

闽西晚石炭世晚期—早二叠世 有孔虫动物群*

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福建石炭、二叠纪有孔虫迄今未见报道。近年来,笔者对闽西船山组和栖霞组下部有孔虫动物群作了系统研究,鉴定 116 种,其中 11 新种。根据这些属种的地层分布规律,本文将其划分为 5 带,这不仅对石炭—二叠系界线的划分提供了有益材料,同时对研究该时期有孔虫动物群面貌也有重要意义。

本文研究的标本均为我系历届毕业生及研究生所采集,化石鉴定曾得到曾学鲁教授、郑洪和洪祖寅老师的帮助,工作中得到骆金铨教授的指导,化石照片由解小健摄制,笔者在此一并致谢。

一、地层简介

福建晚石炭世晚期—早二叠世地层广泛分布于闽西的龙岩、永安、沙县、宁化、顺昌等,以下简要介绍 3 个主要剖面。

1. 龙岩中甲经洋剖面

栖霞组

(未见顶)

81. 灰色、灰黑色泥晶生物碎屑灰岩,见白云岩化、硅化,顶部为紫灰色薄层状硅质岩,产有孔虫 *Palaeotextularia fujianensis* sp. nov., *Nodosaria mirabilis* Lipina, *N. cf. sinensis* Xia et Zhang, *N. sp.*, *Pseudoglandulina conica* K. M.-MacLay, *Multidiscus* sp., *Glomospira regularis* Lipina, *Geinitzina spandeli plana* Lipina, *Pachyphloia* sp., *Globivalvulina* sp., *Plectogyra* sp.; 筳 *Pseudofusulina* sp., *Nankinella* sp.; 腕足类 *Orthotichia* sp. 等。 > 4m

80. 灰色厚层状含燧石结核、条带泥晶生物碎屑灰岩,产有孔虫 *Palaeotextularia fujianensis* sp. nov.; 筳 *Pseudofusulina* sp. 7.8m

79. 灰色、深灰色厚层微晶生物碎屑灰岩,产有孔虫 *Plectogyra* sp.; 筳 *Stauffella moellerana* Thompson, *Sphaerulina* sp. 22.8m

78. 辉绿岩岩脉。 15.63m

77. 灰色厚层状含燧石条带微晶生物碎屑灰岩,产有孔虫 *Palaeotextularia fujianensis* sp. nov., *Nodosaria mirabilis* Lipina, *N. sp.*, *Globivalvulina* sp., *Neotuberitina maliavkini* Mikhailov; 筳 *Stauffella* sp., *Nankinella* sp., *Sphaerulina* sp. 及裸海松。 2.3m

60—76.** 上下深灰色,中部灰色厚层状微晶生物碎屑灰岩,产有孔虫 *Palaeotextularia fujianensis* sp. nov., *Nodosaria zhongjiaensis* sp. nov., *N. delicata* Wang, *N. netchajewi subquadrata*:

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** 详细层序见本期《福建龙岩经洋晚石炭世—早二叠世早期地层及筳类分带》。

Lipina, N. sp., *Globivalvulina kamensis* Reitlinger, G. sp., *Multidiscus* sp.; 筳 *Staffella moellerana* Thompson, *Nankinella* sp., *Sphaerulina* sp. 22.7m

