

IS CHIHSHIA LIMESTONE REALLY DEVELOPED IN KWANG-
TUNG AND KWANGSI PROVINCES OF SW. CHINA?

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The term "Chihshia limestone" of Nanking Hills was primarily applied by F. v. Richthofen to all those calcareous formations underlain by Devonian quartzite and overlain by Permian coal series which carries the characteristic brachiopod *Lyttonia*. For more than 50 years, they were regarded as a unit, although its geological age had been discussed to some detail by F. Frech, A. W. Grabau, I. Hayasaka and Y. T. Chao. It was Prof. J. S. Lee¹ and Mr. S. Chu who first conducted a detailed stratigraphical study in the same area in 1930, and accurately located the definite position of different fossil horizons. At the result of their field investigation, they succeeded in classifying the so-called "Chihshia limestone" into 5 marine limestones ranging from Dinantian up to Lower Permian in age. They are not only distinct by their petrological character, but also remarkable for their faunal peculiarities. On the basis of their rock sequence and fossil contents, the writer² has attempted to redefine the "Chihshia limestone", by restricting it only to the two upper limestones of Lee and Chu (i.e. Chuanshan limestone and Chinlung limestone), which are characterized by *Verbeekina verbeeki* at the lower, but by *Tetrapora elegantula*, *Polythecalis chinensis* etc. at the upper. It is all accepted among the stratigraphers, that the Chihshia limestone thus redefined represents a marine sedimentation of early Permian age in Nanking Hills. This true Chihshia limestone is now known to occur not only in Nanking Hills, but also in other Yangtze regions of Anhui, Hupei, and even in Gnomeishan (Omei) of W. Szechuan. It is further found in Hanchung region of Southern Shensi on the north, and in the provinces of Yunnan, Kweichow, Kwangsi, Kwangtung,

1. J.S. Lee and S. Chu—Note on Chihshia limestone and its associated formations. Bull. Geol. Soc. China, Vol. IX, No. 1, pp. 37-43. 1930.
2. S. S. Yoh & T. K. Huang—The Coral Fauna of the Chihshia limestone of the Lower Yangtze Valley. Pal. Sinica, Ser. B, Vol. VIII, Fasc. 1, pp. 5-6. 1932.

Fukien and Chekiang on the south. Nevertheless the marine Lower Permian strata are well-developed in Kweichow as they are represented by some 400 m. of massive limestone. According to Mr. T. K. Huang¹ the Lower Permian limestone of Kweichow contains 4 characteristic coral zones as follows:—

4. Zone of *Wentzeletta timorica* (Gerth)
3. Zone of *Polythecalis yangtzensis* (Huang)
2. Zone of *Tetrapora elegantula* (Yoh et Huang)
1. Zone of *Stylidophyllum volzi* (Yoh et Huang)

Mr. Huang includes these 4 coral zones under the name of *Chihhsia* in contrast to the Middle Permian *Lopingian* with the zone of *Lophophyllum kayseri* (Huang). Obviously the *Chihhsia* limestone of Nanking Hills comprises zone 2 and zone 3 of Huang, while the other two of Kweichow Province are entirely absent in Nanking Hills.

After the stratigraphical boundary of the true *Chihhsia* limestone has been clearly understood, we now begin to deal with the *Chihhsia* problem in Kwangtung and Kwangsi Provinces, the geology of which is imperfectly known. Since the establishment of the Geological Survey of Kwangtung and Kwangsi at Canton in 1928, the scientific staff first of all, concentrates their energy to set up a standard geological column based upon which extensive geological mapping can be successfully carried out. Five years had elapsed, more than half of the area in these two provinces was formally mapped. As resulted from our observations the typical *Chihhsia* of these two provinces is rather poorly developed, if not entirely absent. In his early report of northern Kwangsi, the writer² erroneously referred the lower division of Szumen coal series to the *Chihhsia* limestone of Lower Yangtze valley. It solely depends on the lithological similarity and superficial determination of the fossil corals. Indeed some specimens of *Syringopora* from the stinky impure limestone in the lower Szumen coal series were confused with the genus *Tetrapora*, when they

