DOI:10.19800/j.cnki.aps.1957.03.003

第 5 卷 第 3 期
1957 年 8 月

古 生 物 學 報
ACTA PALAEONTOLOGICA SINICA

Vol. 5. No. 3
August, 1957

中國志留紀闊翅目 (Eurypterida) 的發現及其意義*

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(附 插 圖 1，圖 版 1)

闊翅類化石在國外發現已達一百三十多年了。1825 年德克(Dekay)和郝爾(Hall)在美國紐約州研究志留紀柏梯(Bertie)石灰岩中的動物羣時，曾提出"闊翅類"的屬名。其後在英國、挪威及蘇聯愛沙尼亞等地也相繼發現闊翅目，於是本目的內容逐漸豐富起來，因而在地層對比方面，本目也起了相當大的作用。1920 年安特生(J.G. Andersson)曾在我國河北灤縣趙各莊首先發現闊翅類(在第十三層煤層之上的頁岩中)，經葛利普(Grabau)[3] 的研究，命名爲 "*Eurypterus Chinensis*"，確定其層位爲下二疊紀，並認爲可與美洲的密西西比紀(Mississipian)的 *E. approximates* 相比。1926 年丁文江又在滇東發現闊翅類，但當時收集的材料僅爲"棒狀之物"，雖經葛氏研究，但其種屬未作最後決定(Grabau[3], 1926, 100 頁)。根據現有材料來加以比較，雲南東部志留紀動物羣中的"棒狀之物"，可能屬於闊翅類的尾刺。

1956 年冬，地質部地礦研究所地層古生物室組織了一個三峽工作組，在孫雲鑄教授的直接領導下進行野外和室內的研究。作者與所內洪友崇、易庸恩、沈慈恩、曲景川以及武漢地質學校羅新民同志當時都參加了野外工作，我們曾在三峽區湖北秭歸楊家培 (距新灘東約 2 里，在長江北岸)。發現闊翅目化石與弓筆石 (*Cyrtograptus*) 共生，並確定其層位爲中志留紀，相當於歐洲的溫拉克 (Wenlock) 層(見插圖 1)。這次採集的材料雖保存得不够清楚，但從大批標本觀察，它們確屬於闊翅目，其中共有二屬四種，三種爲新種，茲描述於後。

關於闊翅類相和筆石相的成因，是近百年來古生物學者所爭論的問題之一。總的說來，可分爲兩派；(1)路得曼(Ruedemann)和克拉克(Clarke)派；(2)葛利普(Grabau)和康納 (O' Connell)派。前者[6]主張闊翅類爲海產動物，後者[7]認爲它是屬於淡水、半淡水或河水中的產物。康納認爲在海水中所發現的闊翅類可能是被河的急流所帶進的。1933年斯特莫(Störmer)[8]也贊同這種意見。

