

江苏南部茅口期的筳类

盛金章

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近年来,在江苏省南部从事地质勘探的同志们陆续在无锡市及苏州市近郊发现了一些茅口期的筳类。这些筳类过去还没有在东南沿海各省见有报道。它们的发现,对茅口期古地理的阐明以及对了解茅口期的岩相变化,都具有一定的意义。

无锡市和苏州市近郊茅口期的沉积,江苏省地质局的有关同志拟名其为堰桥组。这个组的地层次序,综合起来,大致可以分为上、中、下三部:

上复地层——龙潭组

——? 整合——

3. 上部——灰至灰绿色砂岩夹少量砂质页岩,顶部有一层厚度不大的砂质石灰岩。石灰岩中产下列筳类:

Neomisellina lepida (Schwager)

N. ellipsoidalis (Schwager)

N. multivoluta Sheng (MS)

N. compacta (Chen)

Codonofusiella wusiana Sheng et Wang sp. nov. (新种)

Kahlerina sinensis Sheng (MS)

Reichelina? *changanchiaoensis* Sheng et Wang sp. nov. (新种)

Schwagerina aff. *pactiruga* Chen 约80米。

2. 中部——灰至深灰色砂质页岩、页岩夹细砂岩。产腕足类 *Bembexia* sp. 及保存不好的头足类及瓣鳃类等化石。..... 约100米。

1. 下部——深灰至灰黑色砂质页岩夹少量砂质页岩。产腕足类 *Plicatifera minor* (Schellwien) 及头足类 *Paragastrioceras* sp. 等。..... 约60米。

——整合——

下伏地层——栖霞组。

堰桥组总厚约240米,绝大部分由砂页岩组成,只有最顶部有厚度不大的石灰岩层。在岩性上,它和中国南部其他地区绝大部分由石灰岩组成的茅口组不同,而和皖南及宁镇山脉常见的、以砂质页岩为主的孤峯组也有明显的差异。筳类动物群产在堰桥组的顶部,在其中、下部都未曾发现此类化石。

江苏南部茅口期筳类动物群即本文描述者共计5属8种,其中有两个新种。这个动物群中以 *Neomisellina* 一属占的份量最重,共有四种。在这四个种之中,又以 *Neomisellina compacta* (Chen) 的个体最多,其他三种即: *Neomisellina lepida* (Schwager), *N. multivoluta* Sheng (MS) 及 *N. ellipsoidalis* (Schwager) 略少。 *Neomisellina* 一属是盛金章最近新建的一个新属,其属型是 *Schwagerina lepida* Schwager。这个种首见于我国湖北省茅口

組，为希瓦格(Schwager, 1883)描述发表；后来陈旭教授(1956)亦曾描述此种，标本采自湖北武穴組(相当于茅口組)；最近盛金章在广西宜山一带亦曾发现，标本产在茅口組上部 *Yabeina* 带中。我們这次研究的标本中也有这个种存在，但个体不多。*Neomisellina multivoluta* Sheng(MS)及 *N. compacta*(Chen)在广西宜山一带經常和 *N. lepida*(Schwager) 共生。*N. ellipsoidalis*(Schwager)过去虽只在湖北发现，但它也是常和 *N. lepida*(Schwager) 共生的。所有这四个种都是我国茅口期的特产，世界上其他地区还没有见到报道。

Kahlerina 在当前这个动物羣中只有 *K. sinensis* Sheng (MS) 一种，个体很少。这个尚未发表的种在广西宜山一带常見于茅口組的中上部，但以产在上部 *Yabeina* 带中者最多。湯姆生及密勒(Thompson and Miller, 1935)把采自我国四川峨嵋山附近茅口組的两个标本定名为 *Endothyra?* sp. 者，看来也应该属于 *Kahlerina*。

Codonofusiella 在这个动物羣中个体很少，占的份量很小。这个属最初发现于美国开匹敦灰岩(Capitan Limestone)。美国地質古生物学者认为开匹敦灰岩属于晚二迭世，卢衍豪(1956, 頁 75)則认为它大致和我国茅口組的 *Verbeekina-Neoschwagerina* 带相当。在特提斯海区(Tethys Sea Area)及日本，*Codonofusiella* 大都和 *Yabeina*, *Neoschwagerina* 及 *Lepidolina* 共生[斯肯奴及瓦尔德(Skinner & Wilde), 1954, 頁 435; 勘米良(Kanmera), 1954, 頁 6]。在烏苏里江一带，这个属常和 *Lepidolina* 及 *Yabeina* 共生[杜曼斯卡婭(Туманская), 1953]。在我国陝西梁山，除掉一个可疑的 *Codonofusiella* (*Codonofusiella?* *minuta* Sheng) 曾見于茅口組以外，这个属几乎全部富集在上二迭統吳家坪組中(卢衍豪, 1956, 頁 75; 盛金章, 1956)。这个属在苏联北高加索列克盆地的地質分布情况[克·姆·-馬克萊(K. M.-Маклай), 1954]，大致和我国梁山区相似。当前发现的 *Codonofusiella* 是一个新种，即：*C. wusiana* Sheng et Wang，它的主要特征和吳家坪組中所产者区别較大，而和北美开匹敦灰岩中所产的 *C. paradoxica* Dunbar et Skinner 比較接近。

Schwagerina 也是組成当前这个动物羣的一个份子，但个体很少。我們发现的只有一个种即 *Sch. aff. pactiruga* Chen，它和湖南湘乡清溪冲組(相当于茅口組；陈旭, 1956)及陝南梁山茅口組中(盛金章, 1956)最常見的 *Schwagerina pactiruga* Chen 非常接近。

