

NOTE ON THE STRATIGRAPHY OF THE ENVIRONS OF THE MAPING CITY, CENTRAL KWANGSI*

(with special reference to the "Maping Limestone")

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Maping, formerly named Liuchow, is one of the well known cities in Central Kwangsi. The geology of the Maping district and its neighbouring areas were preliminarily surveyed by S. S. Yoh in 1929. In our journey across the Nanling Range we passed through that city, and had a chance to make a reconnaissance (Feb. 18-22, 1933) in the environs. Here we were fortunate enough to obtain a fairly complete succession from the Devonian up to the Triassic formations. Fossils were also collected at many different horizons. The "Maping Limestone" (Yoh) formerly held as the uppermost Permian¹ has proved to be in the stratigraphical position between the Lower Carboniferous, the Yentze Series, and the Middle Permian, the Chihhsia Limestone. Based on the palaeontological evidence as well as the lithological character the said Limestone should be divided into two formations; namely, the lower part, less than 600 m thick, carrying Moscovian faunas is named the Huanglung Limestone in redefined sense, and the upper part, a little more than 120 m thick, carrying typical Uralian faunas called the Maping Limestone. The unconformity between the "Maping Limestone" and the "Yentze Series", as noted by S. S. Yoh, in the Maanshan about 15 km. S.W. of the Maping City or 4 km. north of Lapaoyü, is really not the case; instead, an unconformity was found between the Yentze Series and the Devonian Limestone.

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1. S. S. Yoh, Geology of North Kwangsi, Annual Rep. Kwangtung and Kwangsi Geol. Surv. Vol. 2, Pt. 2, p. 86.

T. K. Huang correlated the "Maping Limestone" (Yoh) to the Chuanshan in his "Permian Formation of Southern China," Mem. Geol. Surv. China, Ser. A, No. 10, p. 83.

Much has been worked out regarding the geology of many other places of the present area, our attention is here concentrated in the hills along which the accompanying section is made. Accordingly the description of the different formations in the present paper mainly follows this sections.

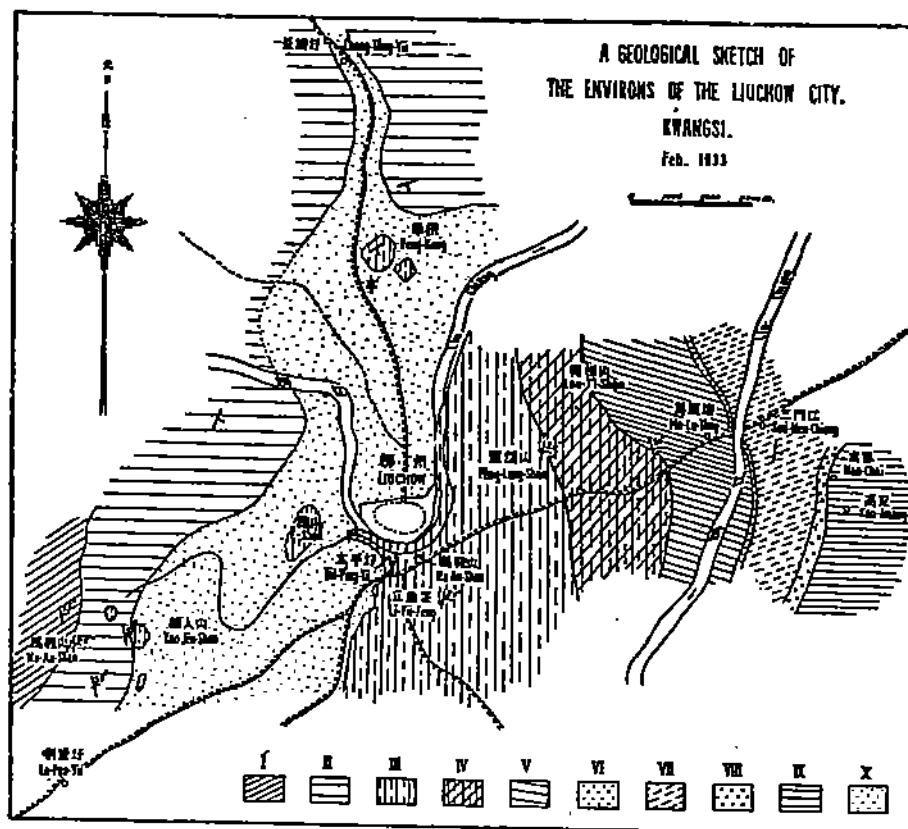


Fig. 1. I, Devonian Limestone, II, Yentze Series, III, Huanglung Limestone, IV, Maping Limestone, V, Chihsia Limestone, VI, Malutang Series, VII, Sanmenkiang Series, VIII, Nanchai Series, IX, Kaohuang Series, X, Red clay and alluvial deposit.

