

廣西二疊紀幾種菊石及其意義

趙金科

(中國科學院古生物研究所)

(附2圖版; 4插圖)

引言

本文所描述的幾種菊石是根據盛莘夫和茹廷鏘兩位同志過去兩年在廣西中部柳江及來賓兩縣境內二疊紀孤峯層內採集的幾塊相當完整的標本。廣西孤峯層的岩石為砂質灰岩及頁岩所組成,厚度自30至100米不等,分佈於僑山以東平樂、恭城等縣,東南部貴縣、興業、橫縣等地及中東部柳江、來賓、石龍等縣境內。內含化石很少,它的下覆岩層是含化石很豐富的棲霞灰岩,上覆岩層是含大羽羊齒植物 *Gigantopteris* 的龍潭煤系,其層位適與中部及西部的茅口灰岩相當。因之過去一般認為孤峯層是茅口灰岩的變相岩層,代表近陸地的淺海沉積。現在找到的菊石提供了古生物學上的依據,所以這些化石更顯得重要和有意義了。

這些菊石共計三屬六種都是新種,其中有一新屬,無他類化石共生,標本係採自三個不同的地點,其中大部為盛莘夫同志所採集,極少數標本是茹廷鏘同志及著者採集的。

第一地點為柳江縣南約10公里的四方塘。此地的孤峯層厚約80米,菊石產在頁岩內,位於棲霞灰岩之上約30米,孤峯層之上為陸相的龍潭煤系的頁岩層。在這一地點,1952年茹廷鏘同志首先採集的有 *Shengoceras lenticulare* 幼年期殼及 *Strigonomiatites nodosus* 兩種,次年盛莘夫同志在同處採集的有 *Waagenoceras simplex* 及 *W. umbilicatus* 兩種。此地現已知共產四種,即:

Waagenoceras simplex 新種*Waagenoceras umbilicatum* 新種*Shengoceras lenticulare* 新屬新種

* 1955年2月20日收到

Strigogoniatites nodosus 新種

第二地點爲柳江縣南距四方塘約 12 公里，思榮鄉西北的波河嶺。菊石亦產於距棲霞灰岩頂部 30 米的頁岩中。此處盛莘夫同志共採有菊石八塊，計有三屬四種，著者採得二塊。

Waagenoceras simplex 新種*Waagenoceras shengi* 新種*Shengoceras lenticulare* 新屬，新種*Strigogoniatites liuchowensis* 新種

第三地點爲來賓縣湘桂鐵路鳳凰車站的西北約 7 公里的飛鵝嶺北坡碎石中，產菊石一種 *Waagenoceras simplex*。這些標本保存尚完整，全部爲錳質或鐵質所代替，氣室部分很完全，惟無住室保存。殼皮已被剝蝕，因此其表面飾物無法看出，而縫合線大都保存良好，是其優點。

著者願就此機會向盛莘夫和茹廷鏘兩同志表示深厚的謝意，把這些有意義的標本送給了著者研究，並給予產地情況供參考之用。最後並向劉雪筠同志代爲照像，張務聰周其義兩同志清繪縫合線，表示謝忱。

化 石 的 分 析

在未討論這些菊石的屬種及其在地層的意義之前，著者感到首先有將現在二疊紀的定義及分層，做一簡略敘述的必要。因爲近二十年來二疊紀的含意及分層已有很大的變動，尤其是底部變動更大。當 1841 年馬其蓀 (Murchison) 原定二疊紀底界爲烏拉山區阿丁斯基層 (Artinskian) 的底部，同時他把西坡的一層石灰岩名爲烏拉統 Uralian，定爲上石炭紀。在 1929—1930 年發現阿丁斯克層的頁岩向西伸展有一部份漸變爲西坡的烏拉統石灰岩，因此烏拉統的時代就發生了疑問。和 1937 年在莫斯科第十七次國際地質會議裏和在 1936 年蘇聯的二疊紀討論會上，都曾討論了這一問題。其後即逐漸廢除烏拉統一名，而將其一部岩層名爲薩可馬層 (Sakmarian)，並列爲二疊紀最下部的建造。現在蘇聯地質學者一般都採用此說，分二疊紀爲上下兩部，下部包括薩可馬建造，阿丁斯克建造，孔卡建造 (Kungarian)；上部包括烏芬建造 (Ufinian)、卡薩建造 (Kazanian) 及塔塔建造 (Tartarian)。在北美的特克薩斯 Texas 的玻璃山區 (Glass Mountain) 和高大陸盆山區 (Guadapene Mountain)，同樣的情形也把以前認爲上石炭紀的岩層劃入二疊紀。即自狼房建造 (Wolfcamp) 起始歸入二疊紀的底部。但美洲的地質學家的分層法不同於蘇聯地質家，即不採用二

分法而採用三分法。以狼房建造爲下二疊紀，林那大及瓦大 (Leonord-Word) 爲中二疊紀，開布頓 (Captan) 建造爲上二疊紀。中國長江下游的船山灰岩及西南的馬平灰岩或華北區的太原系大約相當於蘇聯的烏拉統。因此當 1933 年及以後諸年，丁文江及葛利普兩氏亦曾把上述三個岩系列入二疊紀，但近幾年來一般多自棲霞灰岩底部開始歸入二疊紀，並採用二分法以棲霞灰岩及茅口灰岩爲下二疊紀，或統名爲陽新統，以樂平煤系及長興灰岩爲上二疊紀。就各建造的化石看來，大致棲霞灰岩相當於烏拉山區的阿丁斯克建造，茅口灰岩相當於孔卡建造，亦即相當於特克薩斯州林那大及瓦大建造。因此本文內所引用的北美洲的中二疊紀，實際上就是相當於中國的下二疊紀，至於上二疊紀的含意大致相同，不擬再述。希讀者注意此點。

現在讓我們再來討論本文所描述的幾屬菊石的性質和它們的意義。

在本文所描述的三個菊石的屬中，盛氏菊石 (*Shengoceras*) 一屬爲一新屬，它的特殊地方是具有扁餅狀的外形，呈屋脊狀的外圍和它的亞菊石型的縫合線。這些形狀和性質是其他已知各屬所沒有的。現在尙不能作爲指示化石用。其縫合線的形狀與 *Wuagenoceras* 和 *Timorites* 兩屬相似，同時亦接近於 *Perrinites* 和 *Cyclobus* 二屬，惟側葉的數目較少，再分枝的情形不太顯著，似代表一特殊的類型。

