

甘肅東部五村堡層中
Zamiophyllum 的發現*

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本文所介紹的植物化石是一種地理分佈很廣、地層上的分佈則只限於下白堊紀的一種標準化石。它最先發現於歐洲下白堊紀的瓦爾登期 (Wealden) 的地層中，後來在北美的波托馬層 (Potomac Formation) 及日本的領石統中都有大量發現。此化石除在日本有唯一的例外，一度見於略低的手取統 (上侏羅紀) 外，其餘各處都是出現於下白堊紀的地層中，並且一向被認為是下白堊紀瓦爾登期植物羣中具有代表性的重要份子之一。此種化石過去在中國從無報道，所以此次的發現無論就它的地理分佈和對於決定所在地層的時代來說，都是頗有意義的。

此植物最初見於德國瓦爾登期地層中的標本，不甚完整，為 Etingshausen^[1] 定為 *Pterophyllum buchianum*。1890年，Nathorst^[2] 在“日本中生代植物”一文中才將它改成 *Zamiophyllum buchianum* (Ett.)，並從而正式創立了 *Zamiophyllum* 這一新屬的名稱。Nathorst 認為他的新屬與 *Pterophyllum* 最大的區別是：(1) 裂片是比較斜地着生於軸的兩側，(2) 裂片向基部微微縮小，並在與軸部相接的地方略有加粗的現象。

稍後，Seward^[1] 詳細地觀察了英國博物館所藏的此種標本，發覺到此種植物裂片着生的情形，並不是在軸的兩側而是着生於軸的腹面 (upper surface) 上的。因此，他和 Zeiller^[2] 都主張將此植物歸入 *Zamites*^[3] 之內，而美國的 Berry 於 1911 年還名之為 *Dioonites buchianus*^[4]。實際上，這些標本和 *Zamiophyllum bu-*

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1) Seward, 1895, Wealden Flora, Pt. 2, p. 75, 79; Pls. 3 & 4.

2) Zeiller, 1903, Tonkin Flore, p. 165.

chianum 都是無法區別的。

1939年,日本大石三郎教授^[5],將採自日本各地領石統的此種化石標本及和它相關的文獻作一徹底的研究後,對於此植物裂片着生於軸部的情形又有了比較更全面的了解。據他的描述,所有保存良好的標本都顯示出它的裂片確是着生於軸的腹面上,而不是着生於軸的兩側的;裂片的基部成“半抱莖形”(semi-amplexicaul)地抱住軸的一部分,並且具一頗為顯著的凹形硬結物(callosity),因而這些裂片的開展方向與它所在軸的側面不是在同一平面,而是形成一相當角度的。大石曾經特別指出,這種裂片的特殊着生樣式,應作為此種植物最主要的屬性特徵,並且也是用以和其他近似植物,如 *Pterophyllum*, *Ptilophyllum*, *Zamites* 及 *Dioonites* 等相區別的地方。又此植物還是單型屬的植物,至今只有 *Zamiophyllum buchianum* (Ett.) 一種。

當前研究的標本只有一塊,是前中國石油公司地質探勘處田在藝、梁建式及張傳澄先生於1947年採自甘肅東部華亭縣五村堡(此一地點後面另有補充說明)。此標本所在的岩石為一種綠灰色的雲母砂質頁岩,岩石上面除了這種植物的印跡外,還有一小段魚骨化石。在中國,與下白堊紀瓦爾登期植物共生的魚化石多歸之於 *Lycoptera*, *Asiatolepis*, *Mesoclupea*¹⁾ 等屬,但這塊魚化石却破碎得連它的屬名也難以決定。

此處描寫的標本可能是一塊大的葉部化石。至少6厘米長,7厘米寬,全部的形態如何還不清楚。軸約0.5厘米粗,腹面具有許多細小的縱紋。裂片保存不全,每片寬約1厘米,長度在5厘米以上,顯得狹而長;裂片的排列很緊、對生、向基部微微收縮,與軸約成45°的角度。裂片的基部着生於軸的腹面,成一略凹的“半抱莖形”,並稍具有硬結物。裂片開展的方向與軸的側面不在同一平面,而是成一相當角度的。葉脈緊密,於近基部的地方分叉一次,然後相互平行;每一裂片約有脈28條。