I. DEVONIAN LIMESTONE

The Devonian Limestone apparently occupies a rather wide area in the west of Lapaoyü. Our observation is, however, made only in the Maanshan

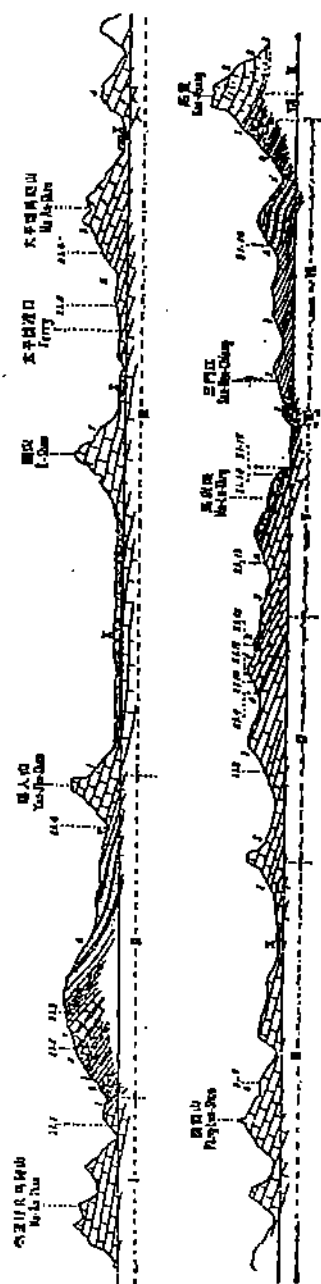


Fig. 2. A Section from Maanshan near Lapaoyü to Kachuang. I-X See explanation in fig. 1. Z1.1-Z1.16 Fossil Horizons.

and its neighbouring hills, about 4 km. north by west of Lapaoyü. There, the limestone is light gray, fine-textured, partly *oolitic*, thick-bedded occasionally with thin-bedded intercalations. The *oolites* are fine, $\frac{1}{2}$ -1 mm across. They are often condensed in some, but scanty in other beds. Pinkish calcite spots are often met with when the limestone contains few *oolites*. Fossils are rare. Fragments of *Pelecypoda* and *Brachiopoda* have been obtained in the uppermost part of this limestone at a short distance east of the Maanshan. A rather minute-tube species of *Chaetetes* embedded in a light gray limestone was found in a tomb-stone nearby the exposure of the Devonian Limestone. This *Chaetetes* is a new species, but commonly occurs in the upper Devonian Limestone elsewhere in Northern Kwangsi and Southern Hunan.

Through comparative studies we know that the present limestone belongs to the upper part of the Upper Devonian Limestone. In the environs of the Kueilin city the *oolitic*, light gray, well-bedded limestone is typically exposed in the hill of Tsingtung and the nearby hills on the eastern side of the Kueikiang. A limestone intimately followed it down and exposed in Laokintung carries many typical Upper Devonian fossils, including *Spirifer*

(*Sinospirifer*) *sinensis* Grabau. The whole limestone succession is termed the Kueilin Limestone² by K. L. Fong.

In Mr. Yoh's paper and geological map the present limestone is erroneously assigned to the "Maping Limestone." The confusion could have been easily avoided had the observer had sufficient time in the field. The characteristics about this limestone are:

(1) Position—Underlying the Lower Carboniferous, the Yentze Series.

(2) Fossils—Absence of Fusulinidae but presence of a *Chonetes* commonly occurs in the Devonian Limestone but never seen in the "Maping Limestone."