第二爲 *Strigogoniatites* 屬，它的屬型是帝汶島 *Strigogoniatites angulatus* (Haniel) 根據漢尼爾 (Haniel) 和米勒 (Miller) 兩氏的意見，可能產自上二疊紀的 Basleo 建造，它的特點是具有稜狀的腹部或外圍，兩側有“耳狀”突起，其表面如 *Pseudogastriceras* 一樣外圍腹部及側面都飾以旋紋。縫合線與 *Paragastriceras*, *Uraloceras*, *Pseudogastriceras* 和 *Ultudoceras* 相同。代表聯續的屬。廣西這一屬的兩種菊石，即 *Strigogoniatites liuchowensis* 和 *S. nodosus* 是代表兩種非常原始的種，其外圍的腹部尙未發育成爲良好的脊形，不過已具有尖稜的形狀，口腔也成三角形了。從這幾點看來，它已接近於 *Strigogoniatites* 一屬。因此列入這一屬中，它們與北美特克薩斯州上二疊紀 Lamar 灰岩中所產的 *Strigogoniatites fountaini* Miller & Furnish 和墨西哥 Timorites 帶所產的 *Strigogoniatites kingi* Miller 相似，都是代表 *Altudoceras* 和 *Strigogoniatites* 兩屬的中間類型，而接近於後者。單從這一屬來判斷地層的時代，則孤峯層可能屬於上二疊紀。

第三屬爲 *Wuagenoceras* 屬。這一屬的代表已知產自西西里島的 Socio 層，帝汶島的 Basleo 層和北美 Word 層及 Captan 的相當層。依照 Miller 和 Furnish 兩氏在北美洲研究的結果，認爲這一屬在中二疊紀下部尙未找到過，在中二疊紀的上部

始有發現，少數的代表可以延展到上二疊紀，這後一種情形，僅見於特克薩斯及墨西哥二區。該處的 *Waagenoceras guadalupense* 和 *W. dieneri* 從中二疊紀的 Word 建造，向上延到上二疊紀的 Captan 建造或其相當的岩層中。就以上情形看來，則廣西這一屬的兩種菊石，也有屬於上二疊紀的可能。但是我們更應該注意的是廣西這兩種菊石，都是代表最原始的種，它們的縫合線都比較簡單，側葉的數目很少。在其同屬已知的各種中側葉的數目是由 5—7 個，而廣西這兩種的側葉只有三個。這又說明，這兩種菊石的時代從生物由簡單到複雜的發展學說看來，似不能新於同屬中其他各種，而應該更老些，至少亦應當為中二疊紀。（註：此處所說的中二疊紀即指中國和蘇聯的下二疊紀）。

就上面所討論的情形看來，我們就瞭解廣西孤峯層找到的菊石的重要和有意義了。它不僅提供了該地層時代的化石根據，而且表示出化石的奇特性。一方面 *Waagenoceras* 三種表示該屬的原始性質，另一方面表示 *Strigogoniatites* 一屬在廣西境內的出現比其他各處要特別早些。其他各處它只見於上二疊紀，而在廣西下二疊紀已有出現了。

種 的 描 述

屬名 *Waagenoceras* Gemmellero 1887

（屬型：*Waagenoceras mojsisovisci* Gemm.）

Waagenoceras simplex Chao 新種

（版圖 I，圖 1—11；插圖 1）

這種菊石是這一屬中最常見的一種，它在以前所述三個地點都有發現。廣佈於柳江及來賓縣境內。在研究的材料中共有七個保存很好，相當完整的標本和幾塊破碎的標本。縫合線經過長時期的風化作用，大多數都露出了。

貝殼的形狀為內捲型，略呈扁圓狀，兩側部分微有扁縮現象。輪環相當高，呈新月形，但寬度仍大於高度。外部輪環幾乎全部包圍內部的輪環，而被後者陷入外環高的二分之一。腹部寬闊呈穹圓形，兩側很凸，自臍緣向外圍同時傾斜和彎曲，與腹部之間無清楚的界綫。臍很窄小而深，臍壁陡直，臍緣顯著但為圓形。在所有的標本中內部和外部的輪環上都未見有收縮溝存在。表皮大都被風化作用剝蝕不見，只有小部分尚能保存，從這保存的部分，我們知道殼皮的表面是很光滑的。住房部分未保存，其長度不詳。

另外有三塊小型的標本，也歸入在一種中，它們可能代表幼年期殼。它們的形狀更較厚些，呈圓球狀。



插圖 1 *Waagenoceras simplex* sp. nov. 的縫合線，×5
左。幼年期殼，副型 (7164)； 右。成年期殼，正型 (7160)。

縫合線為這一屬的標準型式，但比已知西西里島、帝汶島和北美洲所產的同屬各種的菊石都要簡單些，縫合線排列很均勻，大致成一直線。每一縫合線的外側面有一個分開的腹葉，二個單葉形的側葉，一個窄小些的葉位於臍緣上和二個簡單的小葉位於臍壁上。腹葉很長，前上部分略有收縮現象，兩枝腹葉之間為一中央鞍分開，中央鞍的高度約為腹葉長度的五分之二。腹枝葉的內側下部具有粗長的指狀再分枝，外側及內側上部無分枝。第一側葉及第二側葉都很長，兩邊略近平行，下部各有 6—7 個粗壯的指狀分枝，其中下端三個最長。第三側葉位於臍緣上，分枝少些只有四個。臍壁上的兩個葉都是簡單的，是向後的。每兩葉部之間的鞍部都很完整無分枝，頂部略有壓縮現象。

註釋 從貝殼的外形來看，這一種菊石與北美洲特克薩斯州和墨西哥所產的 *Waagenoceras dieneri* Bose 很相似，兩種菊石都是扁圓狀，具有窄小而深的臍，但內部縫合線則非常特殊，在廣西這一種菊石的縫合線更簡單些，側葉也只有三個。而且上面所提到的一種，有時可見收縮溝，而在廣西這一種的幾塊標本中則迄未見到。

層位及產地 這一種的正型是盛莘夫同志採自來賓縣鳳凰西北的飛鵝嶺下碎石，另一成年期殼及四塊幼年期殼，係盛同志和著者採自柳江縣思榮附近的波河嶺的下二疊紀孤峯層中。同縣四方塘附近亦有幾塊破碎的標本發現。

登記號 正型 7459、副型 7460—63

Waagenoceras umbilicatum Chao 新種

(圖版 I, 圖 12, 13; 插圖二 E)

這一種名只是根據採自四方塘的材料中一塊小型的標本而建立的。它可能只代表一幼年期殼，並且只有氣室的部分保存而住房部分完全未見，貝殼的一般外形為球

形具有寬而深的臍，很似北美所產的 *Waagenoceras guadalupense* Girty，輪環的橫切面也是新月形而且很低，在最外一輪環上共有三個不很顯著的收縮溝，在腹部部分微向前彎曲。殼皮大都未保存，就看到的部分判斷似很光滑無任何飾紋。