* 1957 年 6 月 6 日收到。

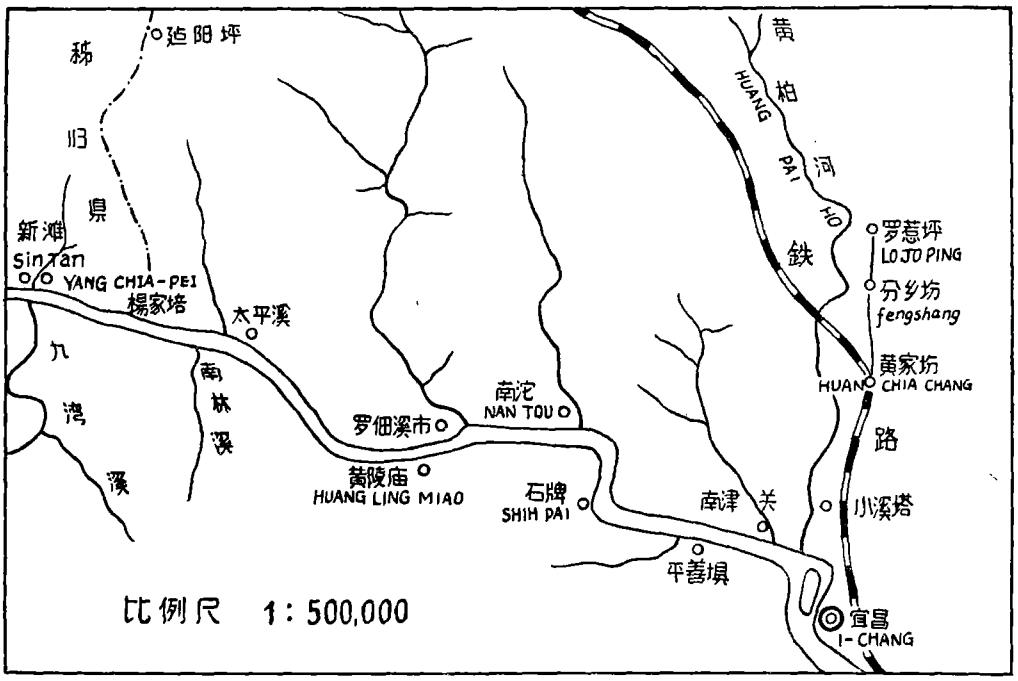

圖 1

著者認爲關於相的正確認識，應從古生物和沉積岩的特徵加以分析研究。而闊翅類的構造及其生活習性，首先應從下列三方面考慮：——

1. 個體的形狀　凡體形扁平廣寬、頭胸部顯明的，可能屬於底棲的生活形式；一般頭胸很小而體形狹窄的屬種可能屬於游泳很快的生活方式；體形似現代的蝎子，應具有爬行的生活習性。

2. 側眼的位置　眼睛位於側邊緣，或側前邊緣的，很可能是屬於游泳的生活方式；眼睛位於側區，而距邊緣較遠的，則多屬於爬行、底棲或掘居的生活方式。

3. 頭胸部附肢的構造　根據形態特徵，這些附肢可能適應於下列各種功能——爬行、掘居、游泳、平衡、劃動、搏斗、捕捉、咀嚼等。這些功能，要看當時情況，就可確定屬於哪些種屬。

根據當前資料，著者認爲大部分標本是屬於底棲的生活方式，因爲標本多數具有適應底棲的特點，如體形扁平寬廣、頭胸輪廓清楚且化石排列方向多趨一致。所以它們的埋藏環境，大體上也就是它們的生活環境，從產化石的岩層的上下岩性推斷（一般爲灰綠色或黃綠色泥板岩、砂質頁岩或細砂岩，而岩層的表面多具波痕狀構造），闊翅類的沉積環境應屬淺海相。同時它與弓筆石共生，也可給筆石相應屬於淺海提出有力證據。一百卅多年以前在紐約洲的下奧陶紀低普開耳（Deepkill）筆石頁岩中發現過闊翅類，但在較新的志留紀及泥盆紀地層發現的地點都很多。如馳名世界的柏梯（Bertie）層，

愛沙尼亞 (Esthonia) 的沙爾莫 (Saaremaa) (Störmer, 1934) 層和挪威 (Norway) 的當圖(Downton)(Störmer, 1934)砂岩層，早爲人所共知。在前兩個地區，動物羣及地層的研究均屬淺海相，因在灰岩中常夾頁岩及珊瑚礁。開耳(Kiaer)認爲當圖砂岩的沉積環境應屬湖相。在日刺坦基(Rudstangen)這個屬於當圖砂岩層的日刺坦基動物羣中，缺乏標準的海生種屬。以後在石灰紀及二疊紀的煤系地層中也有發現，但均爲陸相。根據上列事實，我們就可看到，闊翅類在不同的地質時代，因爲它的生活環境不同，所以表現的身體構造特徵也不盡同。很顯然它們在下古生代與上古生代是有很大的區別的。著者認爲它們在下古生代爲海相，而在上古生代多爲陸相(淡水相)。它們的生態隨環境而變化，由海生過渡到陸生(淡水)。

