

许杰笔石论文集

SELECTED
WORKS
ON
GRAPTOLITES

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BY

Singwu C. Hsü

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By Singwu C. Hsü

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作者近影

前 言

许杰教授是我国老一辈地质学家，从事地质工作已五十多年，地质调查研究的范围较为广泛。他专长于地层古生物方面的研究，特别在笔石研究方面甚为精湛。几十年来，他以锲而不舍的精神和他的同事们的协同努力，在笔石研究方面取得突出的成就，为我国笔石学科及含笔石地层的研究奠定了发展的基础。

一九三四年以来，许杰教授共发表有关笔石研究方面的重要专著和论文十余篇。这些论著涉及的内容较广。其中有些是侧重于对某一地区的笔石动物群进行系统描述和研究，并在此基础上对含笔石地层进行划分和对比（如《长江下游之笔石化石》、《宜昌层及宜昌期动物群》、《柴达木下奥陶系一个新的笔石群》、《新疆霍城县果子沟地区下奥陶统的笔石动物群》等）；有些是侧重于笔石动物的细微结构、演化关系及分类方面的研究（如《论三角笔石》、《中国笔石科的演化和分类》等）；有些论著在深入研究笔石群的基础上，还着重分析、探讨了笔石群与周围环境的关系，笔石群的发育、演化和迁移等问题（如《柴达木下奥陶系一个新的笔石群》、《新疆霍城县果子沟地区下奥陶统的笔石动物群》等）。在本文集中第一次与读者见面的最近完成的《关于中国奥陶纪笔石动物群的若干重要问题》一文，则系统地总结了我国奥陶纪不同类型笔石动物群的特征、相互关系及分布规律，对笔石发源中心问题以及决定笔石群分区的重要因素等问题作了较为详尽的分析探讨。

上述研究成果不仅丰富了中国奥陶纪、志留纪的笔石研究方面的内容，为有关地区含笔石地层的划分与对比以及笔石带的建立作了开创性的工作，而且也为笔石分类学的发展和一些重要理论问题的探讨作出了重要贡献，一直为国内外同行所推重。这些著作还反映出，作者在研究过程中不只局限于属种的描述，而是通过对属种的研究，贯穿着运用辩证唯物主义的观点去分析、解释、论证和探讨问题，因而在应用正确的思想方法进行研究工作方面，也具有很大的意义。

为便于同行们和有关地质人员参考应用，我们汇集了许杰教授十一篇在笔石方面有代表性的专著和论文，编成《许杰笔石论文集》出版。其中《关于中国奥陶纪笔石动物群的若干重要问题》一文是首次发表，其余大部分论文维持原版内容不变，仅对1934年专著《长江下游之笔石化石》，根据作者本人的意见作了一些删减和修订。此外，对原版中一些种的归属，按目前大多数通用的趋势作了必要的更正。凡更正属名的种，均在描述部分所在页加脚注，标明原版中的名称，以便读者引用时查考。

文集中《宜昌层及宜昌期动物群》系与马振图合著，《论三角笔石》系与陈培洛合著，《中国笔石科的演化和分类》系与赵裕亭合著，《新疆霍城县果子沟地区下奥陶统的笔石动物群》系与黄枝高合著，《关于中国奥陶纪笔石动物群的若干重要问题》系与黄枝高、汪啸风合著。

为了保持早期论文的历史面目，文中地名、人名的拼法一律未予改动；这次新发表的则按汉语拼音方案拼写。但其中某些人名的拼法，过去已为国内、外所熟知，也不予改动，以免导致误解。

为了协助许杰教授编好本书，特组成了文集的编辑小组，由李鄂荣、汪熊麟、汪啸风、黄
稜高四人组成，负责编辑事宜。由于时间较为紧迫，如有疏漏，希读者批评指出。

编辑小组谨识

1983.2.

FORWORD

Professor Xu Jie (formerly Singwu C. Hsü), an eminent geologist among his contemporaries in China, has devoted himself to geological work for over five decades. Within his wide scope of geological investigation and research, he specializes his studies in stratigraphy and paleontology, particularly in graptolites. During his fifty years of endeavour, he has made outstanding achievements in the study of graptolites, and has laid the foundation for further development of the study of graptolites and the graptolite-bearing strata.