被我們暂时归入 *Reichelina* 属中的一个新种即 *Reichelina?* *changanchiaoensis* Sheng et Wang 也是組成当前动物羣的一个份子，个体极少，由于它是一个新种而且属名的鉴定还有疑問，所以它对决定地层时代的作用不大。但是必須指出，从壳形和旋壁构造等特征来看，它确实和 *Reichelina* 的属型非常接近。*Reichelina* 最初发现于土耳其，和 *Cancellina*, *Neoschwagerina*, *Codonofusiella* 及 *Polydiexodina* 共生。虽然埃克(Erk, 1941)认为它的时代属于晚二迭世，但其共生的筳則均为我国茅口期的产物。*Polydiexodina* 在我国南部尚未发现，但在祁連山地区确实产在 *Verbeekina* 层附近，也属于茅口期。*Reichelina* 和 *Codonofusiella* 的情况相仿，在我国及苏联北高加索都是二迭系上統常見的一个属，但至少，在土耳其是在茅口期开始出現的。当前的新种 *Reichelina?* *changanchiaoensis* Sheng et Wang 和吳家坪組常見的种相比，显得壳体很大，壳圈包捲很松；差别很大。

综上所述，虽然这次在江苏南部发现的茅口期筳类动物羣不很丰富，但除新种而外，其他各种絕大部分是組成我国南部茅口組上部 *Yabeina* 带的常見份子。尽管我們这次还没有发现 *Yabeina* 属的任何一个种，但可以得出結論，堰桥組頂部的含筳灰岩是可以和

Yabeina 带对比的。而整个堰桥组则大致和整个茅口组相当,其时代属于早二迭世晚期。

本文描述的标本是在无锡市及苏州市附近工作的地质队供给的。薄片是中国科学院地质古生物研究所磨片组制成的。图影是该所照相组摄取的,我们在此向上述有关同志们致谢。本文外文稿是经斯行健教授精心修改的,我们也向他深深致谢。

种的描述

簾目 Order Fusulinida A. M.-Maclay, Rauser et Rosovskaya, 1959

紡錘簾超科 Superfamily Fusulinidea Möller, 1878

小泽簾科 Family Ozawainellidae Thompson et Foster, 1937

小泽簾亚科 Subfamily Ozawainellinae Thompson et Foster, 1937

拉且尔簾属 Genus *Reichelina* Erk, 1941

长安桥拉且尔簾(?) *Reichelina? changanchiaoensis* Sheng et Wang sp. nov. (新种)

(图版 I, 图 5—7)

描述: 壳微小,凸鏡形,壳緣窄而略圓,臍部微凹。成虫有 5 圈,包捲都較松,最后半圈放寬較大。正型标本长 0.50 毫米,寬 1.10 毫米,軸率 0.45:1; 自第 1—5 圈的寬度依次为: 0.10, 0.20, 0.38, 0.68, 1.10 毫米。旋壁薄,由致密层及透明层組成;最外圈的旋壁厚約 0.02 毫米,由致密层及原始层組成,原始层具有极細的微孔构造。隔壁不褶皺。旋脊无。通道在軸切面上呈腎形。初房小,近乎球形,外径約 0.04 毫米。

討論: 当前的标本在壳形及壳体大小等方面和小泽簾很相象,但后者的旋壁系由三层或四层組成,和当前的标本有明显的区别。此外,小泽簾的旋脊比較发育,旋壁很厚,壳緣鋒銳,也和当前的标本不同。在旋壁构造上,当前的标本和拉且尔簾完全相同,二者的壳形也很相象。由于我們的标本最后一圈放寬不如拉且尔簾为大,所以还不能肯定它属于拉且尔簾。因此在属名之前冠一問号,表示存疑。

阿·姆·-馬克萊 (A. M.-Maclay, 1959) 曾建議以陈旭教授 (1934) 描述的 *Orobias kueichihensis* Chen 作为属型建立新属 *Chenella*。陈旭教授的标本采自安徽貴池栖霞組的頂部,其旋壁也是由致密层及透明层組成,最后半圈放寬也較大。笔者等怀疑它可能是拉且尔簾的一个原始的种。所以 *Chenella* 一名是否能够成立,还需要采集更多的标本进行研究才能确定。

当前的标本是一个新种,暂时归入拉且尔簾中。这个新种和 *Reichelina* 的属型即 *R. cribroseptata* Erk 的区别是它的壳緣窄而較圓,壳圈包捲較松,軸率較小。它和 *Reichelina? kueichihensis* (Chen) 不同之处为后者旋壁較厚,壳圈較少,壳体較大,初房較大,壳緣略尖,臍部微凸。

产地: 江苏无锡附近长安桥及藕塘。登記号: 13285 (正型标本), 13286—13287 (副型标本)。

史塔夫筳亚科 Subfamily Staffellinae A. M.-Maclay, 1949

卡勒筳属 Genus *Kahlerina* Kochansky-Devidé et Ramovš, 1955

中华卡勒筳 *Kahlerina sinensis* Sheng (MS)

(图版 I, 图 3—4)

描述：壳小，亚球形。4 圈，长 1.54 毫米，宽 2.00 毫米，轴率 0.77:1。自第 1—4 圈的宽度依次为：0.34, 0.65, 1.16, 2.00 毫米。旋壁厚，由致密层及原始层组成。原始层具极细密的微孔构造。自第 1—4 圈的旋壁厚度依次为：0.03, 0.04, 0.08, 0.09 毫米。隔壁不褶皱。旋脊无。通道不明显。初房圆，外径约 0.16 毫米。

比较：当前的标本鉴定为 *Kahlerina sinensis* Sheng (MS)。这个种的正型标本产在广西宜山一带茅口组顶部。当笔者等写此文时，盛金章的论文尚未发表。当前的标本和广西的正型标本唯一的区别是壳圈略少，很可能是一个未成年的壳。这个种和 *Kahlerina ussurica* (Sosnina) 的区别为其壳体小，壳圈少，旋壁较厚，初房较小。

产地：江苏无锡长安桥。登记号：13283—13284 (近型标本)。

苏伯特筳科 Family Schubertellidae Skinner, 1931

布尔顿筳亚科 Subfamily Boultoninae Skinner et Wilde, 1954

喇叭筳属 Genus *Codonofusiella* Dunbar et Skinner, 1937

无锡喇叭筳(新种) *Codonofusiella wusiana* Sheng et Wang sp. nov.