從上面的描叙可知,當前標本的形態和它的特殊的“半抱莖形”的裂片基部,與 Nathorst 和大石等^[5,7,8]描寫過產於日本各地領石統的 *Zamiophyllum buchianum* (Ett.) 是完全相同的。

又在前面已經指出過,此種植物和 *Pterophyllum*, *Zamites* 等屬的植物是很

1) 劉憲亭,1954,中國古生物學會訊,7期,17頁表中,將產於浙江壽昌的此鱗魚化石列於白堊紀上部,恐仍需要商榷。

易區別的，因此就過去已有的植物化石來說，和它相似，而應該特別比較的就只有 *Zamites yabei* Oishi 了。這種植物過去也曾一度被早坂一郎^[6]定成 Cfr. *Zamiophyllum buchianum*。後來，大石在他的“日本中生代植物羣”^[5,7]一書中，才正式將它改爲這種不同屬的另一新種。*Zamites yabei* 不同於此一植物的地方是它的裂片的開展都是在同一平面，而不是與軸的側面成角度的，並且它每一裂片的脈只約有15條。

關於甘肅東部產化石的下白堊紀地層，過去已經許多地質學家的調查研究^[9,10,11]。就五村堡這個地點來說，早在1924年袁復禮教授就在此處採集過許多保存良好的魚化石。這些魚化石經葛利普教授鑑定，名爲 *Lycoptera kansuensis* 及 *Lycoptera woodwardi*¹⁾。根據魚化石的研究，葛利普^[12]認爲此一含魚化石的地層應與山東的萊陽層相當，而屬於下白堊紀，他並將這個地層取名爲五村堡層 (Wutsunpu Formation)。

於此需要特別說明的是關於五村堡這個地名的出處問題。這一地點在中國地質文獻中的歷史可說是由來已早，它的英文拼音雖然各家都一致地是拼成“Wutsunpu”，但中文的註釋，反而各各不同：最初見於袁復禮報告中的是“武俊堡”（見袁復禮，1925，21頁）^[10]；在葛利普創立此層名的“中國地質史”一書的中國地名譯名表中，却是“無終堡”（見葛利普，1928，771頁）^[12]；本文標本的採集者田在藝等在標籤上寫的却是“武村舖”。但是不管他們將這個地名的寫法如何不同，它所隸屬的省、縣却都註明了是甘肅省東部的華亭縣（葛利普的書中還特別說明了它位於華亭縣東南約20里）；並且又都說是白堊紀地層的所在地，因此他們所指的都是同一的地點則是無可懷疑的。筆者爲此曾查了一下前陸地測量總局出版的甘肅省華亭縣的十萬分之一的地形圖，在華亭縣東南約九公里處果有一個村名“五村堡”，因此筆者於本文暫採用了“五村堡”，以代替從前所出現過的各種不同的名稱。²⁾

五村堡層而外，甘肅東部的另一著名的白堊紀地層爲六盤山系，值得注意的是此系中也找到過一些昆蟲、葉肢介及植物化石。關於這些化石在六盤山系中的確切層位，在原採集者袁復禮和安特生分別所寫的兩篇報告中都沒有詳細說明。不過就葛利普的意見^[12]，六盤山系應該是指含 *Lycoptera* 的五村堡層以上的地層

1) 據劉憲亭，1954（同前）17頁表中列產於甘肅華亭縣的魚化石，此種似已改爲 *Asiatolepis woodwardi*。

2) 張席樞，1936，中國中生代地層概要。地質論評，1卷，2期，120頁所附地層比較表中的“立松浦層”，也應當是五村堡層之誤。

而言，他並且相信六盤山系有屬於上白堊紀的可能。1931年，計榮森^[14]先生詳細地研究了袁復禮採自六盤山系的葉肢介化石後，却認為六盤山系應該和中國各地的下白堊紀地層相當。因此，摩理斯^[13]在他1936年出版的“中亞的白堊紀”一文中，就主張把五村堡層（他書中名“五村堡系”）放在六盤山系之下，兩者的關係是連續的；並認為兩者都是甘肅東部下白堊紀瓦爾登期的代表。