1. T. K. Huang—Permian corals of Southern China, Pal. Sinica, Ser. B. Vol. VIII, Fasc. 2, pp. 9-10, 1932. See also T. K. Huang—The Permian of South China, Mem. Geol. Surv. China No. 10.
2. S. S. Yoh—Geology and Mineral Resources of N. Kwangsi, Ann. Rep. Vol. Pt. 2, pp. 75-79, Geol. Surv. of K. K. 1929.

were examined only by their external features. On the other hand, the lower division of Szumen series formerly referred to Chihsia limestone is in reality of lower Carboniferous age, while the black limestone carrying *Cryptospirifers* and with their coal seam below is undoubtedly Moscovian. Accordingly the age of Szumen series in North Kwangsi needs revision in future reports of the Canton Survey.

The typical lower Permian rocks which can be undoubtedly referred to Chihhsian in these two provinces may be treated separately as follows:—

A. In Kwangsi Province, we encounter the lower Permian rocks only in the southern regions. They are chiefly distributed in the following districts.

(1) Kweichien-Yungning area—This has been collectively called Kweichien limestone by Mr. T. O. Chu¹ of the Canton Survey. It was first noticed in the vicinity of Kweichien (貴縣) city, and consists of dark thin-bedded limestone at the lower and greyish massive limestone at the upper. But the uppermost part of this formation according to Mr. Chu, varies greatly in different places: shales and sandstone occur in the SE part of Hunghsien (橫縣), while silicious shales, sandstones, and calcareous sandstones are present at SW of Pumiachü (都柳圩) of Yungning (營寧). The total thickness of Kweichien limestone is estimated at 300 m. or more. From the light grey limestone in the W. of Pumiachü not far from SE. of Yungning, beautiful compound corals of Chihhsian species *Polythecalis yangtzeensis* var. *hochowensis* (pl. 1, figs 4a-4b) had been obtained in association with *Cornuonia* sp., *Schwagerina*, and other funilimids. The Kweichien limestone occupies wide areas between Kwei, Hung, Pingyang (賓陽) and Yungning districts. Its contact with the Devonian Lienhuashan series is obscure, but it is supposed to be disconformably succeeded by the coal-bearing sandstone and shale known as the Sanchiangkou series.

1. T. O. Chu—A preliminary report on the geology and mineral resources of Kwei, Hung, Yungchun, Yungning and Pingyang districts, Kwangsi Province, Ann. Rep. Vol. 1, pp. 11-12, Geol. Surv. of K. K. 1928.

(2) Wuslan area—The Kweichien limestone is also found widely distributed by T. C. Lee¹ in Wuslan (武宣) district. It overlies the upper Devonian series but is covered by early Quaternary red clay. This area may be regarded as the northern extension of Kweichien limestone in Kweichien-Yungning area. The maximum thickness of this limestone in this district is about 450 m.

(3) Chienchiang area—This is the type locality of Permian ever known in Kwangsi. The Permian rocks are completely exposed in the Hoshan² coal field about 10 km. from Peishihshu (北溪圩) near Chienchiang (遷江) city. The stratigraphical succession and fossil horizons are summarized as follows:—

4. Maping limestone Upper Permian(?)

It is whitish in color, and alternatively massive and thick-bedded. Fossil has been carefully searched in vain.

3. *Gastrioceras* beds late Middle Permian.

This series may be divided into two subdivisions. The lower one contains 30 m. of sandy shales and argillaceous sandstones, which carry chiefly ammonites and some other fossils: *Gastrioceras liui* Grabau, *Tirolites asiaticus* Jackel, *Troplites* sp. *Belemnites*, *Chonetes* sp. and *Philipsia* sp. etc. The upper one consists of black thin-bedded limestone which is devoid both of flint and fossil. Its thickness cannot be more than 40 m.

