

漢中梁山上二疊紀的珊瑚化石*

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一. 前 言

本文所描述的珊瑚化石,係盧衍豪教授於 1942—1943 年在陝西南部漢中梁山上二疊紀地層中採得。梁山區的上二疊紀,根據盧氏最近發表的論文^[1,2],可以分爲上下兩部,上部爲石灰岩夾薄層燧石,厚約 400 餘米,下部爲頁岩,厚僅 2 米,盧氏分別名其爲吳家坪石灰岩和王坡頁岩,相當於中國南方的樂平統。頁岩中未曾發現動物化石,只有不能鑑定的植物化石碎片,而珊瑚化石則全部產在吳家坪灰岩中,它們和甕科 *Codonofusiella*, *Reichelina* 及綠藻共生。吳家坪灰岩中的珊瑚化石,根據已知材料,包括下列種屬:(其中最後三種,已爲曾鼎乾先生描述。)

- Waagenophyllum simplex* Wu (新種)
- Waagenophyllum lui* Wu (新種)
- Waagenophyllum indicum* var. *crassiseptatum* Wu (新變種)
- Waagenophyllum* sp.
- Lophophyllidium liangshanense* Wu (新種)
- Lophophyllidium kayseri* (Huang)
- Lophophyllidium multiseptatum* var. *minor* Wu (新變種)
- Paracrinia* cf. *sinensis* var. *kaoi* Chi
- Allotropiophyllum grabaui* Chi
- Sinopora dendroides* (Yoh)
- Liangshanophyllum sinense* (新種)
- Liangshanophyllum lui* Tseng

* 1957 年 2 月 20 日收到。

Liangshanophyllum stereoseptatum Tseng

Liangshanophyllum wengchengense (Huang)

中國南方的上二疊紀地層,黃汲清教授 (1932)^[8] 總稱樂平統,上部爲長興灰岩,下部如爲陸相沉積,名爲來壩口系(相當於樂平煤系,龍潭煤系或爲大羽羊齒煤系),如爲海相沉積則名爲竹塘系。過去已描述的上二疊紀珊瑚化石,種類不多,據筆者所知,僅有 *Tachylasma aster* (Grabau, 1922) 產於浙江長興長興灰岩內; *Lophophyllum pendulum* (Grabau, 1928), *Tachylasma lopingense* (Grabau, 1928) 產於江西樂平樂平煤系中; *Lophophyllum kayseri* (Huang, 1932), *Lophophyllum kayseri* var. *major* (Huang, 1932) *Lophophyllum xaphrenoides* (Huang, 1932) 產於貴州大定大羽羊齒植物煤系中,至於 *Lophophyllum kweichowense* (Huang, 1932)^[8] 則產於貴陽竹塘系內。此外,1931 年,葛利普^[7]描述了蒙古哲斯灰岩中的一個珊瑚化石 *Waagenophyllum virglense* var. *mongoliense* Grabau 產此化石的灰岩,可能屬於上二疊紀。由此可見上二疊紀的珊瑚化石,從梁山區的大量發現,在古地理上和古生物上具有一定的興趣。

本文原稿,承樂森璣教授審閱修正,英文稿承斯行健教授修正,又承盧衍豪教授贈於研究標本並給予許多寶貴的指示,筆者均致以衷心的感謝。

二. 種 的 描 述

目 *Tetraseptata* Grabau 1922

科 *Lonsdaleidae* Chapman 1893

屬 *Waagenophyllum* Hayasakaia 1924

1915 年早坂 (Hayasaka) 和矢部 (Yabe) 以 *Lonsdaleia indica* Waagen et Wentzel 爲屬型,建立新屬 *Waagenella*。1924 年早坂 (Hayasaka)^[9] 等發現 *Waagenella* 一名,已爲下石炭紀的腹足類所佔用,於是將其改名爲 *Waagenophyllum* Hayasaka。Waagen 和 Wentzel 所描述的 *Lonsdaleia indica*,筆者認爲它的主要特點如下:複體,叢狀,隔壁到達外壁,靠近外壁處,它們常常加厚。橫板帶極狹,向軸部傾斜。鱗板帶亦狹窄,在橫剖面上成同心狀。

該屬在二疊紀的特提斯海區分佈廣泛。1936 年 Heritsch^[10] 於美國南部的特克薩斯州二疊紀 Capitan 灰岩內發現了 *Waagenophyllum*。1935, 1942 年 Smith^[16], Merrian^[14] 分別於加拿大英屬哥倫比亞,美國西北部俄勒岡州亦發現了 *Waagenophyllum*。當筆者研究此屬時,發現 Merrian 所描寫的俄勒岡州產的 *Waagenophyllum* 的四個種 (*W. washhuni* Merrian; *W. ochocoensis* Merrian; *W. sp. a* and *W. sp. b*) 和屬

型 *W. indicum* Hayasaka, 在橫板和鱗板的性質上有很大的差異。這種差異不是種的特點,而是可以作為屬的區別。這四個種的橫板帶較寬,不完全,向鱗板帶傾斜,鱗板帶很寬,在橫剖面上,常成魚鱗狀。根據這些特點,它們不可能被歸入 *Waagenophyllum* 而與石炭紀所產的 *Corwenia* 相似。Merrian 亦曾提出這四個種和石炭紀所產的 *Corwenia* 很相像,但他認為歸入 *Waagenophyllum* 比較合適。筆者認為在二疊紀, *Corwenia* 還有少數存在,這四個種可以稱為孑遺動物。它們也可能代表一新屬或新亞屬。至於最後的定論,還有待於將原標本作進一步研究,並詳細地和 *Corwenia* 比較。