Since the year of 1934, Prof. Xu Jie has published more than ten prominent works or articles dealing with a wide range of graptolite research. Some of his papers lay the emphasis on systematic description and study of graptolite fauna in a certain area, and try to distinguish and correlate the graptolite-bearing strata accordingly, for example, THE GRAPTOLITES OF THE LOWER YANGTZE VALLEY, THE I-CHANG FORMATION AND THE ICHANGIAN FAUNA, A NEW GRAPTOLITE FAUNA FROM THE LOWER ORDOVICIAN SHALE OF TSAIDAM, CHINGHAI PROVINCE, and LOWER ORDOVICIAN GRAPTOLITE FAUNA OF GUOZIGOU AREA, HOCHENG, XINJIANG. Some deal with the microstructure, evolutionary relationship and classification of the graptolite fauna, such as ON THE GENUS TRIGONOGAPTUS, THE EVOLUTION AND SYSTEMATICS OF THE FAMILY SINOGRAPTIDAE, etc. Some analyse and discuss, based on deep study, the graptolite colony and its relations with the surrounding environment, its development, evolution and migration, for instance A NEW GRAPTOLITE FAUNA FROM THE LOWER ORDOVICIAN SHALE OF TSAIDAM, CHINGHAI PROVINCE, and LOWER ORDOVICIAN GRAPTOLITE FAUNA OF GUOZIGOU AREA, HOCHENG, XINJIANG. The recently completed article ON SOME IMPORTANT PROBLEMS OF ORDOVICIAN GRAPTOLITE FAUNAS IN CHINA included in this volume appears for the first time before the readers. In the article, the characteristics, interrelations and distributions of various types of graptolite fauna during the Ordovician Period in China are systematically summarized, and the problems related to the originating source of graptolite and the important factors that determine the regionalization of graptolite colonies are discussed in detail.

The results mentioned above have not only enriched the graptolite contents of the Ordovician and Silurian systems for the division and correlation of graptolite-bearing strata in relevant areas and for the erection of the graptolite belt, but also made significant contributions to the development of graptolite classification and to the approach of some basic paleontological principles. All these creative efforts

of the author's have won the prestige among the paleontologists in China and in other countries. The articles fully reflect that the author does not confine his work only to the descriptions of species and genera, but makes analysis, interpretation, demonstration and discussion of the species and genera from a dialectical materialist point of view. It is therefore of considerable significance in the application of the correct way of thinking in doing the research work.

For the colleagues of the same paleontology occupation and for geologists concerned to use Prof. Xu Jie's results as reference materials, we have selected eleven representative works and articles of his for this publication **SELECTED WORKS ON GRAPTOLITES**. In this selection, the article **ON SOME IMPORTANT PROBLEMS OF ORDOVICIAN GRAPTOLITE FAUNAS IN CHINA** is published for the first time, other papers are mostly edited from the original publications and remain unchanged except for the work **THE GRAPTOLITES OF THE LOWER YANGTZE VALLEY** published in 1934, which has been abridged and revised according to the authors suggestion. Besides, concerning some of the original grouping of the species in previous editions, necessary corrections are made following the present tendency of classification. As for the corrected genera the species belong to, the readers may refer to the footnotes on the page of the description of the very species for its past genus designated.

The co-authors of some of the articles in this Selected Works include: Mr. Ma Zhentu for **THE I-CHANG FORMATION AND THE ICHANGIAN FAUNA**, Mr. Chen Peile for **ON THE GENUS TRIGONOGAPTUS**, Mr. Chao Yuting for **THE EVOLUTION AND SYSTEMATICS OF THE FAMILY SINOGRAPTIDAE**, Mr. Huang Zhigao for **LOWER ORDOVICIAN GRAPTOLITE FAUNA OF GUOZIGOU AREA, HOCHENG, XINJIANG**, and Messrs. Huang Zhigao and Wang Xiaofeng for **ON SOME IMPORTANT PROBLEMS OF ORDOVICIAN GRAPTOLITE FAUNAS IN CHINA**.

In order to keep the historical aspects of the works in early days, all the spellings of the names of people and places remain as they were before. However, in the lately published paper mentioned in the previous paragraph, all the names are put in the Chinese Phonetic Alphabet, with only a few exceptions that are well known at home and abroad so as to avoid misleading.

To support Prof. Xu Jie in making this book well compiled, an Editorial Group is formed consisting of four members Messrs. Li Erong, Wang Xionglin, Wang Xiaofeng and Huang Zhigao, who are to be responsible for editing matters. As time has been pressing, it is quite possible that there are some mistakes or missings, which we hope that the readers will not hesitate to point out.