另外關於筆石相的問題，路得曼 (Ruedemann) 認爲只有深海才有沉積這些岩相的可能性；拉普華(Lapworth)、魏曼(Wiman)及瓦爾塔(Walther)也討論過這個問題。拉普華和威爾士的意見，一般人是同意的，他認爲筆石是營終生漂游或半漂游的生活方式的動物，隨後下沉在較深的海區，在這個區域裏沒有其他動物居住過。它們被腐爛的海藻給與的碳質泥所埋藏，在這種沉積環境裏，已證明缺少底棲生物。與此相反，魏曼認爲筆石是固着在海底，在那裏並未有其他生物生存。從這次收集的資料中，我們發現，不僅在中志留紀地層中與筆石共生的有闊翅類，而在下志留紀及奧陶紀的地層中，曾發現大批的三葉蟲、腕足類與筆石共生。著者並不否認在奧陶紀與志留紀的黑色頁岩中，保存筆石很多，但是應該特別注意，在黑色頁岩中還有其他生物羣存在。路得曼和拉普華已經指出，筆石可能下沉到靠近海岸靜水的底部，因爲在筆石頁岩中，往往出現砂岩和礫岩的夾層，這就很清楚地證明它是接近陸地的。蘇格蘭(Scotland)馬佛特區(Moffat)的沉積却是在比較深的、遠離海岸的水中形成的。葛利普和康納認爲筆石相是接近陸相的海相沉積；他們的結論主要是根據瑞典與蘇格蘭南部兩地的情況。在瑞典含筆石的頁岩甚至直接蓋在缺乏砂岩相的浸蝕面上，因爲泥質多半應沉積在靠近海岸的邊緣，再沒有比黑色頁岩更接近海岸。而且頁岩中缺乏正常的海相動物羣；若距海岸較遠，則應有更多生物門類與之共生。同時大家知道，泥質不可能沉積在深海區。但在蘇格蘭，筆石岩區爲急流所沉積，其主要岩性爲一厚度很大的礫岩、砂岩和泥板岩層側向變爲黑色頁岩，僅包含一類生物的遺留——筆石。葛氏認爲泥質頁岩的沉積，應屬於三角洲的冲積平原和瀉湖相的環境。最近蘇聯瓦·尼·巴甫林諾夫關於筆石相的研究所得的結論也與葛氏相符。無論根據我們所得資料是與筆石共生這一點來看或者根據其沉積岩的特徵來看，都說明我們的資料是和葛氏的結論相一致的。

*　　*　　*　　*

路得曼和葛利普兩派對闊翅類相問題的分歧點，在於各持己見，未能全面地加以綜合分析與論證。更重要的是他們未能從生物的演化與發展來看問題，因爲最初生物的

發展，一般是由海洋而到陸地。尤其是經過加里東(Caledoni n)運動以後，陸上生物得到空前的發展。鬩翅類當然亦不能例外。最近根據各國材料，著者初步地認爲，鬩翅類在下古生代屬於海相，而在上古生代則多爲陸相。路得曼派關於筆石相的假說，並不能說明全部的事實；相反的，如根據目前資料加以分析，我們的結論很接近葛利布的論點。作者同樣認爲鬩翅類相，是和筆石相沉積環境相同，均應屬淺海。

種 的 描 述

新灘大批鬩翅目標本，均採自砂岩，保存均不十分清楚。根據它們頭胸部及腹部的輪廓，初步分成下列二屬：(1) *Eurypterus* (標本最多)，(2) *Mixopterus* (標本較少)，這裏提出初步的研究和修正。

綱：**Arachnida**

亞綱：**Merostomata (Dana) Woodward**

目：**Eurypterida Burmeister**

科：**Eurypteridae Burmeister**

屬：***Eurypterus* Dekay 1825**

體形窄長而大，頭胸約佔全長1/7—1/5，扁平，輪廓近亞方形，側前角圓，後部邊緣平緩彎曲，全部邊緣很寬，有一窄的邊緣溝。眼形如豆，位於頭胸中央的前部，中眼接近中綫。口在腹部裂開。腿長，向後漸漸增長，最前端有一對小螯，第二、三、四對附肢由6—7節組成，並有完美的刺。第五對附肢由八節組成，最後一對附肢也是八節，大而有力，在每一個寬而大的槳狀板的末端，有一個亞圓形的節。腹部前六節佔身體全長的1/4，很短，形狀規則，裂片呈環狀排列，寬度向後逐漸縮小，而成一尖的體形。尾刺長而細。

層位：奧陶紀—二疊紀。

Eurypterus yangi Chang (新種)