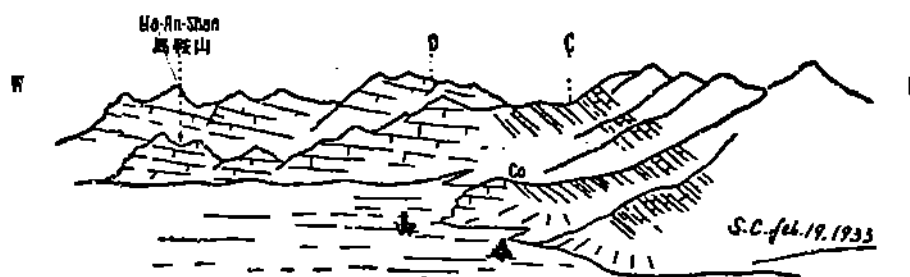


Fig. 3. A Sketch showing the uncomformable relation between the Devonian Limestone (D) and the Yentze Series of the lower Carboniferous (C), Contact (Co.).

(3) Lithology—Öolitic, fine-textured and excellently wellbedded.

(4) Topographic feature—Often forming limestone pinnacles (typically developed in Kueilin and Yangshua, N. E. Kwangsi) in contrast to the hills more or less flat-topped hills built up by the "Maping Limestone."

2. According to the writers extensive observation made in Kwangsi and Hunan Provinces the Kuhua and Kueilin Limestones really represent the lower and upper parts respectively of a single formation of the Upper Devonian age.

II. YENTZE SERIES

This series is composed of four parts; the basal part black shales, the lower part impure limestone, sandstone and shale, the middle part blackish gray limestone with chert nodules and the upper part sandstone intercalated with shales. The details are as follows in ascending order:

1. Black, siliceous shale intercalated with soft carbonaceous shale. 30 m.
2. Dark gray, impure, rather thick-bedded limestone intercalated with yellowish calcareous shale. 30 m.
3. Yellowish gray, micaceous, thin-bedded sandstone interbedded with dark gray sandy shale and black fragile shale. 40 m.
4. Lower part, black and yellowish gray shale intercalated with gray thin-bedded limestone, middle part, black siliceous shale interbedded with carbonaceous shale, and upper part, gray thin-bedded limestone intercalated with yellow calcareous shale. Total thickness 45 m.
5. Limestone which may be sub-divided into four parts in ascending order:
 - a. Gray to dirty gray rather thick-bedded limestone with chert nodules of moderate size scattered here and there. In the lower part *Michelinia* and *Cyathophyllum* are detected, while in the upper part crinoid stem and fragment of Brachiopoda are abundant. Among the latter *Striatifera gigantea* (Martin), *Productus* sp. and *Reticularia* sp. are determinable. Corals, as *Siphonodendron* cf. *irregulare* and *Syringopora* sp. are also obtained. Thickness 20 m.
 - b. Dark gray, thin-bedded limestone interbedded with chert layer or nodules regularly arranged between the individual beds. 10 m.
 - c. Limestone like (a) but with numerous chert nodules. 15 m.

- d. Limestone similar to (b) with chert layer and nodules often projected on the rock surface. Fragmental coral specimens comparable with that in (a) are observed. 35 m.
- 6. Lower part, dark gray soft sandstone interbedded with black and dark gray clay shale which carries the plant remains as *Lepidodendron* and *Neuropteris*. Upper part; yellowish gray quartzose sandstone intercalated with sandy shale and clay shale. 150 m.
- 7. Fine, tough, dirty yellow, rather thin-bedded limestone with thin bands of black flint in the lower part, thick-bedded, solitic with crowded stoliths of moderate size, 1-1½ mm. across in the upper part. 5 m.

The rocks referred to this Series are wide-spread in the northwest of the Liuchow city. But the sequence of strata is somewhat different in different localities. For instance, in Tuchow and Shatang about 20 km. north of the Maping city all limestone beds of the Lower Carboniferous are with little chert. Other strata of the same formation are also somewhat different in lithological character.

The Yentze Series named by S. S. Yoh includes the Lower Carboniferous rocks of N. Kwangsi. Fossils coming from the type locality and other places of this series belong to the upper part of the Lower Carboniferous or Viséan. But as we now know the Szumen coal-bearing series of Yoh³ formerly assigned to the Permian is also of Lower Carboniferous age. As already noted by T. K. Huang⁴ the *Tetrapora*-like corals in the so-called *Tetrapora* bed of the Szumen section are really *Syringopora* of the Lower Carboniferous. Recently C. Li and S. Chu revisited the localities and carefully studied the same section. They recognized that in the Szumen section the so-called Kuhua Limestone, Yentze Series and the Szumen coal-bearing series are all of Lower Carboniferous age. In the "Kuhua Limestone" typical Tournaisian Corals, *Cystophrentis* and *Pseudouralinia*, have been obtained. In the flint limestone