Editorial Group

February, 1983

目 录

CONTENTS

前言 (Forword)

1. The Graptolites of the Lower Yangtze Valley (长江下游之笔石化石)	1
2. The Tremadocian in South Anhui (安徽南部之“特马豆齐安”层)	109
3. The Upper Ordovician and Lower Silurian in West Chekiang (浙江西部 之上奥陶统及下志留统)	112
4. On the Genus <i>Cardiograptus</i> with the Description of its Chinese Representatives (论笔石 <i>Cardiograptus</i> 属及中国之新种)	117
5. The Ichang Formation and the Ichangian Fauna (宜昌层及宜昌期动物群)	121
6. 柴达木下奥陶系一个新的笔石群 (A New Graptolite Fauna from the Lower Ordovician Shale of Tsaidam, Chinghai Province)	157
7. 一个新发现的具有特殊附连物的栅笔石 (A Newly Discovered <i>Climacograptus</i> with a Particular Basal Appendage)	192
8. 论三角笔石 (On the Genus <i>Trigonograptus</i>)	200
9. 中国笔石科的演化和分类(附新属新种描述) (The Evolution and Systematics of the Family Sinograptidae)	229
10. 新疆霍城县果子沟地区下奥陶统的笔石动物群 (Lower Ordovician Graptolite Fauna of Guozigou Area, Hocheng, Xinjiang)	254
11. 关于中国奥陶纪笔石动物群的若干重要问题 (On Some Important Problems of Ordovician Graptolite Faunas in China)	275
图版说明 (Explanations to Plates)	325

THE GRAPTOLITES OF THE LOWER YANGTZE VALLEY

Singwu C. Hsü

INTRODUCTION

The occurrence of graptolites in China was first made known to the world by F. von Richthofen, who, during his repeated journeys through the hills near Nanking in the years 1868, 1869 and 1871,¹ collected some specimens of these fossils from the Lunshan. These graptolites were later identified by Frech, and a list of their specific names was given in the monumental work, *China*.² More than thirty years later (1908-10), Coggin Brown, the then geologist to the Geological Survey of India, discovered the graptolite-bearing strata in two localities in western Yunnan (Pupiao and Shih-tien).³ For more than one decade, after Brown's exploration in Yunnan, nothing had been heard of in connection with any further discovery of graptolite-bearing beds in this country till, in 1921, Dr. Y. C. Sun found a new graptolite horizon in the dark shale layers between the limestone beds in the lowest part of the Yehli limestone at Chaokaochuang, Kaip'ing, Ho-pei province.⁴ This horizon contains the important index graptolites, *Dictyonema flabelliforme*, indicating a Tremadocian age.

In 1924, Prof. J. S. Lee and the students of the Peking National University discovered another important graptolite horizon in the upper part of the Ichang limestone, at Ichang, W. Hupeh.⁵ This horizon furnishes, among others, the familiar Arenigian form, *Callograptus salteri* Hall.

Following Prof. Lee's discovery,⁶ reports poured in about the finding of graptolite-

1. Richthofen, *China*, Bd. III, p. 709. 1912.

2. *Ibid.* Bd. V, p. 17. 1911.

3. *Palaeon. Indica*, New Ser., Vol. VI, No. 3, 1917, p. 3 and p. 57.

4. Sun, Y. C., "Relationship of the Ordovician Strata of the Kaip'ing basin," *Bull. Geol. Soc. China*, Vol. III, 1924, No. 1, p. 17.

5. Lee, J. S., "Geology of the Gorge districts of the Yangtze", *Bull. Geol. Soc. China*. Vol. III, No. 3-4, pp. 367-375.

6. Graptolites were found in several localities before 1924. It is to be regretted that the writer forgot to mention them when the manuscript was written. The several finds were announced in different papers:

Y. C. Sun, Contribution to the Cambrian fauna of N. China, *Palaeon. Sinica*, Ser. B, Vol. I, fasc. 4.

P. L. Yuan, Graptolite beds of Pingliang, E. Kansu, *Bull. Geol. Soc. China*, Vol. IV.

Teilhard de Chardin & E. Licent, Geology of the Ordos, *Bull. Geol. Soc. China*, Vol. III.

C. C. Wang, Geology of the Shiushui Valley, Kiangsi, *Bull. Geol. Surv. China*, No. 14.

litiferous rocks in many separated districts extending from P'ingliang district, Kansu, in the west to the Nanking hills in the east, and from the Kaip'ing basin, etc., in North China down to the Sikiang River (West River) districts in the South. Thus, much light was thrown upon the geographical and zonal distribution of these fossils in this country. Dr. Sun has recently made a brief correlation of all of these graptolite-bearing strata¹ except those discovered in the Sikiang districts in Kwangtung by Dr. H. C. Chang and those discovered in South Anhui and carefully studied in the last two years by the geologists of this Institute.