——— 整 合 ———

船山组

- 58—59. 深灰色厚层状生物碎屑微晶灰岩, 上部富含泥质。产有孔虫 *Globivalvulina* sp.; 筳 *Eoparafusulina contracta* Schella 等。 5.4m
- 50—57. 浅灰色厚层状生物碎屑微晶灰岩。产有孔虫 *Climacammina gigas oviformis* Morozova, C. cf. *tenuis* Lin, C. sp., *Cribronerina celebrata* Lin, *Tetrataxis lata* Bogush et Juferev, *Globivalvulina* sp., *Eotuberitina reitlingerae* K. M.-Maclay; 筳 *Eoparafusulina contracta* Schella, E. sp.; 管壳石 *Tubiphys* 及藻类。 27.1m
- 48—49. 深灰色中至厚层状生物碎屑微晶灰岩, 产有孔虫 *Tetrataxis* sp., *Globivalvulina* sp.; 筳 *Eoparafusulina contracta* Schella 等。 2.7m
- 36—47. 深灰色、灰色厚层状生物碎屑微晶灰岩, 产有孔虫 *Cribronerina* sp., *Tetrataxis conica* Ehrenberg, T. *schelliwieni* Ozawa, *Globivalvulina kamensis* Reitlinger; 筳 *Rugosofusulina* cf. *paragregariformis* Chen et Wang, *Sphaeroschwagerina* sp. 及藻类。 11.7m
- 32—35. 灰色中厚层状生物碎屑微晶灰岩, 底部为厚层状, 产有孔虫 *Palaeotextularia licina* Lin, P. *longiseptata* Lipina, P. *wuanensis* Xia et Zhang, *Climacammina valvulinoides* Lange, C. sp., *Cribronerina prosphaerica* Wang, C. cf. *inepta* Lin, *Cribrostomum eximium* Eichwald, C. *szalinogorski* Lipina, *Deckerella clavata* Cushman et Waters, D. sp., *Tetrataxis lata* Spandel, T. *planolocula* Lee et Chen, *Globivalvulina kamensis* Reitlinger, G. sp., *Eotuberitina reitlingerae* K. M.-Maclay, *Neotuberitina maljavkini* Mikhailov, *Nodosaria* sp.; 筳 *Sphaeroschwagerina glomerata* Schwager, S. sp., *Rugosofusulina* sp. 等。 34.2m
- 25—31. 灰色、深灰色中厚层、厚层生物碎屑微晶灰岩, 产有孔虫 *Palaeotextularia longiseptata* Lipina, *Climacammina aljutovica* Reitlinger, C. *elegantula* Wang, C. sp., *Cribronerina nana* Lin, C. *permica* Lange, C. *borealis* Xia et Zhang, *Cribrostomum* cf. *szalinogorski* Lipina, *Deckerella* sp., *Tetrataxis aculeata* Wang, T. *conica lata* Spandel, T. sp., *Globivalvulina kamensis* Reitlinger, G. sp., *Eotuberitina reitlingerae* K. M.-Maclay, *Nodosaria* sp.; 筳 *Sphaeroschwagerina* sp., *Rugosofusulina* sp. 26.9m
- 1—10. 深灰色巨厚层状生物碎屑微晶灰岩, 产有孔虫 *Palaeotextularia longiseptata* Lipina, P. sp., *Climacammina gingyangensis* sp. nov., C. *tenuis* Lin, C. sp., *Cribronerina nana* Lin, C. *obovata* Nie et Shong, C. sp., *Deckerella media* Morozova, D. *tenuissima* Reitlinger, D. *clavata* Cushman et Waters, *Tetrataxis aculeata* Wang, T. *schelliwieni* Ozawa, T. *planolocula* Lee et Chen, T. *conica lata* Spandel, T. *minima* Lee et Chen, T. sp., *Bradyina lepida* Reitlinger, B. sp., *Eotuberitina reitlingerae* K. M.-Maclay; 筳 *Triticites* sp., *Quasifusulina* sp. 等。 24m

——— 整 合 ———

下伏地层: 黄龙组

深灰色巨厚层状淀晶微粒屑生物碎屑灰岩, 产筳 *Fusulina* sp., *Beedeina* sp. 等。

2. 沙县高地 ZK302 钻孔剖面

船山组

5. 灰色厚层状生物碎屑泥晶灰岩, 产有孔虫 *Palaeotextularia longissima* Reitlinger, P. *longiseptata*

Lipina, *P. longiseptata crassa* Lipina, *P. gibbosa minima* Lipina, *P. licina* Lin, *P. wuanensis* Xia et Zhang, *P. consobrina* Lipina, *P. longyanensis* sp. nov., *Climacammina shaxianensis* sp. nov., *C. yishanensis* Lin, *C. kusjapkulensis* Morozova, *C. huangjiangensis* Lin, *C. aljurtovica* Reitlinger, *C. ivanovae* Reitlinger, *C. elegantula* Reitlinger, *C. wenxiuensis* Wang, *C. valvulinoides* Lange, *C. gigas oviformis* Morozova, *C. moelleri timanica* Reitlinger, *C. stiloforme* Lee et Chen, *Cribrogenerina prosphaerica* Wang, *C. casta* Lin, *C. climacamminoides* Lange, *C. inepta* Lin, *C. borealis* Xia et Zhang, *C. maxima* Lee et Chen, *C. permica* Lange, *C. neimenguensis* Xia et Zhang, *C. sp.*, *Cribrostomum lucilleae* Harlton, *C. eximium paraeximia* Lipina, *C. nelumboforme* Lee et Chen, *Deckerella tenuissima* Reitlinger, *D. delicatula* Wang, *D. elegans* Morozova, *D. spiciformis* Nie et Song, *D. gracilis* Reitlinger, *D. sp.*, *Tetrataxis maxima* Schellwien, *T. cf. lata* Bogush et Jeferev, *T. sp.*, *Bradyina lucida* Morozova, *B. samarica* Reitlinger, *B. pauciseptata* Reitlinger, *B. sp.*, *Globivalvulina kamensis* Reitlinger, *G. minima* Reitlinger, *Nodosaria cf. longissima* Suleimanov, *N. salimuensis* Han, *N. sinensis* Xia et Zhang, *N. hejingensis* Xia et Zhang, *Eotuberitina reitlingerae* K. M.-MacLay, *Neotuberitina maljavkini* Mikhailov; 筳 *Pseudoschwagerina miharanoensis* Akagi, *P. sp.* 等。 4.6m