(图版 I, 图 8—9)

描述：壳微小，纺锤形，中部微凸，两极钝尖。4 圈；长 0.84 毫米，宽 0.40 毫米；轴率 2.1:1。第 1 圈球形，其中轴与外圈的中轴斜交。第二圈近乎球形，最后 2 圈纺锤形。第 1—4 圈的宽度依次为：0.08, 0.13, 0.22, 0.40 毫米。旋壁薄，由致密层及透明层二层组成。隔壁褶皱强，比较规则，褶曲之高约为壳室的 2/3。旋脊很小，仅见于第二圈上。通道不清楚。初房圆，外径约 0.03 毫米。

比较：这个新种和喇叭筳的属型即 *Codonofusiella paradoxica* Dunbar et Skinner 比较接近，但后者的壳圈少而壳体反而较大。此外，后者的初房较大，最后半圈放宽也较大。当前的新种和日本球磨组 (Kuma formation) 中所产的 *Codonofusiella cuniculata* Kanmera 也有些相似，但是它的隔壁褶皱较弱而规则，壳体较小，最后半圈放宽也较小，容易和后者区别。

产地：江苏无锡长安桥。登记号：13288 (正型标本)，13289 (副型标本)。

希瓦格筳科 Family Schwagerinidae Dunbar et Henbest, 1930

希瓦格筳属 Genus *Schwagerina* Möller, 1877

希瓦格筳 aff. 狭褶种 *Schwagerina* aff. *pactiruga* Chen

(图版 I, 图 1—2)

1956, *Schwagerina pactiruga* Chen, 中国古生物志, 新乙种第 6 号, 页 7, 39; 图版 VIII, 图 4—5。

1956, *Schwagerina pactiruga* Sheng, 古生物学报, 4 卷, 2 期, 页 188, 211; 图版 VIII, 图 7—8。

描述：壳大，长纺锤形，中部微拱，两极钝尖。一个保存较好的标本有 9½ 圈，长 7.22

毫米,寬 2.14 毫米。軸率 3.32:1。第 1—9 圈的寬度依次为: 0.20, 0.27, 0.36, 0.47, 0.62, 0.84, 1.10, 1.45, 1.86 毫米。所有壳圈包捲都較紧。旋壁由致密层及蜂巢层組成;其在第 2 圈上厚約 0.011 毫米,在第 5 圈上厚 0.035 毫米,第 9 圈上厚 0.05 毫米。隔壁褶皱很強,比較規則;褶曲窄而高,約为壳室之高的 2/3。旋脊很小,仅見于內部 1—3 圈上。通道不清楚。軸积輕微,分布在中軸沿綫的每个壳圈内。初房外径約 0.14 毫米。

比較: 当前的标本和 *Schwagerina pactiruga* Chen 在外形及隔壁褶皱等方面非常接近。但它每圈的寬度都較后者各相当壳圈的寬度为小,壳圈稍多,但壳体反而略小,所以不能肯定和后者为同种。当前的标本和 *Schwagerina hupehensis* Chen 也有些相象,但后者的壳体大,軸率大,壳圈包捲較松,可以和当前的标本相区别。

产地: 江苏无錫藕塘。登記号: 13281—13282 (近型标本)。

費伯克筴超科 Superfamily Verbeekinidea Staff et Wedekind, 1910

費伯克筴科 Family Verbeekinidae Staff et Wedekind, 1910

米斯筴亚科 Subfamily Misellinae Sheng (MS)

这个亚科是盛金章最近建議的。包括在这个亚科中的属有 *Misellina* Schenck et Thompson, *Brevaxina* Schenck et Thompson, *Pseudodoliolina* Yabe et Hanzawa 及 *Neomisellina* Sheng (MS)。这些属的共同特点亦即是新亚科的特征为拟旋脊在每圈上都发育完善,列孔很多。这些特征是和費伯克筴亚科中的各属具有不連續的拟旋脊及发育不完善的列孔的主要区别之点。

新米斯筴属 Genus *Neomisellina* Sheng (MS)

属型: *Schwagerina lepida* Schwager, 1883。

这个属是盛金章最近建立的。它的特征概述如下:

壳大,粗紡錘形至瓜形。中軸直,两极鈍圓。最初 2—3 圈盘形,中軸短。旋壁由致密层、細蜂巢层及其下一黑綫状物共三层組成。此黑綫状物可能相当于內疏松层,但較內疏松层致密,有时不連續。隔壁平直。拟旋脊窄而高,发育完善。列孔很多。

除属型而外,已經描述的下列各种也包括在这个属中:

Schwagerina lepida var. *ellipsoidalis* Schwager, 1883

Doliolina douvillei Gubler, 1935

Misellina compacta Chen, 1956

比較: 这个属和 *Misellina* 的区别为后者壳体很小,壳圈也很少,拟旋脊低而寬,列孔較少。在地层层位上,这个属也常較后者为高。后者常富集在栖霞組下部,这个属則常聚集在茅口組的上部。

精致新米斯筴 *Neomisellina lepida* (Schwager)

(图版 I, 图 13)

1883, *Schwagerina lepida* Schwager, "China", vol. IV, pp. XVII, figs. 1, 3, 4, 6.

1898, *Möllerina lepida* Schellwien, Palaeontographica, vol. 44, p. 258.