此次田在藝先生等所發現的材料，寄給筆者的只此一塊標本，地層記錄也只有標籤上所寫的“白堊紀”而已，近年是否有更新的材料無法知道，因此對於此區相關的地層問題還難作一確切的評述。不過，如前面說過的，由於當前的標本的有魚化石的共生，產地又是五村堡層的標式地點，所以我們很可以相信，當前的化石標本與袁復禮當年所採的魚化石很可能是出於五村堡層中的同一地層的。至於六盤山系與五村堡層（或系）的關係，到底是如葛利普、摩理斯所設想的上下關係呢，或是五村堡層只是六盤山系的一部分（按袁復禮原文的記載，屬於後者的可能性較大）^[10]，現在還無法肯定。筆者於本文的採用五村堡層而不用五村堡系的名稱，就寓意在即使將來的調查研究，證明五村堡層完全等於六盤山系的某一部分時，此一以產化石稱著的五村堡層的名字，仍無礙於它所隸屬的六盤山系而似可保留。就目前的情況來說，筆者還是同意摩理斯的意見：六盤山系和五村堡層（系）是上下的連續的關係，兩者都代表甘肅東部（包括陝西西部）下白堊紀瓦爾登期的沉積，因為此次在五村堡層有下白堊紀的標準化石 *Zamiophyllum buchianum* (Ett.) 的發現，更從古植物方面也提供了一個有力的證據。

本文的研究工作是在斯行健教授指導之下完成，特此深表謝意。

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ON THE OCCURRENCE OF *ZAMIOPYLLUM* FROM THE WUTSUNPU FORMATION IN EASTERN KANSU, CHINA

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(With 1 Plate)

The monogenic plant here described was first introduced by Ettingshausen^[1] in 1852 under the name *Pterophyllum buchianum* from the Wealden of Germany, and subsequently it was suggested by Nathorst^[2] in 1890 as the geno type of a distinct genus *Zamiophyllum*. Nathorst distinguished his new genus from *Pterophyllum* chiefly on that the pinnae are more oblique to the rachis and taper gradually towards the base which is somewhat thickened. The asame plant was later described by many authors as *Zamites buchianus*^[3], and *Dioonites buchianus*^[4] etc.

In 1939, Oishi^[5] made a thorough study of this plant, based on a considerable number of good specimens from various localities in the Japanese Islands belonging to the Ryôseki Series. After a careful examination of the point of attachment of the pinnae, he found that the pinnae are not attached laterally, but are attached to the upper surface of the rachis by a concave semi-amplexicaul base with callosity, and the plane of the pinnae make an angle with the flank of the rachis. Oishi pointed out that this feature is the essential

character of the genus *Zamiophyllum*.

In 1947, Messrs. T. Y. Tien, C. S. Liang and C. K. Chang sent to the present writer for examination a single fossil specimen collected from the Lower Cretaceous bed of the locality Wutsunpu, about 9 km. SE of Huatinghsien, eastern Kansu province. The fossil plant under consideration is only an impression of a fragmentary frond on a slab of light greenish grey, micaceous sandy shale. The same slab bears no other remains except a fragment of fish bone. The fossil fishes associated with Wealden plants in China are generally known under the generic names *Lycoptera*, *Asiatolepis*, *Mesoclupea* etc., but the present material of the fish remain is too meagre to admit of even generic determination.

The plant here described, is perhaps a large frond, attaining at least 6 cm high and 7 cm broad, and its general outline is unknown. The rachis is 0.5 cm thick and covered with numerous longitudinal striations on the upper surface. The pinnae are imperfect, long and narrow, 5 cm in length and about 1 cm in breadth, set closely, opposite, slightly contracted towards the bases, and attached to the upper surface of the rachis at an angle of about 45 degrees. The nerves are parallel, forking at a short distance from their origin, densely crowded, about 28 in each pinna. The characteristic semi-amplexicaul mode of attachment of the pinnae is well preserved, and the plane of the pinnae forms an angle with the flank of the rachis.

In regard to the shape and size of the pinnae and in regard to the characteristic semi-amplexicaul base of the pinnae, the present fragment agrees in all respects with the Japanese specimens referred to by Nathorst and Oishi to *Zamiophyllum buchianum* (Ett.).