4. 灰色、深灰色厚层状含砂生物碎屑泥晶灰岩, 产有孔虫 *Palaeotextularia longiseptata* Lipina, *P. longiseptata crassa* Lipina, *Climacammina shaxianensis* sp. nov., *C. quasitudicla* sp. nov., *C. fragilis* Reitlinger, *C. sp.*, *Cribrogenerina prosphaerica* Wang, *C. permica* Lange, *C. maxima* Lee et Chen, *C. climacamminoides* Lange, *C. vermiculata* Lange, *Cribrostomum lucilleae* Harlton, *Deckerella elegans* Morozova, *D. tenuissima* Reitlinger, *D. sp.*, *Tetrataxis cf. eomaxima* Putrja, *T. conica* Ehrenberg, *T. planolocula* Lee et Chen, *T. sp.*, *Globivalvulina kamensis* Reitlinger, *G. minima* Reitlinger, *G. bulloides* Brady, *Eotuberitina reitlingerae* K. M.-MacLay, *Neotuberitina maljavkini* Mikhailov, *Nodosaria* sp.; 筳 *Pseudoschwagerina* sp., *Pseudofusulina vulgaris* Schellwien 等。 3.7m

3. 浅灰色厚层状微晶白云质灰岩夹灰白色白云质大理岩。 6.5m

2. 浅灰色、深灰色厚层状生物碎屑泥晶灰岩, 中上部富含有机质, 产有孔虫 *Palaeotextularia longiseptata* Lipina, *P. longiseptata crassa* Lipina, *P. gibbosa minima* Lipina, *P. consobrina* Lipina, *Climacammina ivanovae* Reitlinger, *C. moelleri timanica* Reitlinger, *C. huangjiangensis* Lin, *C. sp.*, *Cribrogenerina prosphaerica* Wang, *C. inepta* Lin, *C. borealis* Xia et Zhang, *C. maxima* Lee et Chen, *Cribrostomum cushmani* Harlton, *Deckerella delicatula* Wang, *Tetrataxis conica* Ehrenberg, *T. sp.*, *Globivalvulina kamensis* Reitlinger, *G. bulloides* Brady, *G. graeca* Reichel, *G. kantharensis* Reichel, *G. sp.*, *Glomospira megaprolocula* sp. nov., *Eotuberitina reitlingerae* K. M.-MacLay, *Neotuberitina maljavkini* Mikhailov; 筳 *Triticites longianica* Zhang, *T. sp.*, *Dunbarinella* sp. 等。 5.38m

1. 浅、深灰色厚层状含砂屑、细砾屑生物碎屑泥晶灰岩, 产有孔虫 *Glomospira megaprolocula* sp. nov., *Palaeotextularia gibbosa minima* Lipina, *Bradyina* sp., *Globivalvulina kamensis* Reitlinger, *Eotuberitina reitlingerae* K. M.-MacLay; 筳 *Triticites* sp., *Schubertella* sp. 以及苔藓虫。 4.05m

-----平行不整合-----

下伏地层: 林地组

深灰色厚层状石英质角砾岩。

3. 宁化泉山乡泉下石灰窑剖面

船山组

2. 灰色厚层状泥晶生物碎屑灰岩, 产有孔虫 *Bradyina crassispira* Lin, *B. samarica* Reitlinger, *B. pauciseptata* Reitlinger, *B. shanxiensis* Xia et Zhang, *B. sp.*, *Palaeotextularia sp.*, *Climacammina sp.*, *Cribrostomum bradyi* Moeller, *Deckerella sp.*, *Tetrataxis cf. conica* Ehrenberg, *T. sp.*; 筳 *Montiparus montiparus* Moeller 等, 还有钙藻和棘皮动物等。 16m