1956, *Misellina lepida* Chen (部份), 中国古生物誌, 新乙种第 6 号, 頁 10, 50; 图版 VI, 图 5, 8。

描述：只有一个不太完整的軸切面，但保存很好，微細构造都能看到。

壳中等，圓筒形，臍部微凹。12 圈，长 4.18 毫米，寬 2.01 毫米。軸率 2.08:1。第 1 圈近乎球形，其后各圈中軸漸次延長，壳形亦逐漸改变。第 1—12 圈的寬度依次为：0.21、0.28、0.36、0.41、0.49、0.61、0.73、0.91、1.10、1.38、1.11 及 2.01 毫米。旋壁由致密层，細蜂巢层及內疏松层組成。內疏松层呈黑綫状。旋壁在第 5 圈上厚約 0.015 毫米，第 10 圈上厚 0.02 毫米。隔壁不褶皺。拟旋脊窄而較高，发育完善，每圈都有。在第 10 圈上每 1 毫米之內有 5—6 个拟旋脊。列孔在外圈較多，切面近乎球形，在第 10 圈上有 14 个列孔。初房圓而小，外径約 0.11 毫米。

比較：当前的标本鉴定为 *Neomisellina lepida* (Schwager)。它和这个种的正型标本唯一的区别是壳圈較少，壳体也略小，很可能，当前的标本是一个未成年的壳。

陈旭教授(1956)把采自湖南清溪冲組中的标本(陈旭，图版 VI，图 6—7)归入这个种者，因为它们具有較大而短的壳，很可能是一个新种或是当前这个种的一个变种，所以沒有把它们列入当前这个种的同义名称表內。

产地：江苏无錫藕塘。登記号：13293 (近型标本)。

紧卷新米斯筳 *Neomisellina compacta* (Chen)

(图版 I, 图 12, 14, 15)

1956, *Misellina compacta* Chen, 中国古生物志, 新乙种第 6 号, 頁 10, 52, 图版 1V, 图 9—11。

描述：壳中等到大，长圓柱形，中部坦平，两极鈍圓。成虫有 13½ 圈，长 7.90 毫米，寬 2.62 毫米。軸率 3:1。所有壳圈包捲都很紧。第一圈近乎球形。其后各圈的中軸逐漸延長。旋壁薄，由致密层、細蜂巢层及內疏松层組成。內疏松层黑綫状。旋壁在第 6 圈上厚 0.01 毫米，在第 10 圈上厚 0.018 毫米。拟旋脊多，三角形。在第 11 圈上每 1 毫米之內有 8 个拟旋脊。列孔相当发育，切面近乎球形。初房近乎球形，外径約 0.2—0.27 毫米。度量結果(毫米)如下：

标本	长度	寬度	軸率	初房 外径	壳 圈 寬 度													
					1	2	3	4	5	6	7	8	9	10	11	12	13	13½
13292	7.90	2.62	3.0	0.23	0.37	0.46	0.53	0.62	0.72	0.86	1.04	1.25	1.44	1.66	1.76	2.05	2.42	2.62
13294	4.18	1.38	3.0	0.27	0.38	0.49	0.56	0.66	0.79	0.91	1.10	1.30	(8½) 1.38	—	—			
13295	5.55	2.01	2.76	0.20	0.30	0.38	0.49	0.57	0.68	0.84	1.03	1.29	1.56	1.79	2.01			

比較：当前的标本鉴定为 *Neomisellina compacta* (Chen)。陈旭教授建立此种时，依据三个标本，其中一个是中切面，另外两个是不完整的軸切面，保存都不太好。这三个标本都是采自湖北武穴組。陈旭教授沒有指出誰者是这个种的正型标本。由于这三个标本保存不很好，所以它們的壳圈数目及壳体大小还无法确知。我們当前的标本个体極多，保存也較好，成虫的壳圈一般較湖北的标本为多。考虑到在許多主要特征方面如壳圈寬度，拟旋脊的形状，壳圈包捲极紧等都和湖北的标本相同或极为接近，所以把它们和湖北的标本定为同种。这个种和 *Neomisellina lepida* (Schwager) 的明显区别是它的壳圈包捲特別紧，軸率及初房也都較大。

产地: 江苏苏州西山。登記号: 13292, 13294—13295 (近型标本)。

近椭圆新米斯簏 *Neomisellina ellipsoidalis* (Schwager)

(图版 I, 图 10)

1883, *Schwagerina lepida* var. *ellipsoidalis* Schwager, "China", vol. IV. pl. XVIII, figs. 2, 5, 7, 8.

描述: 壳中等, 近乎椭圆形, 脐部微凹。一个比较标准的标本有 15 圈, 长 5.4 毫米, 宽 3.4 毫米。轴率约 1.5:1。自第 1—15 圈的宽度依次为 0.13, 0.15, 0.22, 0.28, 0.34, 0.45, 0.62, 0.87, 1.17, 1.53, 1.89, 2.05, 2.59, 2.97, 3.40 毫米。最初 2 圈的中轴与外圈的中轴斜交。第 3 圈粗纺锤形, 轴率 1.36:1。第 5 圈轴率 1.85:1; 第 10 圈约 1.7:1; 第 15 圈约 1.5:1。旋壁三层, 在第 10 圈上厚约 0.015 毫米, 在最后一圈上约 0.02 毫米。隔壁平。拟旋脊发育完善, 在内圈呈三角形, 在外圈呈棒状, 其高约为相当壳室的 2/3。列孔小, 球形, 有的呈椭圆形。初房外径约 0.05 毫米。

比较: 这个种原来被希瓦格当作 *Neomisellina lepida* (Schwager) 的一个变种, 但它的壳呈椭圆形, 和 *N. lepida* 显然不同, 此外, 它的壳圈包捲较松, 轴率也较小, 所以现在把它当作一个独立的种。这个种和 *Neomisellina douvillei* (Gubler) 有些相象, 但它的壳圈包捲较紧, 拟旋脊比较齐整, 容易和后者区分。

产地: 江苏无锡长安桥。登記号: 13290 (近型标本)。

多圈新米斯簏 *Neomisellina multivoluta* Sheng (MS)

(图版 I, 图 11)

描述: 壳巨大, 近乎椭圆形。中部凸, 两极圆。成虫有 21 圈, 长 11.24 毫米, 宽 6.84 毫米。轴率 1.64:1。最初二圈近乎球形, 其后各圈渐变为粗纺锤形至椭圆形。第 1—21 圈的宽度依次为: 0.23, 0.30, 0.42, 0.50, 0.65, 0.84, 1.10, 1.40, 1.79, 2.16, 2.55, 2.95, 3.31, 3.69, 4.15, 4.56, 4.98, 5.40, 5.81, 6.24, 6.84 毫米。旋壁三层, 一如属型。旋壁很薄, 在内 5 圈上各约厚 0.015 毫米, 在其余各圈上各约厚 0.02 毫米。拟旋脊窄而高, 在第 10—15 圈上, 每 1 毫米之内约有 5—6 个拟旋脊。列孔相当多, 切面近乎椭圆形。在第 7 圈上有 7 个列孔, 在第 11 圈上有 26 个。初房圆, 外径约 0.13 毫米。

