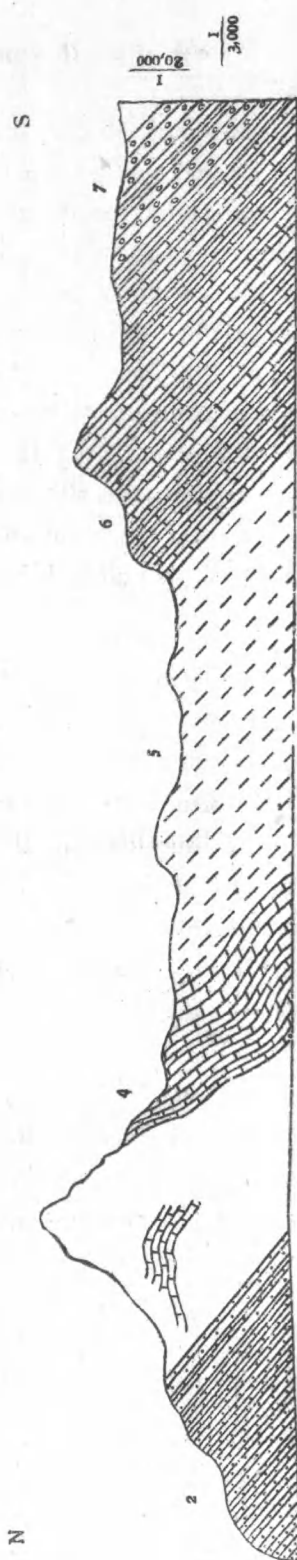


Fig. 5 Section on north-east side of the valley, Liu-Kung-Kou (溝公劉) South of Fu-Chia-Tai (台家傳)

- Pre-Cambrian :- 1. black shale
 2. Sandstone
 Cambrian :- 3. lower red and green shale
 4. middle limestone
 5. upper red and green shale
 6. Oolitic limestone and Wurmkaik.
 Jurassic :- 7. porphyry conglomerate

Sinian system (Cambrian). Since the Carnegie Expedition to China in 1903-04, flinty limestones are known to occur both in Shansi and Chihli, where they were respectively designated under the name of Hu-T'o system and Ta-Yang limestone; the latter, B. Willis and E. Blackwelder assumed to be correlatable with the flinty limestone of the Hu-T'o system and that of the Nan-Kou pass §§) observed by von Richthofen. They have proved these limestones to be of Pre-Cambrian age, since the "Ta-Yang limestone is separated from the Archean below and from the Cambrian above by pronounced unconformities" §1). In view of its similarity in character and the nearness of occurrences, the siliceous limestone of Hsi-Shan is doubtless the same as the Nan-Kou limestone of Richthofen, and is of pre-Cambrian age as proved by B. Willis and E. Blackwelder.

But, neither von Richthofen nor the geologists of the Carnegie Expedition have seen such a series as the Hsia-Ma-Ling formation, exposed between the Cambrian red shale and the siliceous limestone in the same locality. Von Richthofen did see a formation of sandstone and shales at Pei-Yü (柏峪). Unfortunately it is separated from the red shale above by 400 m. of dense gray limestone, §2) though it is in contact with the siliceous limestone below. Lately Mr. V. K. Ting, Director of the Survey, has restudied the section observed by von Richthofen, and has found that he misunderstood its real structure. The section is practically as fig. 6. In reality the sandstone and shale of Pei-Yü are also intercalated between the red shale and the siliceous limestone. It is therefore identical with the Hsia-Ma-Ling formation. As to its age we can do no better than follow the assumption of E. Blackwelder and B. Willis that it is the upper member of Ta-Yang limestone §3), which had been eroded in the sections observed by them, i.e. it is also of pre-Cambrian age.

§§). Research in China Vol. I part II page 10.

§1). Research in China Vol. I part I page 131.

§2). China Vol. II page 306.

§3). Research in China Vol. I part I page 10.

PALAEOZOIC.

CAMBRIAN.

Lower Sinian.

Occurrence.—North from Yü-Ni-Keng (淤泥河) southwest to Ching-Pai-Kou there is a continuous belt of lower Sinian formation which rests on the Hsia-Ma-Ling series as has already been referred to. (see fig 2-5). It is unconformably covered by a Jurassic conglomerate. Evidently it has been subjected to prolonged erosion which must have taken away a part of the strata, so the section here is not complete.