1. 深灰色、略带粉红色厚层状泥晶白云岩间夹微晶灰岩, 底部为角砾状白云岩和白云质角砾岩, 产有孔虫 *Bradyina samarica* Reitlinger, *B. samarica grandis* Reitlinger, *B. sp.*, *Cribrogenerina prosphaerica* Wang, *Deckerella sp.*, *Tetrataxis sp.*, *Eotuberitina reitlingerae* K. M.-Maclay, *Tuberitina sp.*, *Ammodiscus sp.*; 筳 *Obsoletes sp.*, *Protriticites sp.* 等, 还有钙藻和棘皮动物。 21m

——— 整 合 ———

下伏地层: 黄龙组

灰色厚层状泥晶生物碎屑灰岩, 产筳 *Fusulinella sp.*, *Fusulina sp.* 等。

二、有孔虫动物群特征

闽西船山组及栖霞组下部的有孔虫, 经鉴定计有 20 属, 116 种, 其中 11 新种。根据其地层分布特点自下而上可分为 5 个带。

1) *Bradyina crassispira* 带

该带仅见于宁化泉下(宁化剖面), 以 *Bradyina* 的繁盛为主要特征, 计有 *Bradyina crassispira* Lin, *B. samarica* Reitlinger, *B. samarica grandis* Reitlinger, *B. pauciseptata* Reitlinger, *B. shanxiensis* Xia et Zhang。这些分子多数是中石炭统黄龙组延续而来。其中旋壁很厚的 *B. crassispira* 特征显著, 且数量多, 可作为该带的代表。此外, 本带还含有 *Climacammina sp.*, *Cribrogenerina prosphaerica* Wang, *Cribrostomum bradyi* Moeller, *Tetrataxis conica* Ehrenberg, *Eotuberitina reitlingerae* K. M.-Maclay。

该带相当于筳 *Montiparus montiparus* 带。

2) *Glomospira megaprolocula* 带

该带分布于沙县高地(沙县剖面 1—3 层), 龙岩经洋(经洋剖面 1—10 层)。以 *Glomospira megaprolocula sp. nov.* 的发育以及 *Palaeotextularidae*, *Tetrataxis*, *Globivalvulina*, *Eotuberitina* 的初度繁荣为特点, 其中多数分子曾见于中石炭世, 甚至早石炭世, 是地质历程较长的属种。常见的分子有 *Glomospira megaprolocula sp. nov.*, *Palaeotextularia longiseptata* Lipina, *P. longiseptata crassa* Lipina, *P. gibbosa minima* Lipina, *P. longyanensis sp. nov.*, *Climacammina aljutovica* Reitlinger, *C. huangjiangensis* Lin, *Cribrogenerina permica* Lange, *C. inepta* Lin, *Deckerella tenuissima* Reitlinger, *D. clavata* Cusman et Waters, *Cribrostomum posteximium* Reitlinger, *C. cushmani* Harlton, *Tetrataxis conica* Ehrenberg, *T. lata* Bogush et Juferev, *Globivalvulina kamensis* Reitlinger, *G. bulloides* Brady, *G. kanzhorensis* Reichel, *Eotuberitina reitlingerae* K. M.-Maclay 等。另外有极少量 *Nodosaria* 的分子, 如 *N. sinensis* Xia et Zhang, *N. opima* Lin, 繁荣于下带的 *Bradyina* 的分子则很少见及。

该带与筳 *Triticites* 带相当。

3) *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带

该带在沙县高地(沙县剖面 4—5 层),龙岩经洋(经洋剖面 25—47 层),顺昌半山等均有分布。此带有孔虫不仅数量多,而且分异度高,共计 13 属 82 种,以 *Palaeotextularidae* 的分子高度繁盛为本带最主要特征。早期双列、晚期单列、筛状口孔的 *Climacammina* 及单列筛状口孔的 *Cribrogenerina* 的分子亦较丰富。下带发育的分子在此带亦较发育,主要有 *Palaeotextularia longiseptata* Lipina, *P. gibbosa minima* Lipina, *Climacammina aljutovica* Reitlinger, *Deckerella tenuissima* Reitlinger, *Cribrogenerina permica* Lange 等。另外, *Climacammina shaxianensis* sp. nov., *C. kusjapkulensis* Morozova, *C. moelleri zimanica* Reitlinger, *Cribrogenerina prosphaerica* Wang, *C. inepta* Lin, *Deckerella elegans* Morozova 等比下带更加丰富,出现了不少新的种类,如 *Palaeotextularia longissima* Reitlinger, *P. licina* Lin, *P. wuanensis* Xia et Zhang, *Climacammina valvulinoides* Lange, *C. yishanensis* Lin, *C. belemnites* sp. nov., *C. wenxiuensis* Wang, *Cribrogenerina celebrate* Lin, *C. casta* Lin, *Cribrostomum gaudiensis* sp. nov. 等。