***Waagenophyllum simplex* Wu (新種)**

(圖版 I, 圖 1, 2)

複體珊瑚,叢狀。珊瑚個體近橢圓形。個體大小的變化較大,個體的直徑約為 4—4.5 毫米,最大個體直徑可達 5—5.5 毫米,而最小的只有 3—3.5 毫米。個體之間常常彼此接觸,如果不接觸,那末個體之間的最大距離,能達到 5 毫米,一般的距離為 1 毫米。隔壁為數不多,成放射狀排列。長隔壁有 18—19, 伸向個體的中心,但沒有與中柱接觸。短隔壁與長隔壁互生,它的長度約為長隔壁的 %。對隔壁通常和中柱的中板相連。所有的隔壁都加厚,特別靠近外壁處,形成三角形,但是向個體的中心延伸,它們逐漸變細。中柱比較簡單,直徑為 0.5—1 毫米,形狀為圓形或橢圓形,由中板,環狀側板,偶而有 1—2 條幅板所組成。所有這些組成成分都加厚,特別是中板最為顯著。鱗板帶較寬,由 3—4 列的鱗板組成。沒有水平狀的橫板。

比較: 本種和 *Waagenophyllum indicum* var. *hueichouense* Huang 較相像,但和後者的差別,在於本種隔壁的厚度不如後者的厚,而且本種具有簡單的中柱。*W. simplex* Wu 和 *Liangshanophyllum stereoseptatum* Tseng 亦有相似之點,但是本種的大小易變化,中柱簡單,更重要的是缺乏水平狀的橫板帶。

層位和產地: 這一個種產在吳家坪灰岩的中部,產地為梁山燕兒窩東南約 3 公里,和 *Liangshanophyllum wengchengense* (Huang) 共生。

登記號: 8819, 8820。

***Waagenophyllum lui* Wu (新種)**

(圖版 I, 圖 3, 4)

複體珊瑚,叢狀。珊瑚個體小,近橢圓形。 個體大小的變化較大,彼此之間的距離也大,個體的直徑約為 3 毫米。隔壁不多,長隔壁和短隔壁互生,長隔壁的數目為

17—18, 短隔壁的長度只有長隔壁的 $\frac{1}{4}$ — $\frac{1}{3}$, 還有更短的三級隔壁位於長短隔壁之間。有時長隔壁和中柱接觸, 主, 對隔壁也常常和中板相連。所有隔壁都加厚, 但延向個體中心逐漸變薄。中柱簡單, 橢圓形, 直徑有 1 毫米, 由稍微彎曲的中板, 側板和少數的輻板組成。

在縱剖面上, 三帶的特點能區別出來, 鱗板帶較窄, 由 2—3 列的鱗板組成。橫板帶甚窄, 稀疏且向中柱傾斜。

比較: 根據 *Waagenophyllum lui* Wu 的中柱結構, 它和 *Liangshanophyllum* 很相像。由於本種缺乏水平狀的橫板, 因此把它放在 *Waagenophyllum* 比較合適。

層位和產地: 和前者同。

登記號: 8821, 8822。

***Waagenophyllum indicum* var. *crassiseptatum* Wu (新變種)**

(圖版 I, 圖 5, 6)

複體珊瑚, 個體成圓形或橢圓形。個體直徑約為 4.5—5 毫米。長隔壁有 21—22, 短隔壁和它們互生。一部分長隔壁不和中柱相連, 而另一部分的長隔壁則和中柱的輻板連接。短隔壁只有長隔壁的 $\frac{1}{3}$ 的長度。所有的隔壁都特別加厚, 尤其是靠近外壁的地方, 向個體的中心延伸則逐漸變薄。中柱甚大, 寬 1.8—2 毫米, 約佔個體直徑的 $\frac{1}{3}$, 它由緊密而陡的帳篷狀側板, 多而規則的輻板和明顯的中板所組成, 表現蜘蛛狀的結構。

在縱剖面上, 可以看到中柱較寬, 橫板帶較窄, 陡直向中柱傾斜。鱗板帶窄, 不規則。

比較: 本種和 *Waagenophyllum indicum* (Waagen et Wentzel) 的差別, 在於本種有較厚的隔壁和較大而複雜的中柱, 因此把它作為 *Waagenophyllum indicum* 的新變種。

層位和產地: 本種產在吳家坪灰岩的下部。產地為吳家坪西北約 3 公里的地方。

登記號: 8823, 8824。

***Waagenophyllum* sp.**

(圖版 I, 圖 7, 8)

本種是一塊比較破碎的結晶的標本。標本被製成縱橫二切面, 橫切面內的構造特點, 保存不全。而縱切面的內部構造, 保存較好。利用縱切面的內部構造, 能作出屬的鑑定。

在縱切面上, 中柱較寬大, 由向橫板帶下傾的側板和明顯的中柱組成。橫板帶極窄, 緩緩向中柱傾斜, 邊緣區有 3—4 列的鱗板。

層位和產地：本種產在吳家坪灰岩的頂部,產地為燕兒窩東南約2公里地方。
登記號： 8825, 8826。

亞屬 *Liangshanophyllum* Tseng 1949
Liangshanophyllum sinense Wu （新種）
(圖版 II, 圖 1, 2)