以上這些形狀都是上面所提到的一種菊石所有的，因此著者很難找到它們的區別，其不同之點僅在於內部的縫合線上側葉的數目比較少些和簡單些。



縫合線大致似前面所描述的一種，每一側葉包括一個分開的腹葉，三個側葉，其再分枝亦很顯著，但數目則比較少些，只有五個到六個，另外在臍緣上和臍壁上更有兩個簡單、不分枝的，下端為尖形的葉部。



圖 2 上. *Waagenoceras umilicatum* sp. nov. 的縫合線，×5；下. *W. Shengi* sp. nov. 的縫合線，×5。

層位及產地 這一種菊石惟

一的塊標本是採自柳江縣四方塘附近二疊紀孤峯層內頁岩中。

登記號 7464

Waagenoceras shengi Chao 新種

(圖版 I，圖 14, 15；圖版 II，圖 13；插圖 2 下)

這種菊石與前面所描述的一種相同，也是只有一塊標本，但保存很好，因此雖然材料很少，由於它具有特殊的形狀，我們也可以給予種名。

貝殼的外形為球狀，呈半外捲型，輪環具有四邊形的橫切面，高度不大，外環幾乎完全包圍內環，但為後者陷入不深，腹部很寬而圓，自此處彎曲而成臍緣，其間無顯明的界限。臍孔很寬而深，寬度約為貝殼直徑的四分之一。其周圍的臍壁斜立，臍緣呈圓弧形。貝殼的住房部分未見保存，其長度未詳。

貝殼的表面飾以均勻的、顯明的收縮溝和橫肋紋，在最外一輪環上共有 16 個。這些收縮溝和橫肋在腹部向前彎曲很強烈，在兩側腹部分則向後斜伸，而在臍緣上又向前方彎曲，並且加密，造成臍緣上的突起和深溝。

縫合線大致與前一種相近似。每一側線的外部有一個寬型的、分開的腹葉、其內

下部有三個顯著的粗枝，兩個側葉在腹側部分，其形狀略呈棒狀，下部具 5—6 個粗齒。第三側葉則位於臍緣上，只有 3—4 個齒。另外臍壁上也有兩個簡單的、呈尖形的葉部。鞍部的頂也都是完整的，略有壓縮現象。

註釋 這一種菊石與其他同屬的種，最顯著的區別是它的表面具有規則的、顯明的、彎曲的橫肋和收縮溝，這一點很容易識別。根據米勒和佛尼 (Miller and Furnish) 的說法，同屬其他各種與所有上古生代菊石一樣都具有很寬的腹缺，代表它們都具有游泳器管而營游泳生活。現在廣西這一種菊石，就其橫肋和收縮溝在腹部強烈地向前彎曲的情況看來，很可能在它住房的腹部已具有腹鞘構造，而改營海底潛生生活了。

層位及產地 這種菊石惟一的標本係採自柳江縣思榮附近的波河嶺下二疊紀孤峯層頁岩中。

登記號 7465。

屬名 *Shengoceras* 新屬

(屬型 *Shengoceras lenticulare* Chao 新屬新種)

定義 貝殼為半內捲型呈扁餅狀的菊石具有尖稜形的外圍。輪環很高，橫切面呈三角形，兩側面扁平或微凸，臍中寬而深，表面光滑。縫合線為亞菊石型，外側部分由三對單葉式的葉部和相同數目的鞍部組成。

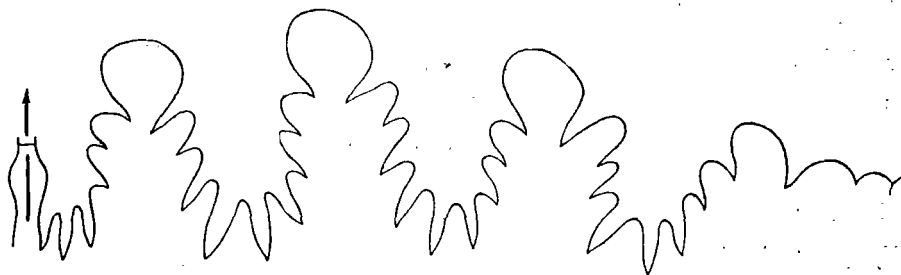


插圖 3 *Shengoceras lenticulare* Gen. et sp. nov. 的縫合線，×4

分佈 中國廣西下二疊紀。

註釋 這一新屬是根據兩塊標本而建立的，一塊是成年期殼，另一塊是幼年期殼，它的外形除表面無旋紋線外，頗似標準的 *Strigogoniates*，外圍具稜形的腹部並在兩側發育成為耳狀物。惟其內部的縫合線則非常特殊，側葉及側鞍極似 *Waagenoceras* 一屬，都是由單葉式葉部和微小的鞍部組成，不過其數目甚少，只有三對而非

如上述一屬有五至七對組成而已。腹葉在兩塊標本上都不太清楚，但由幾處看到它似未被一中央鞍分開很深，每一腹枝葉的下部邊具有三個細長的指狀枝，外邊上有幾個粗齒。

與這一新屬共產的有幾塊屬於 *Waagenoceras* 兩新種。其側葉的數目都是只有三對，因此著者曾以為這兩塊標本可能是經強烈壓扁作用的而成的，後經仔細研究結果，發現其內部的輪環，不可能受到壓縮作用亦具有稜形的腹部，加之外輪環的側面也相當隆起，這一切都說明貝殼之所以為扁餅形並不是由於壓力的結果而是原生的情形。因之另成立一新屬。

至於它的親屬尚不十分清楚，但就其縫合線上的鞍部和葉部的形狀看來，它可能與 *Waagenoceras* 一屬有血緣的關係，由同一祖先演變而出，而代表一種具有稜狀腹部的後裔。

這一屬名是為標準型採集人盛莘夫同志而命名的。

Shengoceras lenticulare Chao 新屬新種

(圖版II, 圖 1—3, 4, 5; 插圖 3)

如在屬的討論中所提到的，這一種菊石的代表只有兩塊標本，一塊成年期殼和一块幼年期殼，二者都是只有氣室的部分保存，未見住房部分。前者比較完整，殼皮大都保存，因此定為這一種的正型，同時也就是屬型了。後者為副型，至於種的描述也大都是根據正型而做的。