3. Op. cit. p. 77.

4. T. K. Huang, The Permian Formations of Southern China, Mem. Geol. Surv. China, Ser. A, No. 10, p. 85.

or "Tetrapora bed" Viséan fossils; as *Kueichouphyllum*, *Syringopora*, *Striatifera gigantea*, etc. are abundant. Besides *Crystospirifer* (*Lochengia*) Grabau and corals, *Striatifera* cf. *kansuensis* Chao and *S.* cf. *maxima* Chao are found in the "Lochengia bed" and its underlying "coal-bearing beds" as well. Consequently the Yentze series and the Szumen coal series of Yoh are apparently not well defined. In the present paper the Yentze series is used, but is redefined to cover all the Lower Carboniferous rocks, namely the Yentze and Szumen Series of Yoh.

We have perhaps digressed a little too far in discussing the Lower Carboniferous rocks of Kwangsi in general. In our own section the fossils in bed 5 are of Viséan age. Furthermore, based on the lithological character the beds 1-4 and 5-7 may be temporarily assigned to the Tournaisian and Viséan respectively.

Unconformity between the Devonian Limestone and the Yentze Series— The relation between the Yentze series and its underling Devonian Limestone is an unconformable one. It is excellently shown in the hills close to the Maanshan about 4 km north of Lapaoyü (fig. 3). Here the Devonian Limestone with very gentle dip (10° - 15° E. by S.) on the western side faces the Yentze series with a rather steep dip (35° - 45° E. by S.) to the east. The general strikes of these two are almost the same ($N20^{\circ}W$ - $S20^{\circ}E$). But at the very contact which has been actually detected in a place marked with *co* in the sketch, the strike and dip of the two formations are different. The Devonian Limestone strikes $N15^{\circ}W$ - $S15^{\circ}E$, and dips $15^{\circ}E$ by S, while the Yentze series strikes $N-S$ and dips $45^{\circ}E$. This difference must be an initial one. We are thus led to believe that this unconformity would represent a phase of the first phase of the Hercynian Movement in Europe. This Movement here is named the Liukiangian corresponding to the Kiangnanian in the the Lower Yangtze Valley.

While we should confine our discussion to the present region it might be well to mention that this unconformity is by no means limited to this place, we have also traced it elsewhere in Kwangsi. In the southeast of I-Ning and in the hills near the Liukiang city the Lower Carboniferous formation completely overlaps the Upper Devonian limestone, and the former directly rests upon the

Middle Devonian formation. The angular discordance is, however, not dominant.

III. HUANGLUNG LIMESTONE

This limestone is mainly composed of light gray limestone. According to the faunal distribution and the lithological character, it can be subdivided into four horizons. The ascending sequence is as follows:

1. Siliceous, massive, light gray limestone. As exposed in the Yaolenshan and Fengkung its lower part is a deeply weathered and profoundly fractured (60 m), while its upper part is a massive, cliff-forming rock. For this reason hills formed by this limestone often makes the appearance of a truncated cone with a superimposed pillar. Total thickness is about 250 m.
2. Dense, thick-bedded, light gray limestone with abundant fine sand-like limestone masses ($\frac{1}{2}$ -1 mm across) in the lower part. It is well developed in the western slope of the Maanshan, Liyüfeng and its southern hills in the vicinity of Taipingyü opposite to the Liuchow city. The exposure in the ferry of Taipingyü represents the lower part of this horizon. It consists of a series of beds carrying abundant corals interbedded with beds containing many fragments of indeterminable Brachiopoda and Pelecypoda (Z1.5). This fossil horizon had been noted by Yoh as the coralline bed. The upper part of this limestone is rather fine with white crystalline limestone about 20 m on its top. It contains *Striatifera* (*St. striata*), *Linoproductus* (*L. lineatus*) and corals (Z1.6). The former genera are rich in specimens on the southwestern side of the Maanshan. This is the location of the *Striatifera* bed of Yoh. In this part of limestone occurs, in the southeastern hills of Liyüfeng, *Stratifera*, *Squamularia*. Corals are also obtained (Z2).
3. Slightly siliceous, heavy-bedded, light gray limestone. 80 m.
4. Thick bedded, light gray limestone with fine sand-like limestone masses like that in 2. Rather large concretions or globulites ($\frac{1}{2}$ -1 cm. across) are often scattered here and there. Good exposures of

this limestone are found in the Panlungshan⁵ and its neighbouring hills. On the eastern side of the Panlungshan and its northern hill which is extensively quarried for lime-burning, typical Moscovian Fusulinidae and corals are collected (Zl.7).