複體珊瑚,叢狀。個體的形狀為圓形或橢圓形,直徑為4毫米。個體大小有變化。它們彼此之間常常接觸,隔壁不多,長隔壁有20—21,短隔壁和它們互生。長隔壁伸向中柱,經常和輻板相連。短隔壁長度只有長隔壁的一半。所有的隔壁都微微加厚,特別靠近外壁地方,隔壁向中心延伸時逐漸變薄。中柱較大。它的直徑小於個體直徑的1/3,由緊密的帳篷狀側板,不規則連續的輻板以及中板所組成。中板清楚,比較平直,和對隔壁相連。

在縱切面上,三帶能很好地區別出來。鱗板帶由2—3列的鱗板組成。橫板帶較寬,一部分的橫板為水平的,而另一部分的橫板向中柱傾斜。中柱由錐狀的側板,不規則的輻板和比較直的中板所組成。

比較：本種個體的形狀和 *Waagenophyllum virglense* var. *mongoliense* Grabau 的個體形狀比較相像。按照這一點,本種可以和它比較,但是和它的差別主要在於本種有較複雜的中柱,有水平狀的橫板。*Liangshanophyllum wengchengense* (Huang) 和本種亦較相像,但是前者的隔壁不如本新種的隔壁多,中柱沒有如此複雜。

層位和產地：同 *Waagenophyllum simplex* Wu。
登記號： 8827, 8828。

Liangshanophyllum wengchengense (Huang)

1932. *Waagenophyllum wengchengense* Huang, 中國古生物誌乙種第八號第二冊, 第50頁,圖版III, 圖3a, b。
1949. *Liangshanophyllum wengchengense* Tseng 中國地質學會誌第24卷第1—4號,第97—104頁,圖版I, 圖1a, b。

(圖版 II, 圖 3, 4)
複體珊瑚,叢狀,個體外形為圓形,直徑約為4.5毫米。隔壁不多,長隔壁為數21。它們伸向個體中心但不與中柱相接,除去對隔壁常和它相接觸。中柱較簡單,外形為圓的。橫板帶較寬,一部分為水平狀,另一部分向中柱傾斜。在邊緣部分,有一列鱗板。
層位和產地：本種產在吳家坪灰岩的中部,在燕兒窩東南的3公里地方。

登記號: 8829, 8830。

科 **Lophophyllididae Moore et Jeffords 1945**

屬 ***Lophophyllidium* Grabau 1928**

***Lophophyllidium liangshanense* Wu (新種)**

(圖版 I, 圖 9)

單體珊瑚,較大,角狀,直徑為 13 毫米。外壁厚,長隔壁數達 30,放射狀的排列,在邊緣部分,由於灰質的特別加厚,因此互相連在一起,以至於短隔壁隱沒在裏面。隔壁向中軸延伸,但沒有與它相接。隔壁的長度常常變化。對隔壁和中軸相連,中軸橢圓形,由一緻密的中隔與其兩側細微的羽簇所組成。中軸的長度為 3.4 毫米,寬度約為 1.4 毫米。主隔壁較短,只有 1.8 毫米長。鱗板缺乏。

比較: 本種可與 *Lophophyllidium wewoakanum* Jeffords 比較,但是和它不同的是本種有較多的隔壁和較小的珊瑚體。

層位和產地: 同 *Wuagenophyllum simplex* Wu 和 *Sinopora dendroides* (Yoh)共生。

登記號: 8831。

***Lophophyllidium kayseri* (Huang)**

(圖版 I, 圖 10)

1932. *Lophophyllidium kayseri* Huang, 中國古生物誌乙種,第八號,第二冊,第 50 頁,圖版 II,圖 3,4,5。

單體珊瑚,個體小,角狀,直徑約為 9 毫米。外壁中等厚度。長隔壁很多約有 25,放射狀排列,向中軸延伸,幾乎和它接觸。在隔壁和中軸之間有很小的距離。短隔壁常常發育。對隔壁和中軸相連。中軸比較小,寬度大於 1 毫米,兩側受壓,中隔在橫剖面上很明顯地成為一條黑線。主隔壁縮短,形成內溝,長度為 1.5 毫米。沒有鱗板。

比較: 根據本種的形狀和中軸形態,可以和原標本相比,但是本標本所具有的隔壁數比後者的隔壁稍多。

層位和產地: 本種產在吳家坪灰岩的中部,和 *Allotroptophyllum grabau* Chi 共生,產地為吳家坪的西北約 2 公里。

登記號: 8832。

***Lophophyllidium multiseptatum* var. *minor* Wu (新變種)**

(圖版 II, 圖 7)

單體珊瑚,珊瑚體較小,角狀,直徑為 7 毫米。隔壁較多,有 25 條,沒有短隔壁。對

隔壁和中軸相連,中軸寬度約為 1.5 毫米。 它由較顯明的中隔和許多細微的羽簇所組成。主隔壁比其他隔壁短,有一部分的隔壁末端彎曲或加厚而彼此在末端相遇,而形成內壁和中軸相隔。隔壁都加厚。沒有鱗板。

比較: 本種只有橫切面來表示,和 *Lophophyllidium multiseptatum* (Grabau) 的差別,是本種的短隔壁缺乏,而且珊瑚體小。

層位和產地: 如前者。

登記號: 8833。

科 Zaphrentidae Edwards et Haime 1851

屬 Paracania Chi 1937

Paracania cf. sinensis var. kaoi Chi

(圖版 II, 圖 8, 9)