貝殼為中等內捲型，呈扁餅狀，外圍腹部具有尖稜。直徑約為 35 毫米。包圍度極大，外環幾全部包圍內環而為後者陷入環高的三分之一。輪環很高，兩側扁平或微凸，橫切面呈三角形，其高度略大於寬度，最厚的地方位於臍緣上。臍緣顯著呈稜狀，在最外一輪環上並有耳狀物出現。臍深而寬，寬度為 8 毫米約為直徑的四分之一。臍壁很高，斜而陡，致使臍成為漏斗狀。殼表很薄，表面光滑，未見任何飾紋。

縫合線的保存大都不很清楚，所幸在一側面保存了最外幾條線的鞍部和側葉，在另一側面又保存了 2—3 條腹枝葉部分。因而此處所描述的縫合線的情形和附圖都是根據數條縫合線而拼成的，其正確性不很可靠。

腹葉寬而長，中間的中央鞍很窄，幾與枝葉的指狀分枝間的缺口難分別。枝葉的下部由三個長的指狀分枝，內邊有三四個粗齒。第一、二側葉都很長，下端具有三個指狀的分枝，下部兩側面各有三至五個粗大的齒。第三側葉位於臍緣之外，遠較第一

第二側葉爲短，下部亦具有四、五個顯著的齒，上部兩側並各一粗大的指狀分枝。至於臍壁上的葉部及鞍部因保存太壞無法確定。外鞍很低。各側葉的鞍部都是完整的，頂部略有壓縮現象。

較小的副型保存更不好，其外形與正型很相似，腹部亦呈稜狀，兩側微凸。直徑爲 22 毫米，臍爲中等寬度。縫合線極似正型，具有一個短小的腹葉和三個側葉，惟其下端的分枝則比較簡單些，只有四個顯著的齒。臍線另有一個簡單的葉部存在。臍壁和正型一樣，破壞很厲害，其上面的輔助葉和鞍部不詳。

層位及產地 這一種菊石的正型係盛莘夫同志採自柳江縣思榮附近波河嶺二疊紀孤峯層的頁岩中與 *Waagenoceras simplex* 共生，副型乃係茹廷鏞同志採自同縣四方塘附近。

登記號 正型 7466，副型 7467。

屬名 *Strigogoniatites* Spath 1930.

(屬型: *Glyphioceras angulatum* Haniel)

Strigogoniatites liuchowensis Chao 新種

(圖版 II, 圖 10—12)

貝殼爲中等大小，直徑爲 49 毫米爲近內捲型呈扁盤狀，兩側有強烈的側壓現象。輪環的橫切面略呈三角形，高度大於厚度。這種情形在最外一旋輪更爲顯著。包圍度相當大，外環包圍內環的絕大部分，只有近臍緣的窄小帶露出，而內環陷入外環很深，約佔外環高度的三分之一。內輪環的腹部呈均勻的圓弧形，到外環逐漸變窄，終至成爲屋脊狀的外圍。兩側面很扁而微凸，最大厚度位於臍緣部分，臍寬 9 毫米，略小於貝殼直徑的五分之一。臍壁陡而直，臍緣呈方稜狀。貝殼的側面外圍及腹部飾以均勻的細旋紋，而側面的內圍和臍緣部分則很光滑。口腔的形狀爲三角形，住房部分未見保存，其長度不詳。

隔壁分佈很均勻，在最外一週輪上共有 15—16 個，縫合線爲腹菊石型由八個葉部和相等數目的鞍部組成。腹葉很寬，中間被一個中央鞍幾全部分開，成爲兩個具尖下端的枝葉。側葉相當窄而長，具有很尖的後端。臍葉位於臍壁上呈不顯明的、微向後彎曲的弓形。外鞍很寬而高，具寬弧形的頂部。側鞍更寬呈一不對稱的弧形。內側葉及內側鞍遠比外側葉和鞍窄小些。內側葉的下部可能亦具尖下端，脊葉窄呈舌狀。

註釋 這一新種菊石雖然只是根據一塊不完整的標本，只有氣空部分被保存下來，由於保存的情形很好，已能表示出它的特性，其復部已現出稜狀，而且在它的住房應當更為顯著些，表示出確屬於 *Strigogoniatites* 一屬，因此我們有足够的理由，相信它的種名是可以成立的。

這一種菊石如同後面所描述的 *Strigogoniatites nodosus* 一樣，是代表 *Strigogoniatites* 一屬中最原始的種，它的貝殼的形狀很似北美太薩斯省巴特孫山區 (Patterson Hills) 拉馬灰岩 Lamar 所產的 *Strigogoniatites fountaini* Miller and Furnish. 的幼年期殼，它們之間的區別僅在於廣西這一種菊石輪環的橫切面形狀，更近三角形和其縫合線上的外鞍更較寬些。墨西哥的德里西亞 Timorites 層中所產的 *Strigogoniatites kingi* Miller 更近似廣西這一種菊石，二者的輪環都具有三角形的橫切面和稜狀的外圍；但是後者具有一更寬的臍，縫合線上具有更窄的鞍部。

前面所提到的北美洲所產同屬內兩種菊石和帝汶島所產的屬型即 *S. angulatus* 都是生於上二疊紀岩層中，而廣西這一種菊石和後面所描述的一種，根據採集人的意見都是採自下二疊紀孤峯頁岩中。而孤峯層過去認為是陽新統上部茅口灰岩的變相地層。假如這兩種菊石屬的鑑定不錯誤，則又明顯地表示這一屬在廣西省境內的出現遠比世界其他各處更特別早些。

層位及產地 柳江縣思榮附近波河嶺下二疊紀孤峯頁岩的下部。

登記號 7468。

種名 *Strigogoniatites nodosus* Chao 新種

(圖版 II, 圖 7—9; 插圖 4)

同前面所描述的同屬的種一樣，這一菊石也是只根據一塊標本而建立的，而且更破碎些。它們在外表上非常相似，都是半外捲型，呈扁盤狀，外輪環的腹部具有屋脊狀的外圍。但是這裏所述的一種也具有它自己獨有的特點，第一，即輪環側面的內圍有一低窪地帶，同時在臍緣部分高起成為肋狀。第二，在外輪環的臍緣上有不很顯著的突起出現，而內部輪環上無此現象，第三，臍部較寬(8 毫米)略大於直徑的三分之一。最後它的腹部和側面上都飾以均勻