Fossil Corals and Fusulinidae of the Huanglung Limestone have been studied by Messrs. C. C. Yü and S. Chen respectively in the Memoir of Institute of Geology, Academia Sinica, No. 14. In the different horizons they occur as follows:

- Z1.5 *Fusulinella* (*Neofusulinella*) *bocki* Möller
Chonetes quadrangulatus Lee et Yü
- Z1.6 *Syringopora sinensis* Chi
Chonetes? irregularis Lee et Yü
Dibunophyllum cf. *yüi* Chi
- Z1.7 *Staffella sphaeroidea* Möller
Fusulinella (*Neofusulinella*) *rhomboides* Lee et Chen
- Z2.0 *Palaeosmilia yihi* Lee et Yü
Dibunophyllum Chui Lee et Yü

From the above-mentioned fossil evidence the Huanglung Limestone is undoubtedly of Middle Carboniferous (Moscovian) age. Based on the similarity of lithological character, stratigraphical position and the fossil contents it is easily to be correlated to the Wieningian formation of Yunnan and Kueichow and to the Huanglung Limestone of the Lower Yangtze Valley. Moreover Fusulinidae in the present limestone show a close affinity to those of the Penchi Series in North China and those of the Moscovian in European Russia.

We have seen that the Coralline and *Striatifera* beds of Mr. Yoh are to be assigned to the Middle Carboniferous. With this palaeontological evidence in view we may easily appreciate the general distribution of the present formation in Kwangsi. According to Yoh the *Striatifera* bed occurs in Kuomen, 1/2 km north of Likao, in Liangtingai, south of Tienhohsien and in a location

5. Panlungshan is a hill with a pagoda on the top and forms one of the good sceneries around the Liuchow city.

about 2 km north of Szumenhsü, Yunghsien. The coral bed and its underlying rocks in the Peishan, north of Ishan city probably also belong to the present formation.

The Huanglung Limestone is most probably disconformably underlain by the Yentze Series without any trace of discordance. But a rather marked physical break is, however, present. That the sudden change of lithological character from the uppermost part of the Yentze series to the basal part of the Huanglung Limestone is in evidence. The top of the Huanglung Limestone is not clearly exposed in the present area. Nevertheless there is little doubt that it is also disconformably overlain by the Maping Limestone carrying Uralian fossils. All the leading fossils of the former suddenly disappear at the approximate junction with the latter. Moreover the Uralian fossil-bearing limestone directly overlying the lower part of the Huanglung Limestone is a fact not unfrequently observed in many places of Kwangsi and southern Hunan.

IV. MAPING LIMESTONE

This limestone comprises the following horizons in ascending order:

1. Pale gray limestone, often deeply weathered and fractured like that in the basal part of the Huanglung Limestone. 60 m.
2. Gray, thick-bedded, slightly siliceous and cliff-forming limestone often with vertical joints. 30-40 m.
3. Pale gray, well-bedded, fine-textured limestone with dark gray rather impure limestone in the basal part. In the hills nearby a Pavilion or liangting which is in the midway between Taiping-yü and Malutang the lower part of this horizon carries many fossils. The dominant ones are Fusulinidæ (Z1.8a within 15 m.). In the same limestone exposed in Lout'ishan Coral fossils are collected by Messrs. Meng and Chang. The upper part of this horizon is characterized by the presence of numerous globular concretions. Corals are the leading fossils (Z1.8). Total thickness 70 m.

4. Pale gray limestone interbedded with chert layers which are often 10-15 cm thick, containing *Schwagerina princeps*, other Fusulinidae and Brachiopoda (Z1.9). Thickness 4 m.
5. Pure, light pinkish gray, thick-bedded limestone. Vertical joints are often parallelly arranged and cut the limestone into columns. Small Fusulinidae are abundant (Z1.10). Thickness 4 m.