比较: 当前的标本鉴定为 *Neomisellina multivoluta* Sheng (MS)。这个种的正型标本产在广西宜山一带 *Yabeina* 带中。它的特点是壳体很大, 壳圈特别多, 旋壁较薄, 壳呈粗纺锤形。这个种和 *N. douvillei* (Gubler) 的区别是后者的壳小, 壳圈少, 拟旋脊高低不齐以及轴率较小。

产地: 江苏无锡长安桥。登記号: 13291 (近型标本)。

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THE FUSULINIDS OF THE MAOKOU STAGE, SOUTHERN KIANGSU

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The Maokou fusulinids described in this paper were collected by the members of a field party of the Kiangsu Geological Bureau in the vicinity of Wusi and Suchow cities, southern Kiangsu. The deposits of the Maokou stage of this region have been named by the collectors the Yianchiao formation. The whole sequence of this formation can be roughly subdivided into three divisions in descending order:

Super-formation—Lungtan formation

—— ? Conformity ——

3. Grey to greenish grey sandstones, shales and sandy shales intercalated with sandy limestones in the uppermost part. The following fusulinids have been found in the limestones.

Neomisellina lepida (Schwager)

N. ellipsoidalis (Schwager)

N. multivoluta Sheng (MS)

N. compacta (Chen)

Codonofusiella wusiana Sheng et Wang (sp. nov.)

Kahlerina sinensis Sheng (MS)

Richelina? *changanchiaoensis* Sheng et Wang (sp. nov.)

Schwagerina aff. *pactiruga* Chen

ca. 80 m.

2. Grey to deep grey sandy shales and shales, containing *Bembexia* sp. and some ill-preserved cephalopods and pelecypods ca. 100 m.

1. Dark grey siliceous shales intercalated with sandy shales, containing *Plicatifera minor* (Schellwien) and *Paragastrioceras* sp. ca. 60 m.

—— conformity ——

Sub-formation—Chihsia Limestone.

All fusulinid species occur in the uppermost part of the highest division of the Yianchiao formation. The fusulinid-bearing limestone bed is ranging from one to three metres

in thickness just below the *Gigantopteris* coal series.

The fossils described and illustrated here comprise 8 species in 5 genera, among which, *Codonofusiella wusiana* Sheng et Wang and *Reichelina? changanchiaoensis* Sheng et Wang are new species, *Neomisellina lepida* (Schwager), *N. ellipsoidalis* (Schwager), *N. multivoluta* Sheng (MS) and *N. compacta* (Chen) have been recorded hitherto only from the upper part, i.e. the *Yabeina* zone of the Maokou Limestone in the middle Yangtze Valley; *Kahlerina sinensis* Sheng (MS) has been found from the upper part of the Maokou Limestone in Kwangsi; *Schwagerina pactiruga* Chen is also very common in the Maokou Limestone of Hupeh and Southern Shensi Provinces. It is believed that the fusulinid-bearing limestone of the Yianchiao formation of southern Kiangsu may belong to the latest Lower Permian age.

DESCRIPTION OF SPECIES

Order Fusulinida A. M. Maclay, Rauser et Rosovskaya, 1959

Superfamily Fusulinidea Moeller, 1878

Family Ozawainellidae Thompson et Foster, 1937

Subfamily Ozawainellinae Thompson et Foster, 1937

Genus *Reichelina* Erk, 1941

Reichelina? changanchiaoensis Sheng et Wang (sp. nov.)

(Pl. I, figs. 5—7)

Test minute, lenticular. Axis of coiling short and straight. Periphery narrowly rounded. Umbilical regions slightly depressed. The holotype consisting of 5 volutions about 0.50 mm in length and 1.10 mm in width, with a form ratio about 0.45:1. Width of the first to fifth volution about 0.10, 0.20, 0.38, 0.68 and 1.10 mm respectively. Spirotheca thin, composed of a tectum and a diaphanotheca. Diaphanotheca of the outermost volution usually with very finely alveolar structures. Thickness of spirotheca of the last volution about 0.02 mm. Septa unfluted. Chomata not observed. Tunnel reniform. Proloculus minute, with an outer diameter about 0.04 mm.

Remarks: In shape and size, this form bears a superficial resemblance to *Ozawainella*; it is easily distinguished by its two layered wall structure, thinner spirotheca, rudimentary chomata and less sharply angular periphery. *Reichelina? changanchiaoensis* Sheng et Wang differs from *Reichelina cribroseptata* Erk, the genotype of *Reichelina*, in having narrowly rounded periphery, looser coiled volutions and smaller form ratio of the shell. *Reichelina? changanchiaoensis* Sheng et Wang and *Reichelina? kueichihensis* (Chen) from the uppermost part of the Chihsia Limestone of Anhui may probably be cogenetic; they are undoubtedly specifically distinct, for the latter has thicker spirotheca, fewer whorls, larger size, larger proloculus, more angulated periphery and more inflated umbilical regions.

Locality: Changanchiao and Outang near Wusi city. Cat. Nos. 13285 (holotype), 13286—13287 (paratypes).

Subfamily Staffellinae A. M.-Maclay, 1949

Genus *Kahlerina* Kochansky-Devidé et Ramovš, 1955

***Kahlerina sinensis* Sheng (MS)**

(Pl. I, figs. 3—4)

Shell small, sphaeroidal, Axis of coiling short and straight. Number of whorls, 4; length, 1.54 mm; width, 2.00 mm; form ratio, 0.77:1. Width of the first to fourth volution about 0.34, 0.65, 1.16 and 2.00 mm, respectively. Spirotheca thick, composed of a thin tectum and a thicker lower layer with finely alveolar structures. Thickness of spirotheca in the first to fourth volution about 0.03, 0.04, 0.08 and 0.09 mm, respectively. Septa unfluted. Chomata absent. Tunnel indistinct. Proloculus spherical, with an outer diameter about 0.16 mm.