Characters.—The lower Sinian formation comprises 5 minor divisions. They are from bottom upwards, (1) lower shale, usually purple, sometimes green, (2) middle limestone, (Pl. I A) the upper part being thick-bedded and gray in colour, the lower part, greenish white or reddish white and thin-bedded, usually rather pure, (3) upper shale similar to (1), (4) dark or light gray limestone, hard and dense, partly crystalline and oolitic in texture, and (5) conglomeratic limestone or wurmkalk, dark or yellowish gray. Sometimes it is difficult to separate (5) from (4) ex. in the exposure west of Tien-Chia-Chuang a bed of typical wurmkalk, about one foot in thickness is found to be intercalated between typical oolitic limestone. The oolites are usually not more than 1mm diameter, but occasionally, as in a bed east of Chin-Yü-Kou (芹峪口) they may reach the size of about $\frac{1}{2}$ cm. In the same formation along Ching-Shui-Ho, the oolitic and the conglomeratic textures are not clearly seen. Here the uppermost part of the lower Sinian seems to be particularly thick. Probably it is transitional to the upper Sinian. Several sections have been measured. Their thickness are approximately as follows:

Locality.	Lower shale	Middle limes.	Upper shale	Oolitic and Cong. lim.
North of Chin-Yü-Kou (fig 2)	70m	90m	170m	
East of " " " (" 3)	25m	180m	190m	220m
Along Liu-Kung-Kou... .. (" 5)		100m	100m	90m
South of Ching-Shui-Ho (" 4)	45m	100m	100m	770m

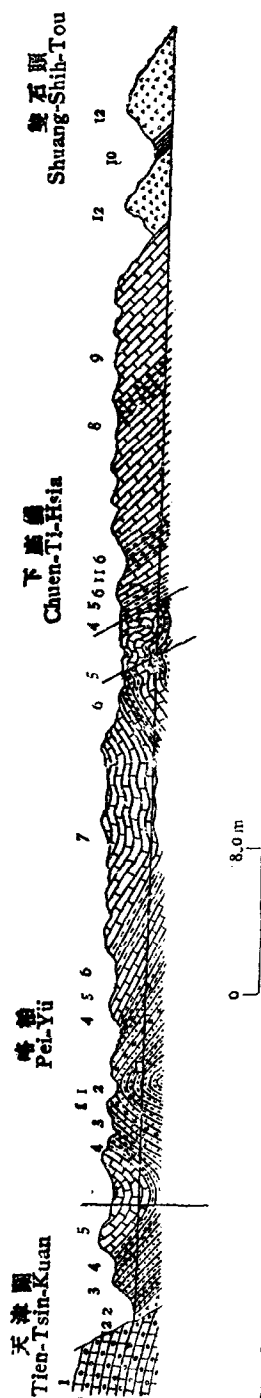


Fig. 6. Section North of Chai-Tang (寨堂), by V. K. Ting. Pre-Cambrian:—1. Siliceous limestone, 2. black shale, 3. ferrogneous sandstone; Cambrian: 4. reddish and greenish shale, 5. white limestone, 6. reddish and greenish shale, 7. oolitic limestone; 8. Wurmalk; Ordovician: 9. dark blue limestone; Mesozoic: 10. Jurassic coal series, 11. diabase and andesite dykes, 12. porphyry.

It seems that the lower shale does not exceed 100m in thickness, the middle limestone is always about 100m, the upper shale is thicker than the lower shale, and the uppermost limestone is varying in thickness according to the degree of erosion.

Mr. V. K. Ting has noticed that the Cambrian system exposed in the section north of Chai-Tang is also composed of the same subdivisions as described, which Richtbafen did not know because of his misunderstanding of the local structure. (Fig. 6.)

ORDOVICIAN.

Upper Sinian.

Occurrence.—The largest exposure of the upper Sinian formation lies in the southwestern part of Hsi-Shan. It forms the most barren and precipitous mountains; the highest and longest ridge composed of this limestone is called Hua-Mu-Ling (花木嶺). On either side of Hun-Ho above San-Chia-Tien (三家店), the same formation also extensively occurs: in the pagoda hill or Yü-Chuan-Shan (玉泉山), in the neighbourhood of Wen-Chuan-Ssu (溫泉寺), Pai-Chia-T'an (白家疃), Yang-Fang (羊坊) etc.; in the west and northwest of Fang-Shan-Hsien (房山縣) city, and in the north of Ching-Shui-Ho (清水河) valley near Chai-Tang, occurrences of this formation can also be found.