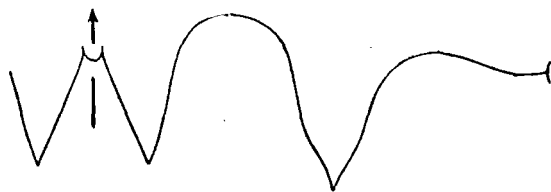


插圖 4 *Strigogoniatites nodosus* sp. nov.
的縫合線, $\times 3$

的、細微的旋紋。口腔皆為三角形。

縫合線與前一種相似。（見插圖 4）

層位及產地 柳江縣四方塘附近下二疊紀孤峯頁岩內。

登記號 7469。

參 考 文 獻

- [1] Bose Emil, 1919. The Permo-Carboniferous ammonoids of the Glass Mountains, West Texas and their stratigraphical significance, *Texas Univ. Bull.* 1762, p. 1-241, Pls. 1-11.
- [2] 趙金科, 1947 廣西地層發育史, 中國地質學會會誌 27 卷, 321-346 頁. (in English)
- [3] Gemmellaro, G. G., 1887. La fauna dei calcari Fusulina della valle del fiume Socio nella provincia di Paterno. *Giorn. Sci. Nat. ed. Econ.*, Vol. 19, p. 1-106, Pls. 1-10.
- [4] ———, 1888. La fauna dei calcari con Fusulina della valle del fiume Socio. Appendice. *Giorn. Sci. Nat. ed Econ.*, Vol. 20, p. 9-36, Pls. A-D.
- [5] Girty, G. H., 1908. The Guadalupian fauna. *U. S. Geol. Surv. Prof. Paper* 58, p. 1-651, Pls. 1-31.
- [6] Haniel, C. A., 1915. Die Cephalopoden der Dyas von Timor. *Paleont. von T. mor, Lief.* 3, Abh. 6, p. 1-153, Pls. 46-56.
- [7] Miller, A. K. and Furnish, 1940. Permian ammonoids of the Guadalupe Mountain Region and adjacent areas. *Geol. Soc. America, Special Paper* 26, p. 1-241, Pls. 1-44.
- [8] ———, 1944. Permian Cephalopods, In: Geology and Paleontology of the Permian area NW. of Las Delicias, Mexico, *Geol. Soc. America, Special Papers* 52, p. 71-170, Pls. 20-45
- [9] Plummer, F. B. and Scoth, Gale 1937. Upper Paleozoic ammonites in Texas. *Texas Univ. Bull.* 3701, p. 1-516, Pls. 1-41.
- [10] Руженцев В., Е. 1951. Нижнепермские аммониты Южного Урала, 1. Аммониты Сакмарского яруса. Тр. Палеонт. ин-та, том. 33, стр. 1-188, табл. 1-15.

SOME PERMIAN AMMONOIDS FROM KWANGSI AND THEIR SIGNIFICANCE

CHAO KINGKOO

Institute of Palaeontology, Academia Sinica

(Abstract With 2 Plates and 4 Textfigs.)

INTRODUCTION

The material on which this paper is based was collected by Messrs. S. F. Sheng and T. T. Jü from the "Kufeng" formation in central Kwangsi during their field investigation in the last two years.

The "Kufeng" formation is chiefly composed of siliceous limestone and shales attaining a thickness from 30 to 100 meters, widely distributed in the eastern, southeastern and east-central parts of Kwangsi. No palaeontological data are readily available in this region. On account of the underlying fossiliferous Chihsia limestone and the overlying Lungtan coal series with *Gigantopteris*, it has long been regarded as the equivalent beds of the Maokou limestone, which is well and widely developed in the central and western parts of that province. The discovery of ammonoids in this formation is therefore of specially interest, for it furnishes fossil evidence on the age of the formation.

The material contained in present study came from three different localities. The majority of the specimens were collected by Mr. Sheng, only a few of them were obtained by Mr. Jü and the writer.

The first locality is at Sze-fongtang in the Liukiang district about 10 km. south of the Liukiang city. The following ammonoids were procured in the shales, which are succeeded disconformably by the Lungtan coal series composed of shales and sandstone.

Waagenoceras simplex sp. nov.

Waagenoceras umbilicatum sp. nov.

Shengoceras lenticulare Gen. et sp. nov.

Strigonomiatites nodosus sp. nov.

The second locality is Poholing about 12 km. further south in the same district near Szejung village. Here the following four species of ammonoids were obtained in the shales about 30 meters above the Chihsia limestone.

Waagenoceras simplex sp. nov

Waagenoceras shengi sp. nov

Shengoceras lenticulare Gen. et sp. nov.

Strigogoniatis liukowensis sp. nov

The third locality is Feignoling, about 7 km. northwest of Funghwang station along the Hsiangkwei Railway in the Laipin district. This locality furnishes only one specimen of ammonoids, namely *Waagenoceras simplex*.

Thus the cephalopod faunule under study contains six species belonging to three genera of ammonoids. No other kind of fossils are known in association with them. The specimens are completely ferruginated with the test of the shells almost completely exfoliated, exposing their suture-lines very clearly.

The writer wishes to take this opportunity to express his indebtedness to Messrs. S. F. Sheng and T. T. Jü for their kindness to entrust him these interesting fossils for study. He is also indebted to Mr. S. Y. Liu of the Institute for fine the photographs.

ANALYSIS OF THE FOSSILS

Before entering the discussion on these ammonoids and their geological age, a brief account on the current usage of the Permian system in China seems necessary. In the last twenty years the definition of this system has been greatly changed than the original one given by Murchison, especially with regard to its lower boundary. As has been used at the present time in the Urals, this system begins with the Sakmarian upward to the Tartarian, the lowest division includes largely, if not wholly, the upper Carboniferous limestone beds formerly known as the Uralian. In adoption of a two-fold classification the Russian geologists include the Sakmarian, the Artinskian and the Kungurian in the Lower Permian and the Ufinian, the Kazanian and the Tartarian in the Upper Permian. In the Glass Mountains as well as in the Guadalupe Mountains in Texas, N. America, the Permian System begins with the Wolfcamp, which was also formerly included in the Upper Carboniferous. The American geologists, however, adopt a three-fold classification. The Wolfcamp forms the Lower Permian division. The Leonord and Word are classified as the Middle and the Captan as the Upper Permian. In China, the Maping limestone and the Chuanshan limestone, which are equivalents of the Sakmarian and Wolfcamp, were formerly included in this system. They are excluded from it in recent years and include in it the Yangsinian as the Lower

Permian (=Chihhsia + Maokou) and the Lopingian as the Upper Permian including the Changhsing limestone. These two divisions, namely the Chihhsia and the Maokou of the Yangsinian, correspond roughly to the Artinskian and the Kungarian of the Urals as well as to the Leonord and the Word of Texas.

Let us now to the discussion on the characters of the ammonoids described in this paper and their geological and palaeontological significances.