(圖版 I, 1a, 1b)

體形窄長，頭胸梯形，前側角方圓，頭胸前緣平緩而微向上凸，週圍有一寬平的邊緣，邊緣溝淺而不清楚，根據標本測量如下：——

前側角處寬度	12 毫米
最後一對附肢處寬度	13 毫米
頭胸中央長度	7.5 毫米
頭胸側緣長度	6.5 毫米

頭胸部除最後一對附肢基部稍有保存外，其餘附肢均不清楚。腹部各節隱約可見，而以九至十節最爲清楚，腹部向後突然變尖，腹節距形，但兩側邊緣，微向外凸出，形似念珠。

這個種名係以楊遵儀教授的姓命名，藉表敬意。

此種和其它種的區別，在於此種體小，腹部向後突然變尖，腹部矩形，其兩側微向外凸，形成念珠狀。

登記號碼：S 1001 (正型標本)。

分佈及層位：產於湖北省秭歸，新灘，楊家培，下新灘層中，常與 *Mixopterus* sp. *Eurypterus styliformis* 及 *Cyrtograptus* sp. 共生，爲中志留紀，相當於歐洲 Wenlock 統。

Eurypterus styliformis Chang (新種)

(圖版 I，圖 2a，2b，2c)

體形粗，呈棒狀，頭胸似正方形，但兩側邊緣後部微向後外方傾斜，頭胸前緣較向上凸，側前角平緩而圓，據標本測量如下：——

側前角處寬度	20 毫米
最後一對附肢處寬度	22 毫米
頭胸中央長度	18 毫米
頭胸側緣長度	15 毫米

頭胸部附屬物：除左側第六附肢的基部，及右側第三或四附屬的一部外，其餘均不十分清楚。腹部由前端向後在 10 毫米處，側邊緣微向外凸，向後延伸又行收縮，腹節方形，從頭胸到腹部收縮緩慢。各節間保存情況，以腹部前部較差，但仍隱約可見，腹部後段節間保存清楚，而以第十及十一節爲最好。

另一塊標本，是一個尾刺，可能歸入此種，此尾刺之上端已斷去，故現有長度爲 20 毫米其錐率爲 1:10，形似錐狀。

此種因腹部收縮很慢，且其比例較長，所以頭部加上中腹在一起，就形成一個長方形的柱子，*Styliformis* 種名，即由此而來的。

登記號碼：S 1002 (正型標本)。

分佈及層位同上。

Eurypterus loi Chang (新種)

(圖版 I，圖 3a，3b)

頭胸輪廓較小，較腹部爲窄，頭胸梯形似帽，前緣微向上凸。根據腹面保存的標本測量如下：

前側角處寬度	7.5 毫米
最後一對附肢處寬度	9.8 毫米

頭部中央長度 6.5 毫米

頭胸側緣長度 5.2 毫米

頭胸的腹面及左側附肢僅第四、五、六各基節較爲清楚。在後唇的位置上,有一印痕可能爲後唇的遺跡(?)。腹部各節間還比較清楚,一般節間長度,在腹的前部較長,約爲 3 毫米,而後部較短,約在 2.5—2.8 毫米左右。腹節上常見有與前緣相平行的橫紋,橫紋比較清楚。

此種與以上兩種的區別,在於本種的體形特別小,頭胸長與寬的比例以此種比率爲最大。

這個種名係用武漢地質學校羅新民先生的姓命名,藉表敬意。

登記號碼: S 1003 (正型標本)。

分佈及層位同上。

科: Carcinosomidae

屬: *Mixopterus* Ruedemann 1921

體蝎形,腹部的寬和窄的部很明顯。頭胸近似方形或梯形,側角被一個或多或少的"s"形的曲綫所切割,側眼位於靠近前緣的稍中部,螯肢小,步足發育,形成茅狀的平刺。附肢末尾沒有刺,這可以作爲 *Carcinosoma* 屬的一個特徵,第一對步足有"鈎器",生在生殖附肢的基節上。第二對步足發育最强。游泳足的第七節長,第八節短。後唇呈梨形。頭胸部有一明顯的背溝 (Dorsal furrow),後腹的第一節較寬並向後側延長,後五節兩後側角向後發育形成鈍尖刺。