Remarks: The present specimen is identical with *Kahlerina sinensis* Sheng (MS). The holotype of this species has been found from the upper part of the Maokou Limestone in the Yishan region, Central Kwangsi. Our specimen differs from the holotype only in having fewer volutions. It is believed that our specimen may be a submature individual.

Locality: Changanchiao near Wusi city. Cat. Nos. 13283—13284 (plesiotypes).

Family Schubertellidae Skinner, 1931

Subfamily Boultoninae Skinner et Wilde, 1954

Genus *Codonofusiella* Dunbar et Skinner, 1937

***Codonofusiella wusiana* Sheng et Wang (sp. nov.)**

(Pl. I, figs. 8—9)

Test minute, fusiform. Middle portion slightly vaulted, poles bluntly pointed. Adult shell consisting of four volutions about 0.84 mm in length and 0.40 mm in width with a form ratio about 2.1:1. First volution globular with a short axis coiled askew to the outer volutions. Second volution ellipsoidal; last two volutions fusiform. Width of the first to fourth volution about 0.08, 0.13, 0.22 and 0.40 mm, respectively. Spirotheca thin, composed of a tectum and a diaphanotheca. Septa strongly fluted throughout the length of the shell. Chomata small, only developed in the second volution. Tunnel indistinct. Proloculus minute and spherical, with an outer diameter about 0.03 mm.

Remarks: This species is closely related to *Codonofusiella paradoxica* Dunbar et Skinner from the Capitan Limestone of North America, but differs from the latter in having more number of volutions, smaller size and smaller proloculus. It can be distinguished from *C. cuniculata* Kanmera by its smaller size and weaker septal fluting.

Locality: Changanchiao near Wusi city. Cat. Nos. 13288 (holotype), 13289 (paratype).

Family Schwagerinidae Dunbar et Henbest, 1930

Genus *Schwagerina* Möller, 1877

***Schwagerina* aff. *pactiruga* Chen**

(Pl. I, figs. 1—2)

1956, *Schwagerina pactiruga* Chen, Palaeontologia Sinica, N. Ser. B, No. 6, pp. 7, 39; pl. VIII, figs. 4—5.
 1956, *Schwagerina pactiruga*, Sheng, Acta Palaeontologica Sinica, vol. 4, No. 2, pp. 188, 211, pl. VIII, figs. 7—8.

Shell large, elongately fusiform. Mature shell consisting of $9\frac{1}{2}$ volutions about 7.22 mm in length and 2.14 mm in width with a form ratio about 3.32:1. Width of the first to ninth volution about 0.20, 0.27, 0.36, 0.47, 0.62, 0.84, 1.10, 1.45 and 1.86 mm, respectively. All whorls compactly coiled. Spirotheca composed of a tectum and a keriotheca with coarsely alveolar structure. Thickness of spirotheca about 0.01 mm in the second volution, 0.035 mm in the fifth and 0.05 mm in the ninth volutions. Septa strongly and regularly fluted. Chomata small, only developed in the inner three volutions. Tunnel indistinct. Axial fillings narrow and thin. Proloculus spherical, about 0.14 mm in outer diameter.

Remarks: In general shape and in the nature of septal fluting, the present specimen is strongly similar to *Schwagerina pactiruga* Chen, but it is smaller and is characterized by more number of volutions. It resembles *Schwagerina hupehensis* Chen somewhat closely, but the latter has larger size, looser coiled volutions, and larger form ratio.

Locality: Outang near Wusi city. Cat. Nos. 13281—13282 (plesiotypes).

Superfamily Verbeekinidea Staff et Wedekind, 1910

Family Verbeekinidae Staff et Wedekind, 1910

Subfamily Misellininae Sheng (MS)

The subfamily Misellininae is recently proposed by Sheng including fusulinids of small to large size, varying in shape from subspherical, inflated fusiform to melon-shaped. The spirotheca is composed of a thin tectum, a finely alveolar keriotheca and a thin dense lower layer. The septa are closely spaced and unfluted. The parachomata are well developed in all volutions. The foramina are abundant.

The subfamily includes the genera *Misellina* Schenck et Thompson, *Brevaxina* Schenck et Thompson, *Pseudodoliolina* Yabe et Hanzawa and *Neomisellina* Sheng (MS).

Genus *Neomisellina* Sheng (MS)

The genus *Neomisellina* is recently proposed by Sheng with *Schwagerina lepida* Schwager as its genotype. The diagnosis of this genus may be defined as follows:—

Shell large, inflated fusiform to melon-shaped. Axis of coiling straight, poles bluntly pointed. Spirotheca composed of three layers: a thin tectum, a thicker keriotheca with fine alveoli and a thin dense lower layer. Septa numerous and unfluted. Parachomata narrow, fairly high, well developed throughout the shell. Foramina abundant.

Remarks: This genus is characterized by its large size, more number of volutions, narrow, high and well developed parachomata and abundant foramina as compared with typical *Misellina*. It occurs in a horizon higher than *Misellina*. *Neomisellina* differs from *Pseudodoliolina* in having more number of volutions, larger size and thicker spirotheca. The wall structures of these two genera are quite different: in *Neomisellina*, the spirotheca is composed of three layers; in *Pseudodoliolina*, it has only a single dense layer.

In addition to the genotype, Sheng refers the following forms to the genus *Neomisellina*:

Schwagerina lepida var. *ellipsoidalis* Schwager, 1883

Doliolina douvillei Gubler, 1935

Misellina compacta Chen, 1956

***Neomisellina lepida* (Schwager)**

(Pl. I, fig. 13)

1883, *Schwagerina lepida* Schwager, "China", vol. IV, p. 138, pl. 17, figs. 1,3,4,6.

1898, *Möllerina lepida*, Schellwien, Palaeontographica, vol. 44, p. 258.

1935, *Doliolina lepida*, Gubler (part), Mém. Soc. Géol. France, No. 26, p. 95, pl. IV, figs. 8—12.

1956, *Misellina lepida*, Chen (part), Palaeontologia Sinica, N. ser. B, No. 6, pp. 10.50; pl. VI, figs. 5, 8.