2. Coal-bearing series Middle Permian.

This series begins with a few meters of ferruginous sandstone and carbonaceous shales carrying one single coal seam about 1 m. thick, and is immediately succeeded by 100 m. of flinty limestone. The limestone is most blackish and flinty at its lowest part which contains the typical middle Permian brachiopods of S. China such as *Lyltonia*

1. T. C. Lee—A preliminary report on the geology of Laipin, Wuslan and Kweichien districts, Kwangsi, Ann. Rep. Vol. 2, Pt. 1, pp. 57. Geol. Surv. of K. K. 1929.

2. K. L. Fong & S. S. Yeh—Geology of Hoshan and Szumen coal fields of N. Kwangsi, Ann. Rep. Vol. 2, Pt. 1, pp. 34-35. Geol. Surv. of K. K. 1929.

richthofeni Kayser, *Entelites kayseri* Waagen, *Reticularia indica* Waagen etc. This limestone gradually changes into light grey color and becomes silicified towards its upper portions where no fossil has ever been found.

1. *Schwagerina* limestone Lower Permian.

This is a light-colored compact limestone characterized by the abundance of *Schwagerina* associated with some gastropods and single corals. This limestone is only partially exposed in Hoshan coal field as its base has not been observed.

(4) Hainyeh-Chenghuang area—In the SW of Hainyeh (興業) city is a series of low limestone hills. They are usually conical in form and isolated from one another. From the close vicinity of the city, these hills can be traced southwestwards for a distance of 20 km., until to the southwest of Chenghuangshü (城隍圩) a small town near the Kwangtung-Kwangsi border, hills of this sort become entirely vanished. Lithologically they consist chiefly of dark well-bedded limestone with more or less bedded flints. In the black limestone of a small hill called Maochangshan ("hill for polishing weapons") (磨槍山) at the midway between the city and the town, the following two corals have been obtained and positively determined by the writer:—

Tetrapora elegantula var. *kunghsiensis* Huang (pl. 1, figs. 1a-1b.)

Corwenia chingyashanensis Huang (pl. 1, figs. 2a-2b.)

This small collection was hurriedly made during a shower, when Mr. W. K. Yao and the writer carried on their geological mapping in S. Kwangsi about 5 months ago. These limestone beds rest upon Lungshan series of early Palaeozoic with a pronounced unconformity. In fact the limestone of Hainyeh-Chenghuang area can be favourably correlated with the lower division of Kwei-hsien limestone further north.

B. In Kwangtung Province—The lower Permian strata are only little known in Kwangtung. They have been observed in the following regions:—

(1) Northern Hanchiang region—Rocks of undoubted lower Permian are represented in N. Hanchiang (韓江) region by limestones, outcrops of which are so fragmentary that no exposure can be traced for a few miles. The

limestone are generally well-bedded and blackish in color. Not infrequently they contain characteristic flint nodules. At a quarry of Yukeng (油坑) near Hsinpuhsü (新埔圩) of Chiaolinghsien (蕉嶺縣) perfect coral specimens of the species *Michelinia siganensis* Reed (pl. 1, figs. 3a-3b) have been collected by Mr. W. K. Yao and the writer in the middle part of the black flinty limestone. This is named Yukeng limestone¹ after the type locality. Here the base is not exposed but its uppermost division is disconformably overlain by the later Permian quartzite which carries thin coal seams and *Gigantopteris* flora in the southern vicinity of Hsinpu. In the same black limestone of other localities between Hsinpu and Chiaoling city, we procured many specimens of *Schwagerina* and *Fusulina*, but strangely, they are not found at Yukeng.