The Corals and Fusulinidae in the different horizons of the Maping Limestone have been studied by Messrs. C. C. Yü and S. Chen respectively. They are as follows:

- Z1.8a *Schubertella lata* Lee et Chen
 Schubertella cylindrica Chen
 Fusulinella angulata Colani
 Fusulinella angulata var. *umbilicata* Chen
 Schellwienia longissima Möller
 Schellwienia subrhomboidea Chen
 Schellwienia contracta Schellwien
 Schellwienia samenkiangensis Chen
 Schellwienia mutabilis Chen
 Schwagerina princeps Ehrenberg
- Z1.8 *Caninia mapingense* Lee et Yü
 Caninia chui Lee et Yü
- Z1.9 *Schwagerina princeps* Ehrenberg
 Productus sp.
- Z1.10 *Schellwienia minima* Schellwien
 Schellwienia parvula Schellwien

A collection of fossils made by K. Chang in the Lout'ishan and listed by S. S. Yoh is approximately equivalent to that of Z1.8. The fossils are quoted in the following:

- Fusulina alpina* var. *rossica* Schellwien
Fusulina solida Colani
Fusulina acuta Lee

Fusulina cf. *simplex* Schellwien

Fusulina cf. *douvillei* Colani

Schwagerina princeps Ehrenberg

A glance at the fossil lists in the different horizons at once tells us that this limestone is undoubtedly of Uralian age. Based on the stratigraphical position, fossil contents and lithology the present limestone is obviously to be correlated with the Chuanshan Limestone in the Lower Yangtze, which is also wide-spread in the southwestern provinces of China, as noted by T. K. Huang⁶. Moreover the foraminifera fauna of this limestone is quite akin to that of the Taiyuan Series in North China.

The distribution of this limestone is approximately the same as that of the Huanglung Limestone in North Kwangsi. In South Kwangsi a new locality, Huanglienao near the Kueih sien city, has been recently found by Prof. J. S. Lee.

V. CHHSIA LIMESTONE

Along the hills on the northern side of the Maping-Kueiling Motor Road from the southeast of Lout'ishan to the western bank of the Liu River near Malutang the exposure of rocks offers a fairly complete view of the Chihhsia Limestone. The contact between this limestone and the Maping Limestone is clearly shown. They are not in angular contact, but probably disconformable. The physical break is shown only by the different lithological character of the two limestones (fig. 4). The basal part of the Chihhsia Limestone is a black, impure, rather thin-bedded limestone, apparently composed of limestone lenticular masses with bituminous shaly limestone matrix. While the top bed of the Maping Limestone is a fine, pure, thick-bedded limestone with many vertical joints. Thus the contact surface is uneven. However no trace of erosion in the top of the latter limestone is so far detected.

The sequence of the Chihhsia Limestone is in ascending order as follows:

1. Black, impure, rather thin-bedded limestone. In the lower part the limestone is apparently composed of limestone lenses and

6. Op. cit. p. 81.

lenticular masses of rather large size cemented by a bituminous shaly matrix. The junction between individual beds is undulating. The upper part of the limestone is well-bedded but still with undulating junctions between individual beds. Small *Fusulinæ* are abundant in the basal part of this horizon (Z1.11). Total thickness 25 m.

2. Black, impure limestone intercalated with irregular layers of black shale and chert nodules. The former is more abundant in its upper and the latter is very rich in its lower part. *Stylidophyllum volzi* (Yabe et Hayasaka) and its allied species are rather rich in specimen in the upper part of this horizon. 10 m.

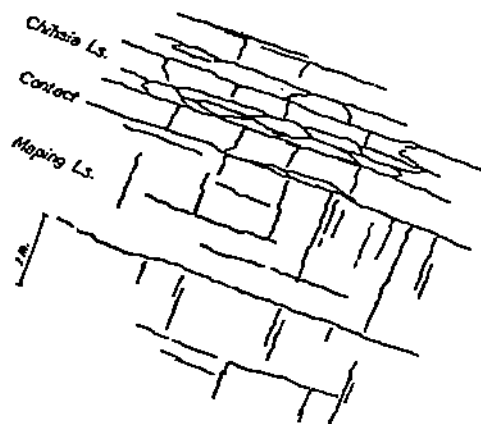


Fig. 4. A Sketch showing the Contact of the Chihsia and Maping Limestones.