分佈及層位同上。

***Mixopterus* sp. Chang sp. indet.**

(圖版 I 圖 4a, 4b)

在這塊保存不好的標本中,我們可以觀察到頭胸部和不完整的腹部共長 34 毫米,主要是根據胸甲的外形,暫時將它歸入 *Mixopterus* 屬中。

胸甲(頭胸)的前緣形成一直綫,直綫的長度約爲胸甲基部寬的 1/3,其胸甲的兩前側角被割去,形成彎曲狀的邊緣,形似"凸"字,後側緣稍向後外方傾斜,形似梯形,頭胸長約 8 毫米,約爲其基部寬的 2/3,靠近胸甲右側彎曲前緣處,有一瘤狀小突起,甚似側眼,但左側眼及中眼均模糊不清。

腹部與胸甲的界綫不明,其分節的痕跡隱約可見。

登記號碼: S 1004 (正型標本)。

分佈及層位同前。

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ON THE DISCOVERY OF THE WENLOCKIAN EURYPTERUS-FAUNA FROM SOUTH CHINA

(SUMMARY)

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The silurian eurypterid fauna was first recorded and studied by Dekay and Hall in 1825 from the Silurian Bertie Waterlime of North America. Thenceforth, this fauna has been used for correlating the Ordovician, Silurian and Devonian formations, particularly in great Britain, Norway and Esthonia etc. Thus the Deepkill Shale of the Lower Ordovician of New York, the Bertie Waterlime of the Upper Silurian, and the Saaremaa beds of Upper Silurian of Esthonia have been well-known for the occurrence of Eurypterus-fauna.

The first eurypterid in China was first found in 1920 by J. G. Andersson from the Lower Permian Coal Series of Chaokochuang, Kaiping district, Hopeh province. It was described by A. W. Grabau[3] as *Eurypterus chinensis*. In 1924 another specimen was collected by V. K. Ting[5] from the Higher Silurian Beds of Eastern Yunnan, but it is only represented by a very poorly preserved telson of undeterminable genus.

The present collection was obtained by a field party under the leadership of Prof. Y. C. Sun from the Lower Sintan (Wenlockian) formation of Yangchiapei near Sintan, Tzekwei, Hupeh province (text figure 1, Chinese text) and Comprises the following genera:

1. *Eurypterus yangi* Chang sp. nov.
2. *E. styliformis* Chang sp. nov.
3. *E. loi* Chang sp. nov.
4. *Mixopterus* sp.

The present material was obtained from a series of the greenish-gray or yellowish-green flags, sandy shales and sandstones, which are characterized by ripple marks and associated with *Cyrtograptus*, both indicating conditions of shallow sea origin.

The *Eurypterus*-beds of the Ordovician and Silurian have been generally considered by various authors to be of the shallow sea origin, while the Downtonian Sandstone was thought by Kiaer to be of continental deposits.

The origin of the eurypterid beds and the graptolite shale have been in dispute nearly for one century. Ruedemann and Clarke[6] consider on

the one hand, the Eurypterus-fauna to be of marine origin, while Grabau and O Connell[4] think that they all inhabited only in the river.

O'Connell particularly points out that the eurypterid remains especially the exuviae, were occasionally carried out into oceans by the current, and his opinion was afterwards supported by Störmer[8] in 1933.

Judging from the fact that our specimens are characterized by the broad and flat carapace with a prominent prosoma and that they are oriented in groups pointing, we may conclude that they all once lived and were buried in the shallow sea environment.

Again, the occurrence of the eurypterid in different geological times as recorded by various authors is great significante. The animal originally must have lived in the Early Palaeozoic sea and began to adopt the fresh water (continental) habit at the begining of the Devonian. There is no exception in the case of Chinese eurypteride.

Another important problem is concerned with the facies of the graptolite shale which was first considered by Ruedemann to be of deep sea origin and particularly discused by Lapworth, Marr, and Walther in Walther's "Ueber die Lebensweise fossiles Meeresthiere". Lapworth's idea is that the graptolites, which led a floating existence either as holoplankton or epiplankton (attached to sea-weeds), sank to the bottom of the deeper littoral zone, where no other organisms lived and where they were buried in the fine mud which was rendered Carbonaceous by the decaying sea-weeds. The absence of bottom organisms in these deposits is generally explained by the great depth of the water.