Although informations concerning the discovery of graptolite horizons have been brought up from various sources, up to the time when the writer has finished the manuscript of this contribution, there is yet no publication in the form of a systematic description of the graptolites collected from the succession of strata discovered at different times.²

During recent years, more specimens of these fossils have been gathered through the exploration of the geologists of this Institute. In the Spring of 1931, Messrs. Y. Y. Lee and C. Chiu, after their arduous field work in Ningkuo, S. Anhui, brought back a copious fauna of graptolites beautifully preserved. In the Winter of the same year, the writer began to take up the work of identifying and describing these graptolites. The descriptions of the species embodied in this work were finished early in the fall of the succeeding year, but the work of figuring the specimens, which has been undertaken by the writer himself, took a considerable period of time.

All the figures given on the plates of the present work are first drawn to the scale of five times of the natural size by means of a Parkes-Lapworth microscope and then reduced by photographing to the natural size. This is done with a view to facilitating comparison with ordinary specimens obtained in the field. Some forms are however enlarged three times of the natural size in order to illustrate the structural details as necessity arises. These figures are incorporated in the text.

All of the graptolites described in this work belong to the order Graptoloidea, the graptolite proper, and are of both Ordovician and Silurian ages. They comprise 74 species and 17 varieties, amounting altogether to a total number of 91. So far as our present knowledge is concerned, 35 of the 91 forms are new, and 8 are of the N. American type which have so far not been found in Western Europe; the remaining 48 are originally of the well-known European forms. The localities where these graptolites were collected are chiefly in the lower Yangtze Valley extending from N. W. Kiangsi down to the Nanking hills. They may be listed as follows,—

1. *Bull. Geol. Soc. China*, Vol. X, pp. 291-99.

2. This manuscript was written in the Autumn of 1933, when Dr. Y. C. Sun's *Ordovician and Silurian Graptolites from China* had not yet been published.

Kiangsi province:

Shang-chuang-shê, Liu-chia-tuan, Wu-ning district

Sung-chia-hsiang, Te-an district

Anhui province:

Pai-yang, Kueich'ih district

Shih-pi-hsia

Li-hu-shan-k'ou

T'an-chia-ch'iao

} Taip'ing district

Nan-ni-hu

Chiang-chün-ling

Mei-shu-hsia

} near Hulo, Ningkuo district

Chekiang province:

Ch'ien-ling, Ch'ang-hua district

Kiangsu province:

Tangshan, near Tangshui, Kiang-ning district

Lunshan, Kaochiapien, Chu-jung district

A number of the species were, however, collected from several localities in Northwestern Hupeh (Fanghsien, Nanchang and Yuan-an districts), a region nearer to the Upper Yangtze. Since they are of the same faunistic nature, their descriptions are also included in the present work.

My sincere thanks are due to Mr. Y. Y. Lee, one of the leading field geologists in the Institute. He has a keen interest in the graptoliferous strata in this country, and has not only kindly handed over his valuable collection to me for study but has untiringly informed me of the horizons and the modes of occurrence of these fossils as observed by him in the field. To my teachers Profs. A. W. Grabau and J. S. Lee, I am deeply indebted for their stimulating and useful criticisms and directions. I also wish to express my thanks to Prof. L. F. Yih, acting director of the Institute, for his many good suggestions and furnishing me every facility during the prosecution of the work. Finally I am under obligation to my senior colleagues Messrs. C. Li, H. M. Meng, C. C. Yü, S. Chu, S. Chen, K. Chang, T. Y. Liu, T. Y. Yü and C. Chiu. These gentlemen have kindly placed their material at my disposal and informed me of their field observations in connection with the fossils collected.