3. Dark bluish gray limestone. Lower part thick-bedded with chert nodules of small size scattered here and there. Upwards the limestone becomes comparatively thin-bedded with few chert nodules. In the uppermost part the limestone is intercalated with more or less irregular chert layers. Total thickness 60 m.

In the lower part of this limestone (Z1.13a) *Tetrapora elegantula* Yabe et Hayasaka, *T. nankinensis* Yoh, *Stylidophyllum* cf. *volzi* (Y. et H.), *Fusulinella inflata* are obtained. *Michelinia*

siyangensis Reed and *Allotropiophyllum sinensis* Grabau are abundant in the Middle part (Z1.13b-Z1.14a). *Tetrapora nankinensis* Yoh, *Michelinia multisepta* Huang and *Fusulinella inflata* are rather scanty. In the uppermost part *Polythecalis sinensis* (Yabe et Hayasaka), *Schellwienia multiseptata* Schellwien, *Michelinia* cf. *multisepta* Huang are collected.

4. Black, thin-bedded, shaly limestone interbedded with thin chert layers. 5 m.

The lithological character as well as the faunistic distribution of the Chihhsia Limestone in the present area are nearly the same as that in the Nanking Hills. The equivalent beds are: (1) the Swine Limestone, (2) the Lower Lydite, (3) the Tetrapora bed, and (4) the Upper Lydite.

The distribution of this limestone has been recently noted by Mr. Yoh⁷ in many localities of Southern Kwangsi and Kwantung. During our own investigation in Central Kwangsi and the Kwangsi-Kueichow border the occurrence of the Chihhsia Limestone is also frequently met with. Thus at this stage we can positively say that the Chihhsia Limestone in the Southwestern China is also wide-spread. This confirms that the latter region was submerged in the Chihhsia Sea⁸

VI. MALUTANG SERIES

This is a pale gray thin-bedded limestone (individual bed 5-10 cm in thickness) interbedded with yellowish gray shaly limestone layers. Thin chert bands not infrequently occur. Thickness 5-10 m. Large *Orthoceras* and fragmental Ammonoids, are obtained. This series is observed only on both sides of the Liu River near Malutang. It is underlain by the Chihhsia Limestone, and is apparently in conformable contact. So far no trace of physical break between them is detected. That this thin formation is separated from the

7. Yoh: Is Chihhsia Limestone developed in S.W. China, Bull. Geol. Soc. Vol. XII, No. 2, p. 259.
8. Huang: op. cit. p. 134, Pl. III. The area of Kwangtung and Kwangsi is marked as a region probably submerged by the Chihhsia Sea.

Chihhsia is based largely on its lithological character which is very distinct. The fossils of this series, though fragmentary as we have obtained, are also remarkable. They are never reported from the Chihhsia Limestone but are well comparable with some of the forms of the Kuhfeng Formation in the Lower Yangtze. Accordingly this series is tentatively correlated with the latter formation. But one thing worthy to be noted here is that a thick-bedded and light gray limestone, the Maokou Limestone, carrying *Neoschwagerina* fauna and invariably preceded by the Chihhsia Limestone, is wide-spread in the southeastern provinces but is absent in the present area. It is only found in Tsienkiang, Central Kwangsi, by J. S. Lee a few years ago. If the correlation of the Malutang Series with the Kuhfeng Formation were correct a disconformity and hiatus between the Chihhsia and the Malutang Series is obvious. The hiatus is represented by the thickness of the Maokou Limestone.

VII. SANMENKIANG SERIES

This series is mainly composed of black siliceous shale, variegated sandstone intercalated with some slate and a few limestone beds. Its succession in ascending order is as follows:

1. Black, carbonaceous, papery shale interbedded with black siliceous shale in relatively thick-bed. 30 m.
2. Black gray slightly siliceous slate intercalated with black siliceous shale. 40 m.
3. Comparative thick-bedded black impure limestone and black siliceous bed. 5 m.
4. Fine, thin-bedded, yellowish gray sandstone intercalated with black shale and siliceous bed. Fragments of *Productus* and other Brachiopoda of marine facies are detected in the upper part. 60 m.
5. Greenish gray rather coarse grained sandstone and sandy shale. 10 m.
6. Black shale occasionally intercalated with black siliceous bands and chert lenses. 60 m.