Shell of medium size, melon-shaped. Middle part slightly vaulted, polar regions broadly rounded. Mature shell consisting of 12 volutions about 4.18 mm long and 2.01 mm wide with a form ratio 2.08:1. First volution spherical with a form ratio about 1:1. Width of the first to twelfth volution about 0.21, 0.28, 0.36, 0.41, 0.49, 0.61, 0.73, 0.91, 1.10, 1.38, 1.71 and 2.01 mm, respectively. Spirotheca composed of three layers. Thickness of spirotheca about 0.015 mm in the fifth volution and 0.02 mm in the tenth volution. Septa unfluted. Parachomata narrow, high, well developed in all volutions; about 5-6 parachomata in one milimeter as counted in the tenth volution. Foramina nearly circular in cross section, about 14 in the tenth volution. Proloculus spherical, about 0.11 mm in outer diameter.

Locality: Outang near Wusi city. Cat. No. 13293 (plesiotype).

***Neomisellina compacta* (Chen)**

(Pl. I, figs. 12, 14, 15)

1956, *Misellina compacta* Chen, Palaeontologia Sinica, N. ser. B, No. 6, pp. 10, 52; pl. IV, figs. 9—11.

This species is closely related to *Neomisellina lepida* (Schwager). It differs chiefly in its more compactly coiled volutions, larger form ratio (3:1) and much larger proloculus (0.23—0.27 mm).

The width of the first to thirteenth volution measured about 0.37, 0.46, 0.53, 0.62, 0.72, 0.86, 1.04, 1.25, 1.44, 1.66, 1.76, 2.05 and 2.42 mm, respectively.

Locality: Sishan of Suchow city. Cat. Nos. 13292, 13294—13295 (plesiotypes).

***Neomisellina ellipsoidalis* (Schwager)**

(Pl. I, fig. 10)

1883, *Schwagerina lepida* var. *ellipsoidalis* Schwager, "China", vol. IV, pl. XVIII, figs. 2, 5, 7, 8.

This species is strongly similar to *Neomisellina lepida* (Schwager). It differs chiefly in its ellipsoidal shell, rather loosely coiled volutions and smaller form ratio.

The width of the first to fifteenth volution measured about 0.13, 0.15, 0.22, 0.28, 0.34, 0.45, 0.62, 0.87, 1.17, 1.53, 1.89, 2.05, 2.59, 2.97, and 3.40 mm, respectively.

图 版 說 明

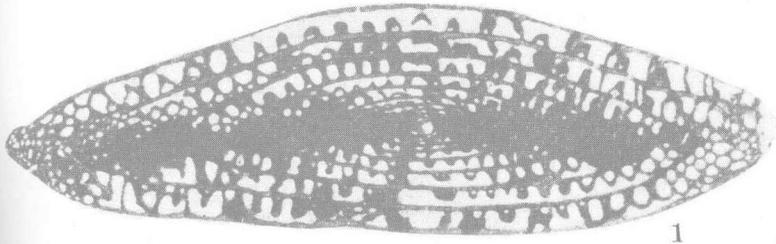
本文描述的标本均保存在中国科学院地质古生物研究所。标本采自江苏省南部无锡市及苏州市附近下二迭统堰桥组的上部。所有图影未加任何润饰。

- 图 1—2. *Schwagerina* aff. *pactiruga* Chen
近型标本, 两个轴切面($\times 10$)。登记号: 13281—13282。
- 图 3—4. *Kahlerina sinensis* Sheng (MS)
近型标本, 轴切面及平行切面($\times 20$)。登记号: 13283—13284。
- 图 5—7. *Reichelina?* *changanchiaoensis* Sheng et Wang sp. nov. (新种)
5. 正型标本, 轴切面($\times 40$)。登记号: 13285。
6, 7. 副型标本, 轴切面及中切面。登记号: 13286—13287。
- 图 8—9. *Codonofusiella wusiana* Sheng et Wang sp. nov. (新种)
8. 正型标本, 轴切面($\times 40$)。登记号: 13288。
9. 副型标本, 中切面($\times 40$)。登记号: 13289。
- 图 10. *Neomisellina ellipsoidalis* (Schwager)
近型标本, 轴切面($\times 15$)。登记号: 13290。
- 图 11. *Neomisellina multivoluta* Sheng (MS)
近型标本, 轴切面($\times 10$)。登记号: 13291。
- 图 12, 14, 15. *Neomisellina compacta* (Chen)
近型标本, 三个轴切面($\times 10$)。登记号: 13292, 13294—13295。
- 图 13. *Neomisellina lepida* (Schwager)
近型标本, 轴切面($\times 15$)。登记号: 13293。

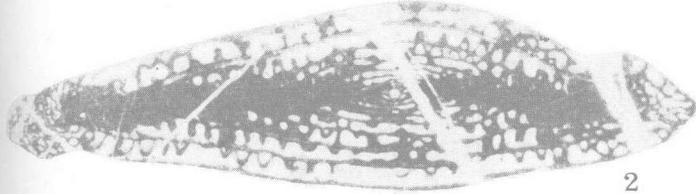
EXPLANATION OF PLATE I

The specimens described in this paper are all preserved in the Institute of Geology and Palaeontology, Academia Sinica. All figures are unretouched photographs. All specimens are found from the uppermost part of the Yanchiao formation of the latest Lower Permian in the vicinity of Wusi and Suchow cities, southern Kiangsu Province.