On the contray, Wiman recognizing the difficulties attending Lapworth's explanation, regards the graptolites as sedentary on ocean bottom, where no other organisms can exist. As a whole, both Lapworth and Ruedeman consider that the graptolite fauna is of deep sea origin and an illuminating example——the Moffat region in Scotland——was fully explained by Lapworth. On the contrary, Grabau and O'Connell interpret these shales as mud deposited on the floodplain and in the lagoon of a large delta series of shallow sea.

Recently Pavlinoff (В. Н. Павлинов)[20] has discussed at some length the same problem. So far as we can make out, there exist no fundamental differences between his and Grabau's views.

Finally from the palaeontological and stratigraphical study of the present Sintan material, the following conclusions may be made:

(1) The graplolite shale facies is certainly of shallow sea origin in favor of Grabau and O'Connell opinion;

(2) The eurypterid facies of Sintan is also of shallow sea origin, both

the living condition of graptolite and the deposition of the eurypterid beds being quite simmilar;

(3) The eurypterus-fauna originally lived in the shallow sea in the Lower Palaeozoic time and began to adopt the fresh water environment in the Early Devonian time (Downton epoch);

(4) The new material of the eurypterid fauna of the Lower Sitan Formation comprises two families, two genera and four species;

(5) The early occurrence of the eurypterid in the Lower Sintan formation is significant from palaeogeographic point of view.

Description of Species

Among our collections there are a few specimens which are sufficient to show the details of the prosoma and mesosoma.

Two genera can be provisionally identified and all of them are preserved in sandstone beds.

They are: (1) *Eurypterus* (very common) and (2) *Mixopterus* (only one specimen).

Class Arachnida
Subclass Merostomata (Dana) Woodward
Order Eurypterida Burmeister
Family Eurypteridae Burmeister
Genus *Eurypterus* Dekay 1825

Eurypterus yangi Chang sp. nov.

(Plate I, figs. 1a, 1b)

This species is only represented by an imperfect specimen. The combined length of the prosoma (cephalo-thorax) and abdomen is 29 mm; Body small, elongate and narrow; cephalo-thorax convex, subquadrate to trapedzoid in outline, with anterior margin rounded; entire margin bordered by an indistinct shallow marginal furrow. The width of the cephalo-thorax is 7.5 mm at the anterior-lateral angles and 8.3 mm at the sixth pair of the appendages, 8.5 mm long at the median part of the cephalo-thorax, but 7 mm at the lateral margin. The appendages of our specimen are not well preserved, only a part of the last pair of appendages is seen. The segments of the abdomen are not well-preserved; the lateral margin from the six segment of the abdomen abruptly tapers backwards. The segment of the abdomen is rectangular in outline, but its lateral margin is a little swollen along both sides.

This species is distinguished from other species in its smaller body and the abrupt tapering of the abdomen.

Holotype: No. S 1001.

This species is named in honour of Prof. T. Y. Yang of the Peking Geological College, Peking.

Horizon and Locality: Lower Sitan formation, Middle Silurian (Wenlockian) near Yangchiapei of Sintan, Tzekwei Hsien, Hupeh Province.

Eurypterus styliformis Chang sp. nov.

(Plate I, figs. 2a, 2b, 2c)

Body large, elongate and stout; combined length of the prosoma (cephalo-thorax) and a part of abdomen is 65 mm; cephalo-thorax transversely subquadrate with subparallel lateral margin, gradually tapering foreward; anterior margin convex foreward, with rounded anterior-lateral angles. The width of the cephalothorax is 20 mm at the anterior angles, 22 mm at the last pair of appendages, and the length of the cephalo-thorax is 18 mm at the median position and 15 mm at the lateral margin. The appendages of the cephalo-thorax are usually not preserved except some indication of a portion of the left sixth appendage.

The abdomen bulges slightly at 10 mm from the anterior end; it is well segmented and transversal segments are subrectangular; particularly well preserved are the ninth, tenth and eleventh of the segments.

An associated Telson probably belongs to this species.