1937. *Paracania sinensis* var. *kaoi* Chi 中國地質學會誌第 17 卷, 第 93 頁, 圖版 III, 圖 3a—d。

單體珊瑚,珊瑚體較小,圓柱狀,直徑約有 10.5 毫米。 橫剖面圓形。外壁厚,隔壁數達 25。長隔壁的長度常常變化,伸向中心,但未到達。在隔壁內端和珊瑚體中心之間有較寬的距離。短隔壁和長隔壁輪生,長度只有長隔壁的 ¼—⅓。所有的隔壁都加厚,特別在它們內端地方有明顯的內溝,沒有鱗板。橫板完全,中部比較平直,在邊緣部分,彎向珊瑚體的兩側。

比較: 這一個種和計榮森先生所描述的種不同之點是: (1) 珊瑚體小; (2) 隔壁比原種的隔壁厚。根據這二點,本種似乎是一新種。但由於缺乏一系列的切面,因此把本種不定為新種較合適。

層位和產地: 同 *Waagenophyllum lui* Wu。

登記號: 8834, 8835。

科 Hapsiphyllidae Grabau 1928

屬 Allotropiophyllum Grabau 1928

Allotropiophyllum grabaui Chi

(圖版 II, 圖 5, 6)

1937. *Allotropiophyllum grabaui* Chi 中國地質學會誌, 第 17 卷, 第 91 頁, 圖版 II, 圖 3a—e。

單體珊瑚,錐狀,珊瑚體較大,本種的切面是壯年期的切面,直徑為 16 毫米。 外壁

薄。隔壁數達 30。短隔壁和長隔壁互生,長度約爲 1 毫米。所有的隔壁從珊瑚體的兩側向對隔壁匯集,形成馬蹄形的內壁。主隔壁縮短成爲內溝。

在縱切面上橫板較完全,在它的邊緣部分變向珊瑚體的外壁。鱗板缺乏。

比較: 本種由一切面所代表, 和計榮森先生所描述的標本的不同處在於有較大的珊瑚體,而且付內溝不顯。

層位和產地: 同 *Lophophyllidium kayseri* (Huang)

登記號: 8836, 8837。

目 Aseptata Grabau 1922

科 Aulopoidae Zittel 1850

屬 *Monilopora* Nicholson et Etheridge 1879

Sinopora dendroides (Yoh)

(圖版 11, 圖 10, 11)

1932. *Monilopora dendroides* Yoh, 中國古生物誌乙種第八號第一冊, 第 10 頁, 圖版 11, 圖 3,4。

1955. *Sinopora dendroides* Sokorov, 蘇聯歐洲部分的古生代床板珊瑚, 第 226 頁, 圖版 52, 圖 1—7。

羣體珊瑚,完全由許多不規則的分枝狀管子所組成,個體的直徑約爲 1.4 毫米。它們之間常常接觸。個體內部構造的特點是缺乏隔壁和橫板。個體體腔常常充滿方解石的結晶,未致方解石結晶所填充的部分,可見個體外壁厚度較大。

層位和產地: 同 *Lophophyllidium liangshanense* Wu。

登記號: 8838, 8839。

參 考 文 獻

[1] Chi, Y. S. (計榮森), 1937. On Some Simple Corals from the Permian of Yungsin, Kiangsi. *Bull. Geol. Soc. China*, Vol. 17.

[2] Douglas, J. W., 1936. A Permian-Carboniferous Fauna from S. West Persia (Iran). *Pal. Indica*, N. Ser. Vol. 22, Mem. 6.

[3] Douglas, J. A., 1950. The Carboniferous and Permian Faunas of the South Iran & Iranian Baluchistan. *Palaeont. Indica*, N. S. Vol. 22, Vol. 7.

[4] Фомичев В. Д., 1952. Кораллы Вугоза и стратиграфия средне и верхнекаменноугольных и пермских отложений донецкого бассейна, госгеолнафт.

[5] Flügel, H., 1955. Permische Korallen aus dem südamerikanischen Taurus. *Neues Jb. Geol. u. Paläontol. Abh.* Band 101(3), 293—318.