(2) Peichiang or the north river region—Rocks which may be referred to lower Permian are very poorly developed in Peichiang (北江). They are reported by T. O. Chu², J. L. Hsü and C. P. Wang to occur in the north, and northwest of Chüchiang (曲江) city, and also in the Kouyatung (狗牙洞) coal field of Luyuanhsien (乳源縣). However they are usually represented by 100 m. of white or light-colored limestone, with one exception in the section of Kouyatung coal field where the limestone becomes grey to dark grey and is rich in flint nodules. No exposure exceeds 1 km. in length and therefore their outcrops are quite scattered and very limited in area. Both white and dark limestone abounds in *Schwagerina* and *Fusulina* beside some brachiopods with Chihian affinity are found. According to T. O. Chu, the lower Permian white limestone capped with 20 m. of quartzite is unconformably overlaid by middle Permian coal bearing series carrying typical *Gigantop-*

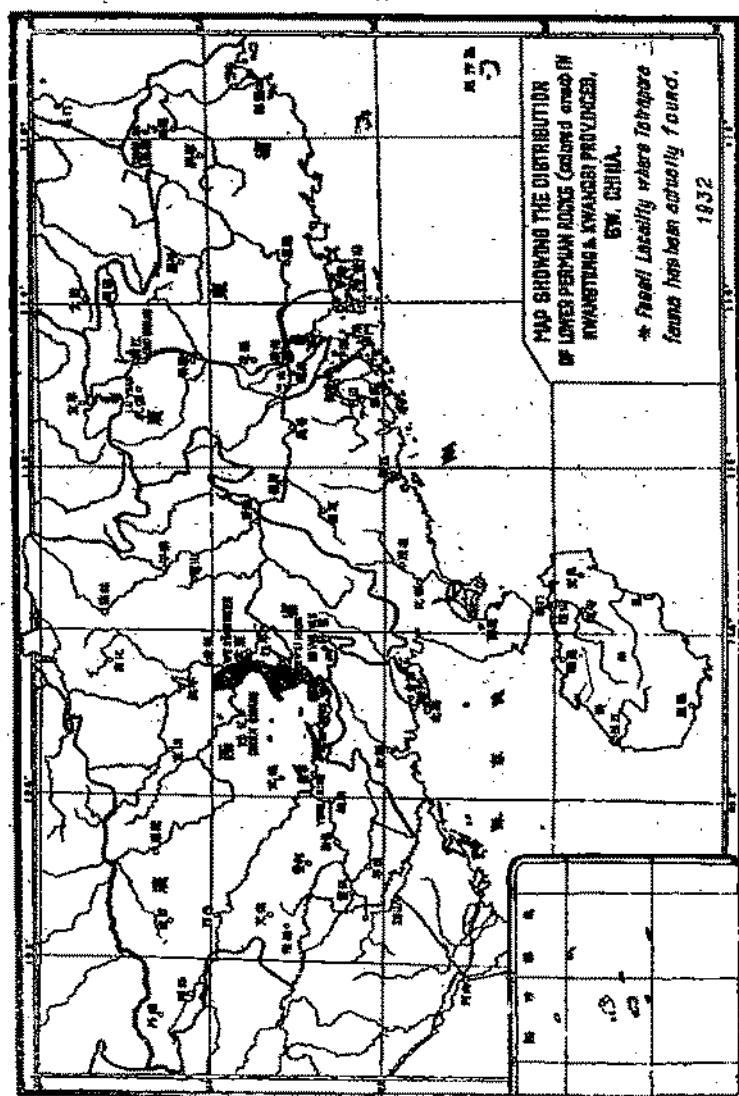
1. S. S. Yoh and W. K. Yao—Preliminary Report on the Geol. Mineral Resources of Hanchiang region, E. Kwangtung. Ann. Rep. Vol. IV. pt. 1. (ready for Press.)
2. T. O. Chu—Geology of Northern Kwangtung. Ann. Rep. Vol. II. Pt. 2, pp. 20-24. Geol. Surv. of K. K. 1929.
C. P. Wang—Geology of Chüchiang coal fields, Kwangtung. Ann. Rep. Vol. III. Pt. 2, pp. 70-72. Geol. Surv. of K. K. 1930.
C. P. Wang—Geology of Kouyatung coal field. Ann. Rep. Vol. III. Pt. 2, pp. 88. Geol. Surv. of K. K. 1930.

teris flora in Chuchiang region, while C. P. Wang observes in the same area that their contact is conformable. This needs final confirmation when further field study is executed.