The general outline of the cephalo-thorax and mesosoma as a whole is styliform, and hence its specific name is given.

Holotype: No. S 1002.

Horizon and locality: As the preceding.

Eurypterus loi Chang sp. nov.

(Plate I, figs. 3a, 3b)

Body small, elongate and narrow; Carapace (cephalo-thorax) cap-like, smaller and narrower than the abdomen, anterolateral angle of the carapace rounded. Measurements of the type (ventral side) are as follows:—

Width of the anterolateral angles 7.5 mm
Width of the last pair of appendages 9.8 mm
Length of the median cephalo-thorax 6.5 mm
Length of the lateral margin of cephalo-thorax 5.2 mm

Only one portion of the fourth, fifth and sixth of appendages in the left lateral margin of the ventral surface of cephalo-thorax is preserved. There is a small mark in the position of the metastoma which may represent the impression of the metastoma (?).

The abdomen is well represerved. The length of segment in the fore

abdomen is about 3 mm and that of hinter abdomen is about 2.5—2.8 mm. Thereare many parallel anterior-marginal lines on the surface of the segment.

This species differs from the other two new species in its small body and comparatively long carapace.

This species is named after Mr. S. M. Lo. of the Wuhan Geological School, Hankou.

Holotype: No. S 1003.

Horizon and locality: As the preceding.

Family Carcinosomidae
Genus *Mixopterus* Ruedemann 1921
Mixopterus sp.

(Plate I, figs. 4a, 4b)

This is represented by an ill-preserved specimen and tentatively put under the genus *Mixopterus* mainly on the outline of the protuberating carapace with the combined length of the prosoma (cephalo-thorax) and the abdomen of 34 mm.

Prosoma trapezoid, short; anterior margin of the prosoma about one-third of the width of the carapace at the base; antero-lateral angles truncated in forming a slightly concave outline of the margin.

The postlateral margin is slightly oblique, and the length of the prosoma is 8 mm about two-third of the basal width. The antero-lateral of the carapace has a node-like lateral eye (?), situated at the right corner.

Only the anterior portion of the abdomen is poorly preserved.

Holotype: No. S 1004.

Horizon and Locality: As the preceding.

圖版 I 說明

圖 1. *Eurypterus yangi* Chang (新種)

1a. 背視,原大,正型標本. 登記號: S 1001. Dorsal view, natural size, Holotype.

1b. 背部復原圖,原大. Restoration of dorsal aspects, natural size.

圖 2. *Eurypterus styliformis* Chang (新種)

2a. 背視,原大,正型標本. 登記號: S 1002. Dorsal view, natural size, Holotype.

2b. 背部復原圖,原大. Restoration of dorsal aspects, natural size.

2c. 尾刺,腹視,原大. Telson, ventral view, natural size.

圖 3. *Eurypterus loi* Chang (新種)

3a. 腹視,原大,正型標本. 登記號: S 1003. Ventral view, natural size, Holotype.

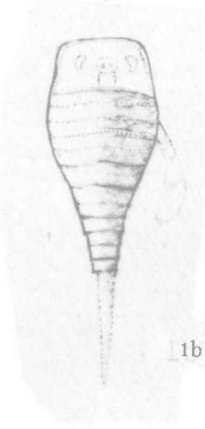
3b. 腹部復原圖,原大. Restoration of ventral aspects, natural size.

圖 4. *Mixopterus* sp.

4a. 背視, 原大. 登記號: S 1004. Dorsal view, natural size.

4b. 背部復原圖,原大. Restoration of dorsal aspects, natural size.