Among the three genera of ammonoids, *Shengoceras* is a new genus characterized by lenticular form with keeled outer periphery and subammonitic sutures. No close relatives are known to occur in other parts of the world. It can not be used alone as an index of stratigraphical horizon. The second genus is *Strigogoniatis*. The genotype, *Strigogoniatis angulatus* (Haniel) of Timor, according to Haniel and Miller, came most probably from the Upper Permian. The two species of this genus, namely *S. liuchowensis* and *S. nodosus*, are very primitive forms with the keeled venter not well developed. They are more or less related to *Strigogoniatis fountaini* Miller and Furnish of the Upper Permian Lamor limestone in Texas and to *S. kingi* Miller from the *Timorites* beds of Mexico. The two species of this genus in Kwangsi, like those two forms mentioned above, represent intermediate forms of this genus and *Altudoceras* of Ruhzencev or *Pseudogastrioceras* (pars.) in the sense of Miller. The angulation of the outer periphery shows that they are more related to the former genus than to the latter. It appears clear that the Kufeng formation from which the fossils were derived may be of Upper Permian age.

The last but the most important genus is *Waagenoceras*, which has been known to occur in the Sosio beds of Sicily, in the Basleo beds of Timor and in the Word formation and its equivalents in North America. According to Miller and Furnish, this genus has not been found in beds older than Upper Middle Permian (=Lower Permian of China), but ranges upward into the Upper Permian. The latter case is only known from Texas and Mexico, where some specimens of *Waagenoceras guadalupense* Girty and *W. dieneri* Bose were procured from the Captan formation. Moreover, it should be noted that the Kwangsi species of this genus represent the most primitive forms with simple sutures and much small number of lateral lobes, being only three on each lateral side, instead of five to seven as in other forms. It seems to the present writer that the three species of this genus cannot be younger than other known forms of its congeners and may

be even older in geological age.

The discovery of these ammonoids in the "Kufeng" formation is of specially interest, not only for it furnishes us fossil evidence on the geological age of that formation, but also for the peculiarity of the genera. The three species of *Waagenoceras* show very primitive characters of that genus on the one hand; while the occurrence of the two primitive species of *Strigogoniaticites* indicates that this genus has made its appearance in this region in a much earlier geological horizon than its congeners in other parts of the world.

DESCRIPTION OF SPECIES

Waagenoceras Gemmellaro 1887

(Type: *Waagenoceras mojsisovicsi* Gemm.)

Waagenoceras simplex chao sp. nov.

(Pl. I, figs. 1-11, textfig 1a-b)

This is the most common form of the genus *Waagenoceras* procured in the Liukiang and Laipin districts. Specimens included in this species are seven well preserved individuals and several fragments. Most of which exhibit their suture-lines during long time of weathering.

The form is strongly involute, subglobose in outline with the flanks more or less compressed laterally. The whorls are rather high with lunar cross-section, being wider than high. The outer whorl embraces almost completely the inner penultimate one and is impressed by the latter about one-half of its whorl height. The venter is broad and well arched. The lateral flanks are convex sloping and converging from the umbilical rim towards the outer periphery with strong curvature. There is no clear demarcation between the ventral portion and the lateral flanks. The umbilicus is very narrow and deep with steep walls and distinct but rounded shoulders. No constrictions are noticeable on the outer whorl as well as in the inner volutions. Where the test is preserved, it shows that the surface is quite smooth. Length of body chamber unknown.

The three younger forms referred to this species show more globose character of the shell (Pl. I, figs. 6-11).

The suture-line is characteristic of the genus but is much simpler than those of typical forms of Sicily, Timor, Texas and Mexico. They are evenly and well spaced, running more or less in a straight line across the venter. Each side of the

external part consists of a ventral divided lobe, three monophyllic lateral lobes, a narrow simple one on the umbilical shoulder and two simple lobes on the wall. The ventral lobe is very long and slightly contracted anteriorly. It is divided by a narrow, high, siphonal saddle notching upward about two-fifths of the ventral lobe. The lower portion of the lateral branches is strongly and coarsely serrated, while the upper part remains simple and smooth. The first and second lateral lobes are long with more or less parallel sides and six to seven coarse digitates; among them the three terminals are much more pronounced. The third lateral is much simpler and shorter bearing four denticles. The remaining lobes on the umbilical edge and wall are simple and pointed posteriorly. The saddles between the lobes are entire with their tops more or less depressed.

Remarks: Morphologically, this species bears close resemblance to *Waagenoceras dieneri* Bose of Texas, especially the young forms, in having a narrow and deep umbilicus. Great differences are noticeable in the present form in possessing primitive suture-lines with much small number of lobes. Moreover, constrictions are sometimes present in the mentioned form, which are not observed in the Kwangsi materials.

Horizon and Locality: The holotype was obtained by Mr. Sheng in the loose rocks at Feignoling, northwest of Fenghuang in the Laipin district. Another mature specimen and four young forms were found by Sheng and the writer in the "Kufeng" shale on Poholing in the Liukaing district.

Cat. No. Holotype 7459, paratype 7460-7463.

***Waagenoceras umbilicatum* chao sp. nov.**

(Pl. 1, figs. 12,13 Text-fig. 2a.)

The erection of this species is based on a single, small example in the Szefongtang collection, which is probably an immature form. It represents only the septate portion with the body chamber entirely unknown and part of the shell broken. The general external shape of the shell is quite similar to that of *Waagenoceras guadalupense* Girty, being characterized by globular configuration with wide and deep umbilicus. The whorl is also lunar in cross section. Three indistinct constrictions are noticed in the outer volution curving forward on the broad venter. The test of the shell has been largely exfoliated, which seems to be perfectly smooth. Any attempt is failed to find their specific difference in external character

between this form and the mentioned species, except the character of the suture-line, which contains much small number of lateral lobes and saddles.

The suture-line is essentially like that of the preceding form; each side of the external suture being composed of a divided ventral lobe and three laterals on the ventro-lateral side. The digitates of these lobes are quite distinct but much fewer in number. A simple triangular lobe is located on the umbilical edge and another similarly shaped lobe is present on the umbilical wall.

Horizon and Locality: The unique example of this species came from the "Kufeng" shales near Sze-fongtang in the Liukiang district.

Cat. No. 7464.

***Waagenoceras shengi chao* sp. nov.**

(Pl. I, figs. 14,15; Pl. II fig. 13; text-fig. 2b.)

This species, like the preceding form, is also represented by a single but well preserved example. Although the material under studying is so scant, its peculiar surface sculpture makes it desirable to give a specific name.

The form of the shell is globose in shape, moderately evolute with trapizoidal whorl section. The whorls are very low, almost completely embracing and moderately impressed by the inner volution. The venter is broadly arched, curving strongly from that portion towards the umbilical edges without marked demarcation between the ventral part and lateral flanks. The umbilicus is rather wide and deep, occupying about one-fourth of the diameter, and is bordered by steeply inclined walls and distinct, rounded shoulders. The body chamber is not preserved; the length of which is unknown.