Characters.—The upper Sinian formation is a limestone, usually massive either black or dark gray or grayish white in colour. Exeptionally it is so thin bedded that it looks like slate, and somewhat siliceous. Below, it passes insensibly into the lower Sinian, for instance, in the valley from Tan-Li (旦里) to Nan-Chuang (南莊) and in the deep valley from Ho-Pei-Tsun (河北村) to Tih-Shui-Yai (滴水崖); above, it is often succeeded by a coal series of Carboniferous age. Its contact with the latter is generally irregular in outline having depressions filled by red clay.

In the region of An-Tze (安子) and Nan-Chiao (南窖) the limestone conformably underlying the carboniferous coal series is mostly massive, black or grayish white in colour, and very pure in composition. Only its uppermost portion is rather thin-bedded. The same limestone in Tung-Shan-K'ou (東山口), Chin-Ling (金陵), Yang-Erh-Yü (羊耳峪) etc., lies in contact with granite so it has been converted into marble. Near Shi-Pu (石堡), the uppermost Sinian is more shaly than any other exposure. It yields garnet crystals and has been deeply weathered. In the districts of Shih-Ta-Pei-Shan (四大背山), Tieh-Shih-To (鉄石坨), Pe-Yü-Kou (北峪溝) and Lung-Chuang-Ho (龍泉河) or Liu-Li-Ho (琉璃河) the upper Sinian formation is best developed. It is dark gray to black in colour. On either side of Liu Li Ho (琉璃河) it becomes a white or grayish white marble somewhat dense, and rather pure. South of that river it everywhere underlies the Carboniferous coal series. From Tih-Shui-Yai to Pan-Ko-Chuang (班各莊), it has been thrust against the latter. In the valley of Nang-Kiang-Kou (南港溝) south of Chuang-Hu (莊戶), it is less pure than usual. A bed of calcareous shale and thin layers of yellowish dolomite are interbedded between massive dark gray limestone. The same applies to the limestone near Hsin-Fang (新房) south of T'an-Che-Ssu (禪柘寺) where the lime burnt from the reddish limestone is gray and earthy, while that from the dark blue variety of the same locality is clean white. On the eastern end of Ma-An-Shan (馬鞍山) the blue limestone is traversed by a multitude of fine calcite veins and is partly brecciated. In Ta-Chiao-Ssu (大覺寺), Wen-Chuan-Ssu (溫泉寺), and Shan-Wei-Tien (上華甸), a part of the upper Sinian formation had been metamorphosed into marble through the intrusion of granite bodies. The thickness of this formation is roughly estimated at about 750 m.

Age and Correlation.

Trilobites are quite common in the oolitic limestone and several collections have been made, for example, near Tien-Chia-Chuang and north of Ch'ai-Tang. *Actinoceras* has been recognised in the upper Sinian limestone in different localities by different members: Mr. C. C. Liu saw it in a place southwest of Shih-Tze-Tao (十字道), Messrs. C. Y. Hsieh and T. Y. Loo discovered it in Nan-Kiang-Kou (南港溝) valley south of Chuang-Hu (庄戶) and Chien-Chun-Tai (千軍台), and Mr. H. C. T'an found it on the summit of Tih-Shih-T'o (鉄石它). As shown in the map, all these localities are rather near to one another. It seems probable that they all belong to the same horizon.

What has been designated by von F. Richthofen as "Sinische Formationsreihe" in Shantung includes all the strata of Cambrian age and also the siliceous limestone then supposed to be Cambrian. The Ordovician limestone has been miscalled by him *Kohlenkalk*§). The Sinian system as used by B. Willis and E. Blackwelder consists of the Manto-shale and Kiu-Lung limestone of Cambrian age, and the Tsinan limestone of Ordovician age in the province of Shantung; while in Chihli and Shansi, it comprises the Cambrian Manto shale and the Cambro-Ordovician Ki-Chou limestone which cannot be subdivided so readily as in Shantung into the Kiu-Lung and Tsi-Nan groups, though it possesses most of their characters. In Hsi-Shan, the Cambrian and the Ordovician formations are on the whole similar to that of the latter regions, and therefore without doubt they can be correlated with the Sinian system of B. Willis and the corresponding part of Richtbofen's "Sinische Formationsreihe", but the lower part of the Cambrian in the region discussed is rather constant in composition, always consisting of a lower red shale, a middle limestone, and an upper red shale; and the *Actinoceras* limestone is especially thick. Moreover, in this region the red shale formation occurs everywhere together with the oolitic limestone; but the *Actinoceras* limestone is often extensively exposed without the oolitic group. So here it is desirable to keep the two main divisions separated: lower Sinian corresponding to the Cambrian formations, and the upper Sinian the Ordovician limestone.

§) China Vol. II page 226 and 301.