COMPARISON OF THE GRAPTOLITIFEROUS STRATA IN VARIOUS LOCALITIES IN THE LOWER YANGTZE VALLEY WITH SPECIAL CONSIDERATION OF ZONING

Graptolite-bearing strata of both Ordovician and Silurian ages occur in many localities in the Lower Yangtze. Those belonging to Lower and Middle Ordovician are best developed in South Anhui where a succession of graptolite zones has been observed and is considered here as the standard, with which graptolite horizons found in other districts are compared. So far no true Upper Ordovician beds have been heard of in this part of the Valley, though a few of the typical Hartfell graptolites have been found in association with the Llandeilian or Normanskill forms at the top of the Middle Ordovician deposits at several localities. Such an association of species merely indicates that this part of the deposits is transitional between the Middle and Upper Ordovician formations. Silurian shales with graptolite faunas equivalent to those of the Lower and Middle Birkhill (Lower Valentian) of the British succession appear to be widely distributed in this region; but, so far, the graptolite horizon which represents exactly the base of Lower Silurian has only been found in the basal part of the Kaochiapien shale at Lunshan near Nanking. Within the realm of the Lower Yangtze Valley graptolite shales of Upper Valentian and, probably, of Upper Salopian ages have, up to the present, only been discovered at one locality. For convenience of comparison the Ordovician and Silurian graptolite-bearing strata are here considered separately.

A. ORDOVICIAN.

I. South Anhui.

1. *Ningkuo District.*

Near Hulo, a small town about 40 km. to the south of the city of Ningkuo district, the low hills are all formed of the Ordovician shales of great thickness. The shales generally strike in a northeast and southwest direction and dip to the north. In the Winter of 1931, in the course of making a general survey in the area covering these hills, Mr. Y. Y. Lee, with the assistance of Mr. C. Chiu, carefully studied the successive graptolite horizons and collected a large amount of well preserved graptolites. In the fall of the next year, following Mr. Lee's advice, the writer himself took a trip to these hills and made a section between Miaoshan and Nan-ni-hu, which may represent the general succession of the graptolite horizons as developed in the area. At Chiang-chun-ling and Mei-shu-hsia, two localities also near Hulo, small collections of graptolites were also made by him.

(a) Section between Miao-shan and Nan-ni-hu. The section begins with a kind of dark bluish, calcareous, phyllitic shale, of which the base is not exposed. The observed thickness is about 570 m., occupying a greater part of the thickness of the whole section. In its upper part several specimens of *Ogygites* were found, which suggests most probably an early Ordovician age.

Upon the *Ogygites* shale lies the clayish and, sometimes, slabby shale of various colours (greenish in the lower, dark bluish in the middle and brownish in the upper part), which is very rich in graptolites. Throughout a thickness of about 110 m. of this shale the graptolite assemblage is practically the same. The common forms are;

Didymograptus hirundo Salter
Didymograptus abnormis Hsü (sp. nov.)
Isograptus gibberulus (Nicholson)
Didymograptus nitidus (Hall)
Tetragraptus bigsbyi (Hall)
Phyllograptus anna Hall
Phyllograptus ilicifolius Hall
Phyllograptus curvithecatus Hsü (sp. nov.)
Trigonograptus ensiformis Hall
Glyptograptus dentatus Brong., etc.

This assemblage is essentially the same as that of the zone of *Didymogr. hirundo* in the British Isles. Hence the writer has designated this horizon as "zone with *Didymogr. hirundo*."

Above the last mentioned horizon immediately comes the characteristic pale brownish, earthy shale. This is about 31 m. in thickness, throughout which the typical Upper Arenigian forms predominate while most, if not all, of the characteristic Middle Arenigian forms disappear. The common associated forms are:

Amplexograptus confertus Lapworth
Didymograptus acutidens Elles and Wood
Didymograptus ellesi Ruedemann
Nicholsonograptus fasciculatus var. *praelongus* (Hsü) (var. nov.)
Tylograptus spinosus Ruedemann
Tylograptus spinosus var. *flexilis* (Hsü) (var. nov.)
Phyllograptus anna Hall
Phyllograptus angustifolius Hall
Cryptograptus gracilicornis (Hsü) (sp. nov.)
Climacograptus forticaudatus Hsü (sp. nov.)
Climacograptus uniformis Hsü (sp. nov.), etc.

As *Amplexogr. confertus*, *Didymogr. acutidens* and *Nicholsonogr. fasciculatus*

are forms restricted to the zone of *Didymogr. bifidus* in Great Britain, so the species *Didymogr. ellesi* and *Tylogr. spinosus* are confined to the zone of *Didymogr. bifidus* and *Phyllogr. anna* in the Salt Belt of New York, N. America, a zone equivalent to that of *Didymogr. bifidus* in Great Britain. Thus the above assemblage is certainly corresponding to those of both the British and the American zones just mentioned. This is somewhat further confirmed by the presence in the assemblage of *Cryptogr. gracilicornis*, which has the nearest affinity with *Cryptogr. antennarius*, a species also restricted to the zone of *Didymogr. bifidus* in Britain. Because of the predominance of *Amplexogr. confertus*, the writer has designated this horizon as "zone with *Amplexogr. confertus*," using the last named species as the zone fossil instead of *Didymogr. bifidus* which is absent from the above assemblage.