- [6] Grabau, A. W., 1928. Palaeozoic Corals of China, Pt. I, *Pal. Sinica*, Ser. B, Vol. 2, fasc. 2.
- [7] —————, 1931. The Permian of Mongolia. *Am. Mus. Nat. Hist. Nat. Hist. of Central Asia*, Vol. 4.
- [8] Huang, T. K. (黃汲清), 1932. Permian Corals of S. China, *Palacont. Sin.*, Ser. B, Vol. 8, fasc. 2.
- [9] Hayasaka, I. (早 坂), 1924. On the Fauna of the Anthracolithic Limestone of Omi-Mina. *Tohoku Imp. Univ. Sci. Rept.*, Ser. 2 (Geology), Vol. 8.
- [10] Heritsch, F., 1936. A New Species of *Waagenophyllum* from the Permian of the Glass Mountains, Texas, *Am. Jour. Sci.*, Ser. 5, **31**, 144—148.
- [11] Jeffords, R. M., 1946. Pennsylvanian Lophophyllidid corals. *Univ. of Kansas Palacont. Contributions Coelenterata* 1.
- [12] 盧衍豪, 1956. 漢中梁山二疊紀並論中國南方二疊紀分層及對比. *地質學報*. **36**(2) 159—196.
- [13] Masao Minato, 1955. Japanese Carboniferous and Permian Corals. Jour. of the Faculty of Science Hukkaido University. Ser. 4, *Geol. & Miner.* Vol. 9, No. 2.
- [14] Merriam, C. W., 1942. Carboniferous and Permian Corals from Central Oregon. *Jour. Palaont.*, Vol. 16.
- [15] Moore, R. C. & Jeffords, R. M., 1941. New Permian Corals from Kansas, Oklahoma, and Texas. *States Geol. Surv. Kansas, Bull.*, 38, Pt. 3.
- [16] Smith, S., 1935. Two Anthracolithic Corals from British Columbia and Related Species from the Tethys. *Jour. Palaont.*, **9**, 30—42.
- [17] Smith, S., 1941. Some Permian Corals from the Plateau Limestone of the S. Shan States, *Burma, Pal. Indica*, N. Ser. Vol. 30, Mem. 2.
- [18] Schindewolf, O. H., 1955. Die genera *Verbeekijella* Penecke, *Timorphyllum* Gerth, *Wannerophyllum* n. gen., *Lophophyllidum* Grabau aus dem Perm von Timor, *Palacont. Suppl.*, Band IV, V, Abteilung, 3 liefg.
- [19] Tseng, T. C. (曾鼎乾), 1949. Note on the *Liangshanophyllum*, a New Subgenus of *Waagenophyl- lum* from Permian of China, *Bull. Geol. Soc. China*, **24**(1—4), 97—104.
- [20] Waagen, W. & Wentzel, J., 1887. Producta Limestone Fossils, Coelenterata. *Pal. Indica*, Ser. 8, Vol. 1, fasc. 6—7.
- [21] Yoh & Huang, T. K. (黃汲清), 1932. The Coral Fauna of the Chihsia Limestone of the Lower Yangtze Valley. *Pal. Sin.*, B Series.
- [22] Соколов, В. С., 1955. Табуллиты палеозоя Европейской части СССР. *гостоптехиздат*.

UPPER PERMIAN CORALS FROM LIANGSHAN, S. SHENSI

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(With 2 Plates)

The specimens which form the subject of the report were collected by Dr. Y. H. Lu from the Wuchiaping limestone of Liangshan, Hanchung, southern Shensi. This limestone series is characterized by dark and grayish limestones intercalated with chert beds. According to Lu^[12], it may belong to the upper part of the Upper Permian and may be equivalent to the Changhsing limestone and the upper part of the Choutang Series in South China. The corals dealt with in this paper occur in association with the fusulinids (*Codonofusicella*, *Ricchetina*) as well as with the green algae. They comprise the following species (The last three species have been described by Tseng from the Liangshan region):

- Waagenophyllum lui* sp. nov.
- Waagenophyllum simplex* sp. nov.
- Waagenophyllum indicum* var. *crassiseptatum* var. nov.
- Waagenophyllum* sp.
- Lophophyllidium liangshanense* sp. nov.
- Lophophyllidium kayseri* (Huang)
- Lophophyllidium multiseptatum* var. *minor* var. nov.
- Paracuninia* cf. *sinensis* var. *kaoi* Chi
- Allotrotophyllum grabaui* Chi
- Sinopora dendroides* (Yoh)
- Liangshanophyllum sinense* sp. nov.
- Liangshanophyllum lui* Tseng
- Liangshanophyllum wengchengense* (Huang)
- Liangshanophyllum stereoseptatum* Tseng

There are three genera with six species and two varieties of the Upper Permian corals hitherto known in China: namely, *Tachylasma lopingense* (Grabau, 1922) from the Changhsing limestone of Chekiang; *Tachylasma lopingense* (Grabau, 1928) and *Lophophyllum pendulum* (Grabau, 1928) from the Loping Formation of Kiangsi; *Lophophyllum kayseri* (Huang, 1932), *Lophophyllum kayseri* var. *major* (Huang, 1932) and *Lophophyllum zaphrentoides* (Huang, 1932) from the *Gigantopteris* Coal Series of Kueitingsien, Kweichow, *Lophophyllum kweichowense* (Huang, 1932) from the *Gigantopteris* Coal Series of Kweiyanghsien, Kweichow, and

Waagenophyllum indicum var. *mongoliense* (Grabau, 1931) from Jssu of Mongolia (Grabau, 1931). The occurrence of abundant corals from the Liangshan region in Shensi is, therefore, of some interest.

DESCRIPTION OF SPECIES

Order Tetraseptata Grabau 1922

Family Lonsdaleidae Chapman 1893

Genus *Waagenophyllum* Hayasaka 1924

The generic name *Waagenophyllum* was proposed by Hayasaka (1924, p. 23) to replace *Waagenella* Yabe and Hayasaka which is preoccupied by De Koninck for a Lower Carboniferous gastropods. The main characteristics of this genus given by writer is as follows: "Corallum compound, phaceloid. Septa reach epitheca and are united at their peripheral edges by stereome. Tabular zone is narrow, and steeply inclined to the axial column. Dissepimental area narrow".

The genus is widely distributed in the Permian Tethys Sea region. It was also found in Texas, Oregon and British Columbia of North America. In 1942, Merrian described four species: namely, *W. washhani* Merrian; *W. ochocoensis* Merrian; *W.* sp. a; *W.* sp. b from Oregon. All of them are very different from the genotype *W. indicum* (Waagen et Wentzel). In these American species, the septa are more numerous than in the genotype. The dissepiments in cross section frequently show herringbone pattern and the tabular zone is wide, incomplete and sloping to the peripheral region. The points of difference may be preferably regarded as a generic distinction rather than specific. As remarked by Merrian, the American forms show a similarity to the genus *Corwenia* and their generic position has not been fully established, they seem for the present to fit best in *Waagenophyllum*. It seems to the writer that the above-mentioned four species of Merrian may be regarded as the relics of the Carboniferous *Corwenia* in the Permian rocks. It is possible that the species may represent another new genus or at least a new subgenus of *Waagenophyllum*.