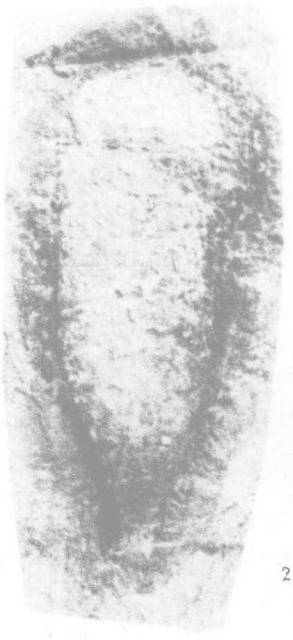
1a



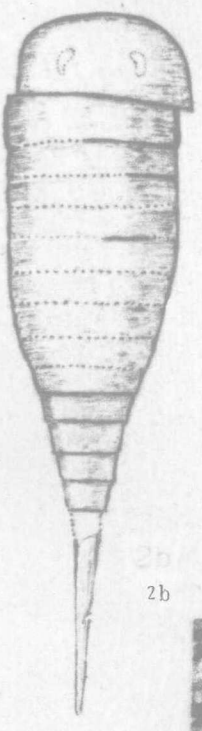
1b

3a

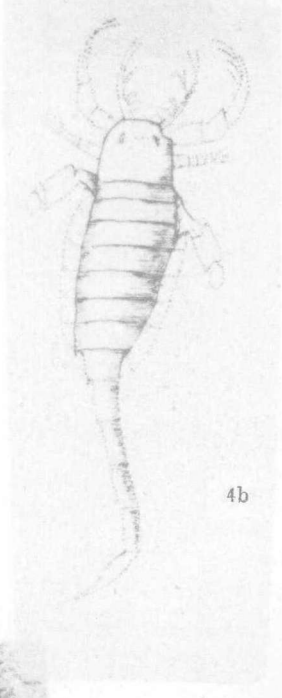
3b



2a



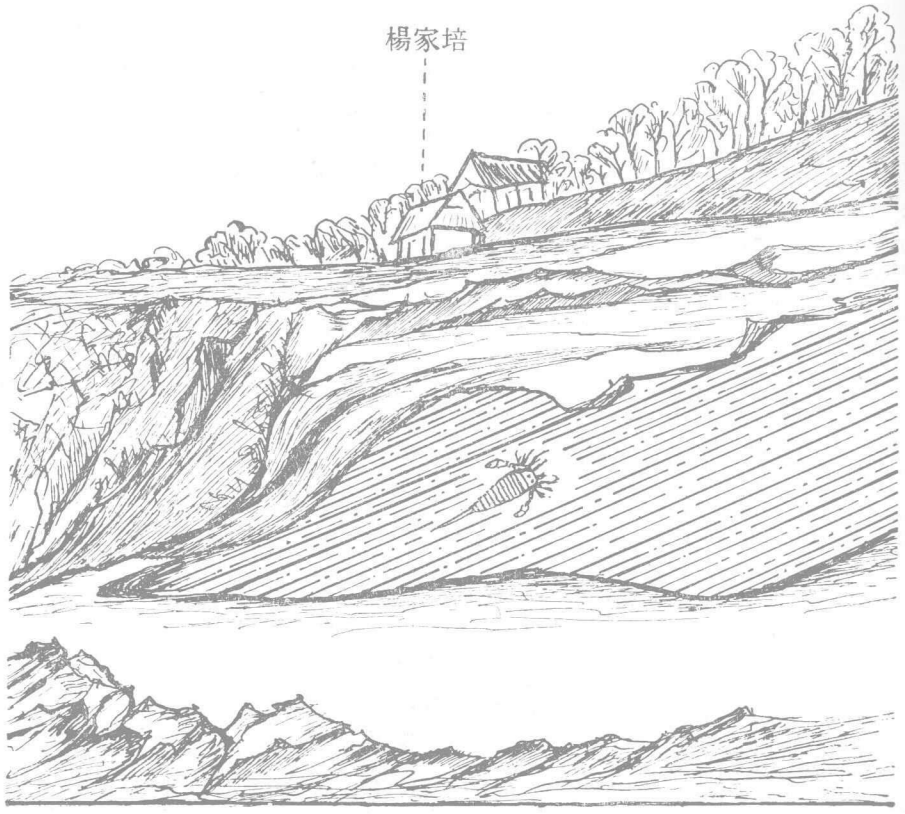
2b



4b

2c

4a



圖版 II 說明

圖 1. 照片：湖北、新灘、楊家培志留紀鬩翅類化石產地.
Photograph of Silurian Eurypterus-beds, Yangchiapei, Sintan, Hupeh.

圖 2. 素描圖：湖北、新灘、楊家培志留紀鬩翅類化石產地.
Sketch of the Silurian Eurypterus-beds, Yangchiapei, Sintan, Hupeh.