(3) Hopu region of West Kwangtung.—The reference of the post Devonian limestone in Hopu (合浦) region to Kweichien limestone of Kwangsi is merely based on stratigraphical grounds by Mr. T. C. Lee¹. According to Mr. Lee, they are represented by 400 m. of thick-bedded dark grey limestone which is thought to rest on the Fintung series of Devonian-Carboniferous, and to underlie the Sanchiangkou series of Permian. Brachiopods and corals have been obtained, but they are poorly preserved and have not been positively determined. Therefore the age of the so-called Kweichien limestone in Hopu region is quite doubtful at present.

So far as our present knowledge of the stratigraphy in these two provinces permits us to judge, the Lower Permian is better developed in S. Kwangsi than in North and East Kwangtung. Among the lower Permian formations, only three of them furnish typical corals of Chihsia limestone, viz. *Polythecalis yangtzensis* var. *hochowensis* (Huang) and *Conocera* sp. from the Kweichien limestone of Yungning-Kweichien area; *Tetrapora elegantula* var. *kunghsienensis* (Huang), and *Conocera chiuyaoshanensis* (Huang) from the lower part of Kweichien limestone in Hainyeh-Chenghuang district, and finally *Michelinia siyanensis* Reed, from the Yukeng limestone of North Hanchiang region. Scanty as these corals might be, they are quite sufficient to guarantee the existence of Chihsia limestone in these regions. It is so because all the corals so far detected are only confined to zone 2 or zone 3 which Mr. Huang established in Kweichow sections. Further careful search in the lower Permian formations of these two provinces will bring out the discovery of other fossils belonging to the true Chihsia limestone of Lower Yangtze valley.

1. T. C. Lee—Geology and Mineral Resources of Suwen, Hailang, Suichi Lien-chiang, Hopu, Chin, and Lingshan districts, Kwangtung. Ann. Rep. Vol. 3, Pt. 2, pp. 9-10. Geol. Surv. of K. K. 1930.



**Explanation of
Plate I.**

PALTE I

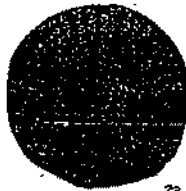
- Fig. 1. *Tetrapora elegantula* var. *kunghsiensis* Huang
 1a. Transverse section $\times 6$. Maochangshan. SW of Hsiuehhsien, S Kwangsi. Coll. S. S. Yoh & W. K. Yao, 1932.
 1b. Longitudinal section of the same specimen, $\times 6$.
- Fig. 2. *Conostoma chiuyaooshanensis* Huang.
 2a. Transverse section $\times 5$. Maochangshan, SW Hsiuehhsien, S. Kwangsi. Coll. S. S. Yoh & W. K. Yao, 1932.
 2b. Longitudinal section of the same $\times 4$.
- Fig. 3. *Michelinia siyanensis* Reed.
 3a. Transverse section $\times 2$. Yukeng, near Hsinpuhsü, of Chiaolinghsien, E. Kwangtung. Coll. S. S. Yoh and W. K. Yao, 1931.
 3b. Longitudinal section of the same $\times 2$.
- Fig. 4. *Polythesalis yangtzensis* var. *hochowensis* Huang.
 4a. Transverse section $\times 2$. Puminohsü, near Yungninghsien, S. Kwangsi. Coll. T. O. Chu and T. C. Lee, 1928.
 4b. Vertical section of the same $\times 2$.



1a



3a



2a



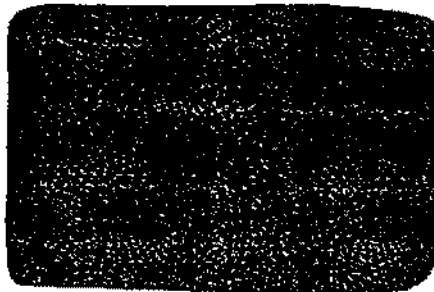
2b



3b



1b



4a



4b