This series is rather wide-spread in an area from the western bank of the Liu River to the vicinity of the Loyung city. It forms with its overlying formation, a broad pitching syncline. With the underlying Malutang Series it is in disconformable relation. The fact is that the Malutang Series exposed on the western side of the Liu River near Malutang is about 10 m thick, while in the opposite side of the river in a little distance of Sanmenkiang it is only less than 5 m thick. This reduction of thickness in the latter locality might be due to initial difference of deposition. However at a short distance the difference is apparently too large to be attributed to the variation of deposition.

Mr. Yoh had erroneously marked this series as his Lower Carboniferous Yangtze Series in the Geological Map of North Kwangsi. Based on the stratigraphical position and the lithological character this series is undoubtedly to be correlated with the wide-spread Permian Coal Series in South China, e.g. in Kwangsi the Coal-bearing bed together with the black chert limestone and *Gastrioceras* bed in Hoshan coal field⁹ of Tsenkianghsien, and the Lungtan Coal Series in the Lower Yangtze, etc. It must be noted however that as far as the writers' investigation goes there is no coal seam in this series, and no coal pit has been opened in this area.

VIII. NANCHAI SERIES

This series consists of black siliceous beds interbedded with dark gray impure limestone. The limestone bed increases in number from the base upwards and at the same time becomes lighter in colour and slightly siliceous in constitution. The siliceous bed is also replaced by chert bands and nodules in the upper part of this series. Total thickness is 45 m. This series is apparently conformable with the underlying Sanmenkiang Series. However the lithological change from the latter to the former is rather abrupt. Both the lithology and the stratigraphical position are quite similar to that of the Changhsing Limestone in Changhsing coal field of Chekiang. The position is also similar to that of the *Oldhamina* bed in other parts of S. China. No palaeontological evidence is, however, available to confirm this correlation.

9. Fong and Yoh: Hoshan and Szumen Coal Fields, Annual Rep. Geol. Surv. Kwangtung and Kwangsi, Vol. 2, Pt. 1, p. 34.

IX. KAOHUANG LIMESTONE

The rocks exposed in the southern hill of Kaohuang village and its neighbouring ones, offer a fairly good succession of three parts of this limestone. They are: (1) Lower part, thin-bedded, gray fine limestone intercalated with thin layers of yellowish gray limestone, free of chert, often wavy and contorted as seen along its strike. Indeed its thin-bedded and wavy appearance recalls in some measure the Chinglung or Thin-bedded Limestone of the Lower Yangtze. Thickness 15 m. (2) Middle part, siliceous, massive, pale gray limestone deeply weathered. About 50 m thick. (3) Upper part, siliceous, dirty gray heavy-bedded limestone built up the pillar-like tops of a mountain range in the south of Kaohuang. Thickness 40-60 m. No fossil has been detected in this limestone. From its position and lithological character this limestone is tentatively correlated with the Tayeh and Chinglung Limestones or the Yangtze Valley. The Thin-bedded and Massive Limestones in the Hoshan section¹⁰ is apparently to be correlated with this limestone on similar ground.

What has been stated above can be briefly summarized as follows: An unconformity between the Upper Devonian Limestone and the Lower Carboniferous Yentze Series is well shown in the east of the Maanshan, north of Lapaoyü. This would represent the Bretonian movement of H. Stille. For this movement we offer the term Liukiangian. The Yentze Series in the present paper is redefined to cover all the Lower Carboniferous rocks, both the Yentze and the Szumen Series of Yoh. It is provisionally subdivided into the lower and upper parts to be correlated with the Tournaisian and Viséan respectively. The "Maping Limestone" of Yoh lies between the Chihsia Limestone and the Yentze Series and is not a single formation. From the faunal distribution as well as the lithological character it is understood that in it both the Middle Carboniferous rocks, the Huanglung Limestone and the Lower Permian rocks, the Maping Limestone are included. The faunas of the Huang-

10. Fong and Yoh: op. cit.

lung and Maping Limestones are quite akin to that of the Huanglung and Chuanshan Limestones respectively in the Lower Yangtze. The Chihsa Limestone is essentially similar to the limestone under that name in other part of South China, especially in the Nanking Hills. The Malutang Series is correlated with the Kuhfeng Formation of S.E. China. A disconformity is most probably present between it and the Chihsa. The Sanmenkiang and Nanchai Series are tentatively assigned to the Lopingian. Finally the Kaohuang Limestone is probably of Triassic age and is correlated with the Chinglung and Tayeh Limestones of the Yangtze Valley.