The surface is sculptured with regular, distinct grooves or constrictions, numbering 16 in the last volution. They bend strongly forward on the ventral portion and recline backward on the ventro-lateral flanks then curve forward again on the umbilical rims forming elongated nodes and grooves.

The suture-line is essentially similar to that of the preceding form. Each side of the external part consists of a wide, divided ventral lobe with three distinct digitates in the lower portion of the inner side of the prongs or branches. Two lateral lobes are noticeable on the ventro-lateral flanks, which are more or less club-shaped with five to six digitates. A third one is located on the umbilical edge consisting of only three strong serrations. Another serrated lobe seems to

be present on the umbilical wall, where the surface is much worn. All the saddles between the lobes are entire.

Remarks: The presence of regular, distinct grooves or constrictions on the surface of the shell distinguishes this species from its congeners without any difficulty. As stated by Miller and Furnish, other species of this genus, like most other Palaeozoic genera of Ammonoids possess broad sinus indicating the presence of a swimming organ. The strong forward bending of the constrictions on the ventral portion indicates that the species under consideration may have possessed a broad ventral rostrum on the body chamber. The presence of a broad ventral rostrum naturally implies that the animal has adopted a nectobenthonic habit in the sea water.

Horizon and Locality: The only specimen of this species was procured from the "Kufeng" shale at Poholing in the Liukiang district.

Cat. No. 7465.

Genus *Shengoceras* Chao Gen. nov.

Genotype: *Shengoceras lenticulare* Chao Gen. et sp. nov.

Diagnosis: More or less involute, lenticular ammonoids with sharply keeled outer periphery. Whorls high and triangular in cross section with laterally compressed sides. Umbilicus moderately wide and deep. Surface smooth. Suture-line subammonitic, with three pairs of megaphyllic saddles and same number of monophyllic lobes in the external part.

Occurrence: Lower Permian of Kwangsi.

Remarks: The specimens upon which this new genus is erected comprise a well preserved mature individual and a young form. The general external shape of it recalls that of typical *Strigoniites* in having a sharply keeled outer periphery and tendency to develop a pair of "ear" around the umbilical border, except the absence of spiral lines on the outer portion of lateral sides, which is characteristic of the mentioned form. More important is the peculiarity of its suture-lines, which are quite like those of *Waagenoceras*. Both of them are characterized by megaphyllic saddles and monophyllic lobes, but the number of saddles and lobes in the external suture-line is much smaller even in the mature specimen, being only three pairs instead of 5-7 as in that genus. The ventral lobe is not very clear in the two specimens under studying, but it seems much less divided by a

siphonal saddle.

Associated with these specimens are a number of new species of *Waagenoceras*. The number of lateral lobes of which mention has already been made is also smaller, usually three on each lateral side. On this account, the writer has once suspected that these specimens may represent strongly compressed *Waagenoceras*. A closer examination of the specimens convinced the writer that the penultimate whorl in the mature specimen is also characterized by keeled venter and most part of the sides are gently convex, indicating the presence of a keel in the outermost whorl not due to lateral compression but to the original nature of the shell. Its phylogenetic relation is not well known, but the character of the suture-line suggests that it may represent keeled offshoot from a common ancestor with *Waagenoceras*.

The generic name is given for Mr. S. F. Sheng, who collected the mature specimen.

***Shengoceras lenticulare* Chao gen. et sp. nov.**

(Pl. II, figs. 1-4,5,6, text-fig.3.)

As stated in the generic discussion, this species is represented by two examples, a mature one and a young form. The former comprises all the septate part with the test largely preserved, which is designated as the holotype of the species and consequently the genotype of the genus. The following description is based on the larger mature specimen.

Shell moderately involute, lenticular in shape with sharply keeled outer periphery. The diameter measures 35mm across the umbilicus. The embracing is very great and the indentation by the penultimate volution is very deep, about one-third its whorl height. Whorls rather high with the lateral sides greatly compressed, giving a triangular cross-section, much higher than wide. Lateral sides gently convex with the maximum thickness at the umbilical edge, which is distinct and angular. Two "ears" begin to make their appearance on the outer portion of the last whorl. The umbilicus is deep, narrow and funnel-shaped, occupying an area less than one-fourth (8 mm) of the diameter, bordered by high, steeply inclined walls. The test of the shell is well preserved in most part, which is quite smooth throughout different growing stages.

The suture-line is not well exhibited in most part of the shell. Fortunately

enough the outermost two sutures are shown on one side, each comprises three short monophyllic lateral lobes. The first and the second with three prominent digitates at the posterior portion and distinct serrations on the sides. The third one is much shorter than the other laterals with fewer but distinct serrations. A simple short lobe is followed on the shoulder and another one on the wall. All the saddles are entire with more or less depressed tops. The auxiliary elements on the umbilical wall can not be ascertained. The ventral lobe can not be perceptible on this side, but it is shown in another two lines on the opposite side. It is very long and wide, divided by a very narrow siphonal saddle. Each prong or lateral branch bears three distinct serrations at the posterior end and distinct serrations on the outer side. The lateral saddles are very low and broad.

The second specimen (Pl. II, figs. 5,6) is a more poorly preserved example consisting most of the septate portion with the body chamber completely worn away and part of the penultimate whorl broken. The general external shape is quite like that of the typical form just described, being characterized by a keel on the outer periphery. The diameter amounts to 22 mm across the umbilicus, which is moderately sized.

The suture-lines are similar to that of the holotype with a short ventral lobe and three laterals but much simpler; each bearing four distinct serrations or digitates at the end. A simple lobe is also located above the shoulder. Like the preceding specimen, the shoulder is deeply worn with the remaining sutural elements not preserved.

Horizon and Locality: The holotype was procured by Mr. S. F. Sheng from the Permian Kufeng formation at Poholing in the Liukiang district associated with *Waagenoceras simplex* Chao; the smaller specimen was obtained by Mr. T. T. Jü at Szefongtang in the same district.

Cat. No. holotype 7466, paratype 7467.