Waagenophyllum lui sp. nov.

(Pl. I, figs. 3, 4)

Corallum compound, fasciculate, corallites small, slightly elliptical, irregular, variable in size, loosely aggregated, with an average diameter of 3 mm. Septa not numerous, alternately major and minor, the major ones are 17—18 in number, while the minor ones are $\frac{3}{4}$ — $\frac{1}{2}$ as long as the major ones. Sometimes, the major septa reach the axial column, the cardinal and counter septa are commonly connected with the median plate. All the septa are thick, gradually tapering towards their ends. Axial column simple, elliptical, about 1 mm in diameter, composed of a slight curved median plate, tabellae and few septal lamellae which are occasionally connected with major septa.

In longitudinal section, the three characteristic zones can be more or less distinctly observed. Dissepimental area is narrow and is composed of 2—3 rows of dissepiment. Horizontal tabulae are absent.

Remarks: *Waagenophyllum lui* resembles *Liangshanophyllum* in the axial structure. In regard to the absence of horizontal tabulae, it seems more plausible to put it into the genus *Waagenophyllum*. The present species differs from others so far described in having irregular shape and variable size.

Occurrence: This species occur in the middle part of the Wuchiaping limestone about 3 km SE of Yen-erh-wuo.

Cat. Nos. 8821, 8822.

***Waagenophyllum simplex* sp. nov.**

(Pl. I, figs. 1, 2)

Corallum compound, fasciculate, composed of numerous round or slightly elliptical corallites, with an average diameter of 4—4.5 mm, the large ones measuring 5—5.5 mm in diameter, small ones only 3—3.5 mm. They are usually in contact with one another. If they are unconnected, their interspaces are generally 1 mm apart while the largest distance therein may reach 5 mm. Septa radially disposed, not numerous. Major septa 18—19 in number, extending to the center, nearly in contact with axial calumn, but fall short to connect it. The minor septa, about $\frac{2}{3}$ length of the major. The counter septum is not infrequently connected with median plate. All the septa are very thick and triangular in their peripheral edges, tapering gradually toward the center. Axial calumn is very simple, 0.5—1 mm in diameter, elliptical or circular in shape, composed only of median plate and tabellae rings, occasionally with 1—2 septal lamellae. They are all thickened by stereome, especially the median plate. Dissepimental area is wide, composed of 3—4 concentrically disposed rows. Horizontal tabulae are absent.

Remarks: The present form bears some resemblance to those of *Waagenophyllum indicum* var. *kweichowense* Huang. It differs, however, from the latter in having thinner septa and simpler columella. *Waagenophyllum simplex* is also similar to *Liangshanophyllum stereoseptatum* Tseng, but the corallites of the former are very variable in size, the columella is simpler, and the horizontal tabulae are absent.

Occurrence: This new species occur in close association with *Liangshanophyllum wengchengense* (Huang) in the middle part of the Wuchiaping limestone about 3 km SE of Yen-erh-wuo.

Cat. Nos. 8819, 8820.

***Waagenophyllum indicum* var. *crassiseptatum* var. nov.**

(Pl. I, figs. 5, 6)

Corallum compound, corallites round or elliptical in shape, with an average diameter of about 4.5—5 mm. Septa not numerous, usually 21 major and as many minor septa. Major septa only partly stop short of the axial column, whilst another part of them reaches it well, and united even with the radiating lamellae within the axial column. The minor septa are about $\frac{1}{3}$ of the major ones in length. All septa are thickened, especially near the epitheca, gradually tapering toward center. Axial column thick, well-defined, about 1.8—2 mm in diameter, composed of closely set, steeply-sloping tent-like tabellae with a numerous, regular vertical lamellae, and a median plate.

In longitudinal section, the columella is so wide and is made up of more or less vertical ascending tabulae, which slowly bend toward centre. Just along the epitheca of the corallites, there is a thin and irregular zone of vesicles.

Remarks: The present new variety is quite similar in form, structure of axial column and other characters to the *Waagenophyllum indicum* (Waagen et Wentzel), but it is distinguished from the latter in having thicker septa and more complex columella. All these differences, however, are of minor importance and are not sufficient for specific separation. It seems, however, that the present form may represent a new variety of this species.

Occurrence: This form was found in the lower part of the Wuchiaping limestone, about 2 km SE of Yen-erh-wuo.

Cat. Nos. 8823, 8824.

***Waagenophyllum* sp.**

(Pl. I, figs. 7, 8)

The present form is only known by a small fragmentary and crystallized specimen. It is represented by a transverse and a longitudinal section. The internal details of the transverse section are not perfectly known, while the longitudinal one is rather well-preserved and can be referred to the genus.

In longitudinal section, the axial column is thick, composed of slowly downward tabellae and more or less distinct median plate. The tabulae are slowly downward toward the center. In the peripheral region, 3—4 rows of dissepiments are preserved.

Occurrence: This form was collected from the top of Wuchiaping limestone about 2 km SE of Yen-erh-wuo.

Cat. Nos. 8825, 8826.