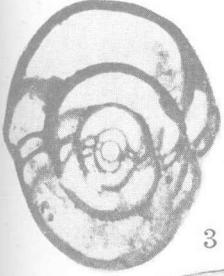
- Figs. 1—2. *Schwagerina* aff. *pactiruga* Chen
Two axial sections ($\times 10$). Cat. Nos. 13281—13282.
- Figs. 3—4. *Kahlerina sinensis* Sheng (MS)
Axial and parallel sections ($\times 20$). Cat. Nos. 13283—13284.
- Figs. 5—7. *Reichelina?* *changanchiaoensis* Sheng et Wang (sp. nov.)
5. Axial section ($\times 40$) of the holotype. Cat. No. 13285.
6, 7. Axial and sagittal sections ($\times 40$) of paratypes. Cat. Nos. 13286—13287.
- Figs. 8—9. *Codonofusiella wusiana* Sheng et Wang (sp. nov.)
8. Axial section ($\times 40$) of the holotype. Cat. No. 13288.
9. Sagittal section ($\times 40$) of a paratype. Cat. No. 13289.
- Fig. 10. *Neomisellina ellipsoidalis* (Schwager)
Axial section ($\times 15$). Cat. No. 13290.
- Fig. 11. *Neomisellina multivoluta* Sheng (MS)
Axial section ($\times 10$) of a typical specimen. Cat. No. 13291.
- Figs. 12, 14—15. *Neomisellina compacta* (Chen)
Three axial sections ($\times 10$). Cat. Nos. 13292, 13294—13295.
- Fig. 13. *Neomisellina lepida* (Schwager)
Axial section ($\times 15$). Cat. No. 13293.



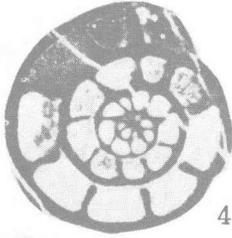
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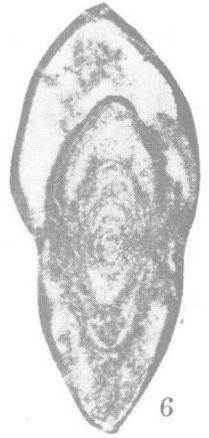
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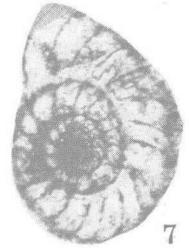
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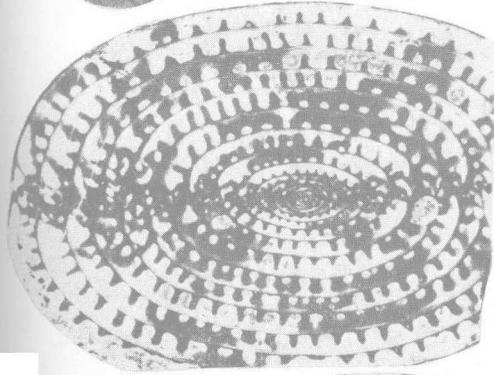
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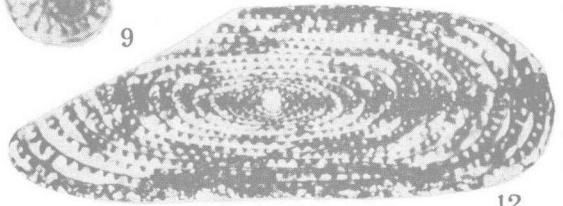
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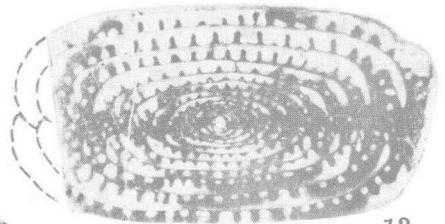
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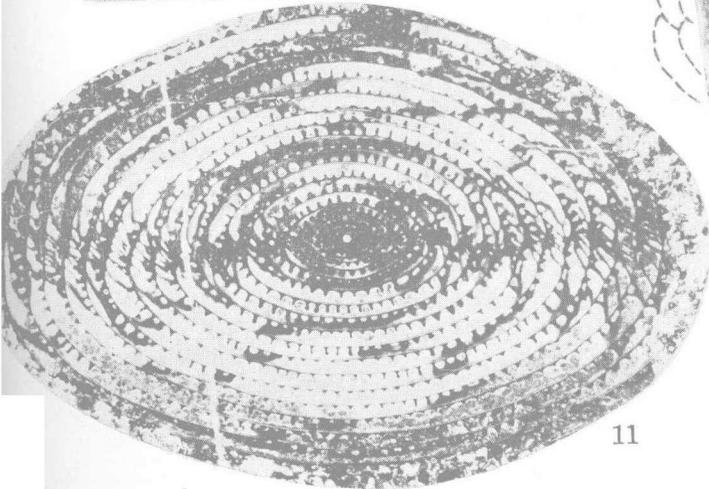
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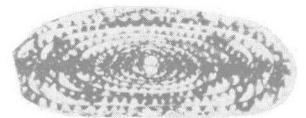
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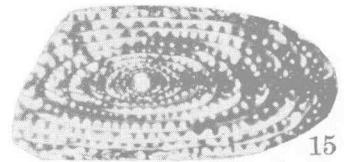
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Locality: Changanchiao near Wusi city. Cat. No. 13290 (plesiotype).

***Neomisellina multivoluta* Sheng (MS)**

(Pl. I, fig. 11)

Shell very large, ellipsoidal. Mature shell consisting of 21 volutions about 11.24 mm in length and 6.84 mm in width with a form ratio about 1.64:1. First two volutions nearly globular, remaining volutions shortly fusiform to ellipsoidal. Width of the first to twentieth volution about 0.23, 0.30, 0.42, 0.50, 0.65, 0.84, 1.10, 1.40, 1.79, 2.16, 2.55, 2.95, 3.31, 3.69, 4.15, 4.56, 4.98, 5.40, 5.81, and 6.24 mm, respectively. Spirotheca thin, composed of three layers. Thickness of spirotheca about 0.015 mm in the inner five volutions and 0.02 mm in the outer ones. Septa plane. Parachomata narrow and high, about 5—6 parachomata in one millimeter as counted in the tenth volution. Foramina abundant, nearly elliptical in cross section, about 7 in the seventh volution and 26 in the eleventh volution. Proloculus spherical, about 0.13 mm in outer diameter.

Remarks: This species differs from *Neomisellina douvillei* (Gubler) in its much larger size, more numerous parachomata, and larger form ratio.

Locality: Changanchiao near Wusi city. Cat. No. 13291 (plesiotype).