***Strigogoniatites* Spath 1934**

Genotype: *Glyphioceras angulatum* Haniel

***Strigogoniatites liuchowensis* Chao sp. nov.**

(Pl. II, figs. 10-12)

The shell is moderately sized, more or less involute and subdiscoidal in shape with the lateral flanks greatly compressed laterally. The whorl section is more

or less triangular, especially in the outer whorl, which is higher than wide. The involution is very great; the outer whorl embraces the inner penultimate one almost completely leaving a narrow belt near its umbilical edge and deeply impressed by it about one-third of its whorl height. The venter is well rounded in the inner volutions becoming narrower and narrower toward the outer one, where an indistinct keel is developed during the growth of the shell to form a roof-like outer periphery. The umbilicus is moderately deep and wide, measuring 9 mm across, or less than one-fifth of the diameter (48.5 mm) bordered by perpendicular walls and distinct, rectangular shoulders. The test of the shell is almost completely exfoliated; the inner cast or impression shows that the outer portion of the flanks and the ventral part are marked with regular, fine longitudinal striagations or lines; whereas the inner part of the flanks and the umbilical wall may remain smooth. Aperture triangular in shape. Length of body chamber unknown.

Septa regularly spaced, numbering 15-16 in the last volution. The suture-line is composed of eight primary lobes and corresponding number of saddles. The ventral lobe is very wide, deeply notched by a medial saddle, dividing it into two sharply pointed branches. The lateral lobe is rather narrow with a sharp point at its posterior end. On the umbilical wall is an umbilical lobe, which is broadly rounded. The outer saddle is very wide, broadly rounded at its top and is much higher than the lateral one, which is wider and asymmetrically arched. The inner lateral lobes are much narrower and shorter than the outer ones, probably also pointed at its end. The dorsal lobe is narrower than the internal laterals and is tongue-shaped.

Remarks: Although this species is founded on a single example and only the septate portion is represented. The perfect state of preservation makes it desirable to assign it in the proper position in the genus *Strigonomiatites*. The sharpening of the venter in the outer periphery has appeared as a conspicuous keel and there is reason to believe that it should be more pronounced on the body chamber.

This species, like the next describing form, *S. nodosus* sp. nov., represents a primitive form of the genus *Strigonomiatites*. It is closely allied to the young forms of *S. fountaini* Miller and Furnish from the Lamar limestone in the Patterson Hills of Texas, differing therefrom in the more triangular whorl section and more broadness of the outer saddle in the suture-line. *Strigonomiatites kingi*

Miller from the *Timorites* beds of Las Delicias, Mexico, is a more related species of the genus in having a triangular whorl-section and a keeled venter in the early maturity, but that species is a more widely umbilicate form with also a narrower outer saddle in the suture-line.

The two species mentioned in foregoing paragraph as well as the genotype, *S. angulatus* of Timor came from the Upper Permian rocks, while the present species and the following form, according to the collectors, were procured from the "Kufeng" formation. This formation is believed to be the corresponding beds of Maokou limestone or Upper Yangsinian in the region. If the assignment of these two species is correct, it obviously implies that this genus has appeared in much earlier geological period in the Kwangsi province.

Horizon and Locality: From the "Kufeng" siliceous shale at Poholing in the Liukiang district, Kwangsi.

Cat. No. 7468.

***Strigoniatites nodosus* chao sp. nov.**

(Pl. II, figs. 7-8, textfig. 4.)

Like the preceding form, this species is also erected upon an unique but more fragmentary example. They are morphologically alike being moderately evolute, subdiscoidal in shape with well rounded venter in the inner volutions and fastigate outer periphery in the outer whorl. However, some peculiar surface sculptures of specific value exist in this form. First of all, the inner portion of the lateral flanks is strongly depressed to form a shallow, spiral groove, and a raised umbilical ridge is resulted. Secondly, faint nodes are present on the umbilical shoulder in the outer whorl, which are absent in the early whorls and may be more pronounced on the body chamber. Thirdly, the umbilicus (8 mm.) is wider, more than one-third of the diameter (34.6 mm.); and lastly, the ventral portion and the lateral flanks are completely ornamented by fine, regular, spiral striations. The aperture is also triangular in outline.

The suture-lines are materially and morphologically like those of the preceding form.

Horizon and Locality: From the "Kufeng" siliceous shale at Sze-fongtang in the Liukiang district, Kwangsi.

Cat. No. 7469.

圖 版 說 明

圖 版 I

圖 1—4. *Waagenoceras simplex* Chao 新種。

1, 2. 正型的側面及正面, 原大, 登記號: 7459。

3, 4. 同上, 放大 1.5 倍。

產地: 廣西來賓鳳凰西北飛鵝嶺北坡。

圖 5. *Waagenoceras simplex* Chao 新種。

副型的側面, 放大 1.5 倍。登記號: 7460。

產地: 廣西柳江思榮波河嶺孤峯層。

圖 6—7. *Waagenoceras simplex* Chao 新種。

幼年期殼的側面及正面, 放大 1.5 倍。登記號 7461。

產地: 同上。

圖 8. *Wagenoceras simplex* Chao 新種。

另一幼年期殼的側面, 表示縫合線, 放大 1.5 倍。登記號: 7462。

產地: 同上。

圖 9—11. *Waagenoceras simplex* Chao 新種。

9, 10. 另一幼年期殼的側面及正面, 放大 1.5 倍。登記號: 7463。

11. 同一標本的腹面, 表示體管的形狀, 放大 2 倍。

產地: 廣西來賓鳳凰西北飛鵝嶺北坡。

圖 12—13. *Waagenoceras umbilicatum* Chao 新種。

正型的側面及正面, 放大 1.5 倍。登記號: 7464。

產地: 廣西柳江縣四方塘孤峯層。

圖 14—15. *Waagenoceras shengi* Chao 新種。

正型的側面及正面, 放大 1.5 倍。登記號: 7465。

產地: 廣西柳江思榮波河嶺孤峯層。

圖 版 II

圖 1—4. *Shengoceras lenticulare* Chao 新屬新種。

1—3. 正型的正面, 側面及腹面, 原大, 登記號: 7466。

4. 正型的縫合線, 放大 2 倍。

產地: 廣西柳江思榮波河嶺孤峯層。

圖 5—6. *Shengoceras lenticulare* Chao 新屬新種。

幼年期殼的腹面及側面, 原大, 登記號: 7467。

產地: 廣西柳江思榮, 老虎弄, 孤峯層。

圖 7—9. *Strigogniatites nodosus* Chao 新種。

7, 8. 正型的側面及正面, 原大, 登記號: 7469。

9. 正型的另一側面示旋紋, 放大 1.5 倍。

產地: 廣西柳江四方塘孤峯層。

圖 10—12. *Strigogniatites liuchowensis* Chao 新種。

10, 11. 正型的側面及正面, 原大, 登記號: 7468。

12. 正型的另一側面示縫合線及旋紋。

產地: 廣西柳江縣思榮波河嶺孤峯層。

圖 13. *Waagenoceras ahengi* Chao 新種。

正型的腹面, 放大 1.5 倍。登記號: 7465。

產地: 同上。