Owing to the fact that in the above assemblage the three common forms *Didymogr. ellesi*, *Cryptogr. gracilicornis* and *Nicholsonogr. fasciculatus* var. *praelongus* are absolutely confined to the base, the middle part and the top of this zone respectively, it seems advisable to divide this zone again into the three sub-zones as listed below in the descending order:

3. Sub-zone with *Nicholsonogr. fasciculatus* var. *praelongus*
2. Sub-zone with *Cryptogr. gracilicornis*
1. Sub-zone with *Didymogr. ellesi*

The pale brownish shale is in turn overlain by a kind of whitish sandy shale containing hard silicified bands. This shale has a total thickness of about 40 meters. It furnishes the following species;

- Glossograptus hincksii* Hopkinson (abundant)
- Glossograptus hincksii* var. *robustus* Hsü (var. nov.)
- Trigonograptus lineatus* Hsü (sp. nov.) (abundant)
- Tylograptus spinosus* var. *flexilis* (Hsü) (var. nov.)
- Climacograptus forticaudatus* Hsü (sp. nov.)
- Climacograptus uniformis* Hsü (sp. nov.)

Because of the almost equal abundance of *Glossogr. hincksii* and *Trigonogr. lineatus*, the writer has named this horizon "zone with *Glossogr. hincksii* and *Trigonogr. lineatus*."

Finally on the top of the white shale lies two meters of soft, clayey and brownish shale, in which all of the following species except *Pseudoclimacogr. scharenbergi*, make their first appearance;

- Dicellograptus sextans* var. *exilis* Elles and Wood
- Dicranograptus ziczac* Lapworth var. *minutus* Hsü (var. nov.)
- Pseudoclimacograptus scharenbergi* (Lapworth)
- Climacograptus latus* Elles and wood
- Climacograptus putillus* (Hall) var. *eximius* Ruedemann

On account of the predominance of *Dicellogr. sextans* var. *exilis* and *Climacogr. latus*, the writer has designated this horizon "zone with *Dicellogr. sextans* and *Climacogr. latus*."

Now, from the whitish sandy shale up to the soft, brownish shale just mentioned we have established the following two successive zones (in descending order):

Zone with *Dicellogr. sextans* and *Climacogr. latus*

Zone with *Glossogr. hincksii* and *Trigonogr. lineatus*

Above the zone with *Dicellogr. sextans* and *Climacogr. latus*, the uppermost and the last zone in our section, comes a kind of yellowish, well-bedded and argillaceous limestone (7 m.), which is in turn overlain by a series of sandstones and shales of enormous thickness. From the argillaceous limestone upward to the sandstone series no fossils whatever have been obtained in the rock. They are probably of Silurian age. Owing to their barrenness of graptolites, they are out of our topic.

Now, to sum up, we have in this section totally established four zones and three sub-zones above the *Ogygites* shale. These are all listed below in the descending order:

Zone with *Dicellogr. sextans* and *Climacogr. latus*

Zone with *Glossogr. hincksii* and *Trigonogr. lineatus*

Zone with *Amplexogr. confertus*

sub-zone with *Nicholsonogr. fasciculatus*

sub-zone with *Cryptogr. gracilicornis*

sub-zone with *Didymogr. ellesi*

Zone with *Didymogr. hirundo*

Ogygites shale

The two lower zones (including the three sub-zones) and at least a part of the *Ogygites* shale belong to Lower Ordovician. For this Lower Ordovician shale the writer proposes the name "Ningkuo shale" after the name of the district. In order to be distinguished from the Lower Ordovician, the shale belonging to the two upper zones, which represent the lower part of Middle Ordovician, is named "Hulo shale" after the small town near which the section was taken. It should be noticed here that both the Ningkuo and Hulo shales are well developed at one and the same locality and that their respective names merely indicate their difference in age and not in locality.

(b) Horizon at Chiang-chun-ling. The collection made at this horizon includes the following species:

Glossograptus ciliatus var. *debilis* Ruedemann

Climacograptus putillus (Hall)

Climacograptus putillus var. *eximius* Ruedemann

Orthograptus pageanus var. *micracanthus* Elles & Wood