Subgenus *Liangshanophyllum* Tseng 1949

***Liangshanophyllum sinense* sp. nov.**

(Pl. II, figs. 1, 2)

Corallum compound, fasciculate, corallites round or elliptical in form, 4 mm in diameter.

Variable in size. They are usually in contact with one another, though occasionally free. Septa not numerous, usually 20—21 major and as many minor septa. The major septa extend to the center, usually connected with septal lamellae. The minor septa are only a little more than half as long as major ones. All septa are slightly thickened, especially near the epitheca, tapering gradually toward the center. Axial column is thick, occupying a little less than one-third of the theca, composed of closely-set tent-like tabellae, interplaced with a number of irregular radial vertical lamellae and a distinct and more or less straight median plate which is connected with counter septum.

In longitudinal section, the three zones may be well distinguished. Dissepiments are composed of only 2—3 rows. Tabulae sometimes horizontal and sometimes inclined toward the center. The axial column is composed of narrow cone-in-cone shaped tabellae and a more or less straight median plate.

Remarks: In regard to the shape of the corallites, the present form may be compared with *Waagenophyllum virgense* var. *mongoliense* Grabau; it differs from the latter chiefly in having more complex columella and more horizontal tabulae. *Liangshanophyllum sinense* agrees with *Liangshanophyllum wengchengense* (Huang) in the characters of the longitudinal section, but differs from the latter in having thicker septa and complex columella.

Occurrence: This new species was found in the middle part of the Wuchiaping limestone about 3 km SE of Yen-erh-wuo.

Cat. Nos. 8827, 8828.

Liangshanophyllum wengchengense (Huang)

1932. *Waagenophyllum wengchengense* Huang, Permian Corals of Southern China, Pal. Sin., Ser. B, Vol. 8, fasc. 2, p. 50, pl. 3, fig. 3.

1949. *Liangshanophyllum wengchengense* Tseng. Note on the *Liangshanophyllum* New Subgenus of *Waagenophyllum* from Permian of China. Bull. Geol. Soc. China, Vol. 24, p. 103, pl. 1, figs. 1a—b.

(Pl. II, figs. 3, 4)

Corallum compound, fasciculate, corallites round in shape, with an average of 4.5 mm in diameter. Septa not numerous. Major septa are 21 in number and extend to the center, but not connected with axial column, except the counter septum which is constantly in contact with it. Axial column rather simple, round in outline. Tabulae are wide, partly horizontal, and partly inclined toward the axial region. At the peripheral region a single row of dissepiments is constantly preserved.

Occurrence: This species was collected in the middle part of the Wuchiaping limestone about 3 km SE of Yen-erh-wuo.

Cat. Nos. 8829, 8830.

Family Lophophyllididae Moore et Jefford 1945

Genus *Lophophyllidium* Grabau 1928

Lophophyllidium liangshanense sp. nov.

(Pl. I, fig. 9)

Corallum simple, large, horn-shaped, measuring 13 mm in diameter, epitheca thickened. Major septa 30 in number, radially arranged, extremely thickened and fused by stereoplasma toward the periphery where the minor septa occur in the stereoplastic mass. Septa extend to the columella but not connected with it. They are frequently variable in length. The counter septum is connected with the palicolumella, which is perfectly elliptical and is composed of a distinct dark median band and numerous long fibre-fascicles on both sides, giving a short diameter of 1.4 mm and a length of 3.4 mm. The cardinal septum is very short, only measuring 1.8 mm in length. Dissepiments absent.

Remarks: In regard to the shape of corallum, the present form may be compared with *Lophophyllidium uexwakanum* Jefford, but differs from that species in having more numerous septa and in smaller size.

Occurrence: This species occurs in association with *Sinopora dendroides* (Yoh) in the middle part of the Wuchiaping limestone, about 3 km SE of Yen-erh-wuo.

Cat. No. 8831.

Lophophyllidium kayseri (Huang)

1937. *Lophophyllum kayseri* Huang. Permian Corals of Southern China. Pal. Sin., Ser. B, vol. 8, fasc. 2, p. 25, pl. II, figs. 3—5.

(Pl. I, fig. 10)

Corallum simple, small, horn-shaped, about 9 mm in diameter. Epitheca moderately thickened. Major septa numerous, about 25 in number, radiatly disposed and extend nearly to the columella, but do not reach it. There is a very small intermediate space between the inner ends of the major septa and the central columella. Minor septa are developed. The counter septum connecs with the columella which is rather small, not wider than 1 mm and only a little more than 1 mm long. It is to be laterally compressed and its median band is distinct and appeared as a dark line. The cardinal septum is abort and forms a fossula with 1.5 mm in diameter. The alar fossulae seem to be existed. Dissepiments absent.

Remarks: The present form is identical with the type specimen in form and in the palico-lumella. The only difference is that the septal number in our form is larger.

Occurrence: This species was found in the middle part of the Wuchiaping limestone about 2 km NE of Wuchiaping, where it is associated with *.Illotrophiophyllum grabau* Chi.

Cat. No. 8832.

***Lophophyllidium multiseptatum* var. *minor* var. nov.**

(Pl. II, fig. 7)

Corallum simple, rather small, distinctly horn-shaped, about 7 mm in diameter. Septa numerous, about 25 in number. Minor septa are not developed. The counter septum continues to the large columella which is less than 1.5 mm in thickness. It is composed of a rather coarse median band and numerous fibre-fascicles. The cardinal septum is slightly shorter than the rest, which are joined at their ends both by bending and by stereoplastic thickening. All septa are thickened throughout the length. Dissepiments absent.