This plant differs easily from all the species of the allied genera, i. g. *Pterophyllum*, *Ptilophyllum*, *Zamites* and *Dioonites* by its more oblique, long and narrow pinnae, and especially by the characteristic semi-amplexicaul mode of attachment. The only plant with which the present specimen is comparable is the one originally described by Yabe^[6] as Cfr. *Zamiophyllum buchianum* (Ett.) from the Nisi-Yakayama bed of Yamaguti Prefecture, and later considered by Oishi^[5,7] as a new species, *Zamites yabei*. This species resembles the present form in the general habit of the frond and in the oblique long and narrow pinnae. But in *Z. yabei*, as Oishi has pointed out, the plane of the pinnae is parallel and does not form an angle with the flank of the rachis, and furthermore, the nerves are merely 15? in each pinna.

The present species is most characteristic both morphologically and stratigraphically, being known only from the Wealden and the Lower Cretaceous strata of Europe and North America. In Japan, it has been commonly recorded from various localities of the Ryôseki Series^[6,8] which is generally believed to be equivalent to the Potomac Formation of North America and the European Wealden; and it appears, as a single exceptional case, to occur even from a slightly lower horizon^[6], Kiyosure Group in Yamaguti Prefecture, which can be correlated with the Tetori Series of Central Japan. It has not yet been found in China. It is to be hoped that future search in the Lower Cretaceous formations in China will reveal more satisfactory specimens of this interesting plant.

The stratigraphical relations of the fossiliferous beds of the Lower Cretaceous in eastern Kansu have been studied by many geologists^[9,10,11], and from the same locality (Wutsunpu), a large number of well preserved fossil fishes were collected. The lowest Lower Cretaceous in fossil-bearing formation eastern Kansu is general known as the Wutsunpu Formation^[12] or Wutsunpu Series^[13].

This formation, according to Prof. P. L. Yuan, consists mainly of yellow, red and green sandstones, grey and bluish shales, and a bluish grey finely laminated limestone.

In the argillaceous and calcareous beds of the upper part of the formation specimens of *Lycoptera* were found. They were described by Dr. Grabau under the names *L. kansuensis* and *L. woodwardi*. The latter species, according to the same author, also occurs in the Lower Cretaceous of Shensi; and this formation is considered to be the equivalent of the Laiyuan Formation of Lower Cretaceous age.

In this area the deposit directly overlying the famous *Lycoptera* beds of the Wutsunpu Formation is known as the Liupanshan Series. It is of interest to note that some small insects, *Estheria*, and plant remains have been found^[9,10] from the Liupanshan Series. Although remarking that the biota fails to indicate a precise horizon, Grabau^[12] has tentatively assigned the series to the Upper Cretaceous. In 1931, Mr. Y. S. Chi^[14] identified *Estheria middendorffi* var. *sinensis* Chi and *E. kansuensis* Chi from material collected by Yuan in certain beds of the Liupanshan Series; and concluded that the fossil-bearing formation is "essentially equivalent to the Lower Cretaceous continental formation of the Yangtze, Shantung and other regions of China."

In his important paper dealing with "Central Asia in Cretaceous Time",

published in 1936, Morris^[14] considered that the Wutsunpu Series and its overlying Liupanshan Series are continuous and that both series represent the Wealden deposits in eastern Kansu (see Morris, 1936, p. 1491 and Pl. 1, p. 1476). The present writer is in complete agreement with Dr. Morris' suggestion. The presence of an important index fossil *Zamiophyllum buchianum* from the type-locality of the Wutsunpu Series affords the palaeobotanical evidence to support a Lower Cretaceous age of the Wutsunpu Formation.

圖 版 說 明

下列各圖都未加任何潤飾，攝影者為劉雪筠同志，標本保存於中國科學院古生物研究所。登記號碼 (Reg.): PB 2182。

圖 1. *Zamiophyllum buchianum* (Ett.) ($\times 1$) 葉的部分形態，原大。

圖 2. Ditto. ($\times 2$) 同上，圖 1 標本的一部分， $\times 2$ 。表示裂片基部的着生情形及葉脈。

圖 3. *Pisces* gen. et sp. indet. ($\times 2$) 魚化石，屬名及種未鑑定。

圖 1 標本右下側的一部分， $\times 2$ 。

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