Remarks: The present species is only represented by a transverse section of mature stage. It agrees fairly well with *Lophophyllidium multiseptatum* (Grabau), but differs from the latter in the smaller size and in the absence of the minor septa.

Occurrence: This species occurs in the middle part of the Wuchiaping limestone, about 2 km NW of Wuchiaping.

Cat. No. 8833.

Family Zaphrentidae Edwards et Haime 1851

Genus *Paracania* Chi 1937

***Paracania* cf. *sinensis* var. *kaoi* Chi**

1937. *Paracania sinensis* var. *kaoi* Chi. Simple Corals from the Permian of Yungsin, Bull. Geol. Soc. China, vol. 17, p. 97, pl. II, figs. 3a—d.

(Pl. II, figs. 8, 9)

Corallum simple, rather small, cylindrical, about 10.5 mm in diameter, nearly round in outline. Epitheca thickened. Septa numerous, measuring 25 in number. The major septa are frequently variable in length and extend to the center, but do not reach it. There is a rather wide space between the inner ends of the major septa and the center. Minor septa alternated with major ones, about $\frac{1}{3}$ — $\frac{1}{4}$ as long as major ones. All septa are thick, especially in their ends. The fossula is distinct. Dissepiments absent.

In longitudinal section, tabulae rather complete, flat in the center, bending steadily downward at the margin and extending to the epitheca.

Remarks: This form is distinguished from the original form, as described by Chi, in smaller size and thicker septa. It is possible that the present form may represent a new

species. Since our form is represented only by a single transverse section, it is more appropriate to give it no new specific name.

Occurrence: This species was collected in the middle part of the Wuchiaping limestone about 3 km SE of Yen-erh-wuo.

Cat. Nos. 8834, 8835.

Family Hapsiphyllidae Grabau 1928

Genus Allotropiophyllum Grabau 1928

Allotropiophyllum grabauì Chi

1937. Allotropiophyllum grabauì Chi. Simple Corals from the Permian of Yungsin. Bull. Geol. Soc. China, vol. 17, pl. 1, fig. 3; pl. II, figs. 3a—e.

(Pl. II, figs. 5, 6)

Corallum simple, conical, rather large, the mature portion 16 mm in diameter. Wall thin. Septa numerous, about 30 in number. Minor septa alternate with major ones, 1 mm in length. All septa converge to the counter septum from each side, making horse-shoe-shaped wall. Cardinal septum becomes abort.

In longitudinal section, the tabulae are complete, steadily downward at the margin and extending directly to the epitheca wall. Dissepiments absent.

Remarks: This species is represented by a fragmentary specimen from which two sections were made. It differs from the original specimen in having large size of individual. Also, the alar septa which are prolonged to reach the horse-shoe-shaped wall are indistinct.

Occurrence: This species occurs in the middle part of the Wuchiaping limestone about 2 km NW of Wuchiaping and is in association with Lophophyllidium kayseri (Huang).

Cat. Nos. 8836, 8837.

Order Aseptata Grabau 1922

Family Aulopoidae Zittel 1850

Genus Sinopora Sokolov 1955

Sinopora dendroides (Yoh)

(Pl. II, figs. 10, 11)

1932. Monilopora dendroides Yoh. The Coral Fauna of the Chihsia Limestone of the Lower Yangtze Valley. Pal. Sinica, Ser. B, vol. 8, fasc. 1, p. 10, pl. II, figs. 3—4.

1955. Sinopora dendroides Sokorov Табуляты Палеозоя Европейской Части СССР. Гостоптехиздат. стр. 226, таб. 52, фиг. 1—7.

Corallum compound, entirely composed of many irregular ramifying tubes, 1.4 mm in diameter. They are frequently contacted with each other. The internal structure of the corallites is characterized by the absence of both septa and tabulae. The visceral chambers are not frequently opened and sometimes are filled with crystallized calcite. In cross section, the wall is very thick.

Occurrence: This species was found in the middle part of the Wuchiaping limestone, about 3 km SE of Yen-erh-wuo.

Cat. Nos. 8838, 8839.

圖 版 說 明

圖 版 I

圖 1,2. *Waagenophyllum simplex* (新種)

1. 橫切面 × 3; 2. 縱切面 × 4.
登記號: 8819, 8820. (全型)

產地: 漢中梁山燕兒窩東南約 3 公里。

圖 3,4. *Waagenophyllum lui* (新種)

3. 橫切面 × 3; 4. 縱切面 × 4.
登記號: 8821, 8822. (全型)

產地: 同前

圖 5,6. *Waagenophyllum indicum* var. *crassiseptatum* (新變種)

5. 橫切面 × 4; 6. 縱切面 × 4.
登記號: 8823, 8824.

產地: 漢中梁山吳家坪西北約 3 公里。

圖 7,8. *Waagenophyllum* sp.

7. 橫切面 × 3; 8. 縱切面 × 3.
登記號: 8825, 8826.

產地: 漢中梁山燕兒窩東南約 3 公里。

圖 9. *Lophophyllidium lianghanense* (新種)

9. 橫切面 × 3.
登記號: 8831. (全型)

產地: 漢中梁山燕兒窩東南 3 公里。

圖 10. *Lophophyllidium kayseri* (Huang)

10. 橫切面 × 3.
登記號: 8832.

產地: 漢中梁山吳家坪西北約 2 公里。