Tetrataxis 也进入高峰期,除下面延续上来的分子外,常见的还有 *T. schellwieni* Oza-wa, *T. angusta serpukhovensis* Reitlinger, *T. aculeata* Wang, *T. maxima* Schellwien, *T. eomaxima* Putrja 等。

Nodosaria 的成员比下带也有发展,个体也较大,如 *N. sinensis* Xia et Zhang, *N. tali-muensis* Han, *N. hejingensis* Xia et Zhang。

Globivalvulina, *Eotuberitina*, *Neotuberitina* 则基本上是下部的继续,但数量上更多。*Tuberitina collosa* Reitlinger 个体数量也非常丰富。

此外, *Bradyina* 在本带中下部又有一定的代表,但个体比较小,如 *B. samarica* Reitlinger, *B. compressa minima* Morozova, *B. pauciseptata* Reitlinger, *B. shanxiensis* Xia et Zhang, 往上则很少见及。

本带相当于筴 *Pseudoschwagerina* 带至 *Sphaeroschwagerina* 带。

4) 间隔带

分布在龙岩经洋(经洋剖面 48—59 层),沙县高地、顺昌半山等。本带有孔虫急剧减少,除了 *Globivalvulina* 外,其它属种所见甚少。很可能该时期沉积环境与前期相比有较大的变化,许多有孔虫在此不宜生存。这类情况与新疆塔里木盆地西南缘较相似(赵治信等, 1984)。本带属种计有 *Palaeotextularia longissima* Reitlinger, *Climacammina gigas oviformis* Morozova, *Cribrogenerina prosphaerica* Wang, *C. celebrate* Lin, *C. cyclindrica* Lin, *Deckerella tenuissima* Reitlinger, *Tetrataxis conica* Ehrenberg, *T. lata* Bogush et Juferev, *T. eomaxima* Putrja, *Globivalvulina bulloides* Brady, *G. minima* Reitlinger, *Eotuberitina reitlingerae* K. M.-MacLay, *Neotuberitina minima* Suleimanov, *Nodosaria* sp.。这些分子基本上是下面延续上来的。

本带的层位与筴 *Eoparafusulina contracta* 带相当。

5) *Palaeotextularia fujianensis*-*Multidiscus* 带

分布在龙岩经洋(经洋剖面 60—81 层)、顺昌半山、沙县高地。此带与前几带的最大差异是古串珠虫科除了形态特殊、个体小的 *Palaeotextularia fujianensis* sp. nov. 以外,其它分子则消失,取而代之的是 *Nodosaria*, 其次还有 *Multidiscus*、*Geinitzina*、*Pachyphloia*, 而且个体较下带的小得多, 如 *Palaeotextularia fujianensis* sp. nov., *Nodosaria zhongjiaensis* sp.

nov., *N. delicata* Wang, *N. cf. sinensis* Xia et Zhang, *N. yishanensis* Lin, *N. paifengensis* Wang, *N. mirabilis* Lipina, *N. parva* Lipina, *N. shunchangensis* sp. nov., *N. qikensis* sp. nov., *Multidiscus robustatus* Lin, *M. sp.*, *Geinitzina spandeli plana* Lipina, *G. cf. multicamerata* Lipina, *Pachyphloia* sp., *Glomospira regularis* Lipina 等。整个动物群面貌显示出二叠纪色彩。而少量的 *Globivalvulina*, *Eotuberitina*, *Tetrataxis*, *Plectogyra* 分子则是从下面延续上来。

另外,在顺昌半山的含粗碎屑灰岩中,除了发育 *Nodosaria* 外,还出现大量的 *Langella*、*Pseudoglandulina* 分子。常见的有 *Langella paraperforata* sp. nov., *Pseudoglandulina lepida* Wang, *P. paraconica* K. M.-MacLay, *P. conica* K. M.-MacLay 等。同样,䄇也以长轴率的 *Eoparafusulina* 代替了常见的矿化䄇 *Staffella*。这说明沉积环境的改变,使有孔虫动物群面貌也发生改变。

本带层位上与䄇 *Staffella moellerana* 带至 *Schwagerina cushmani* 带的下部相当。

三、石炭-二叠系界线上下有孔虫动物群的变化

从有孔虫的角度看,福建石炭-二叠系界线划在 *Glomospira megaprolocula* 带与 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带之间(即䄇 *Pseudoschwagerina* 带之底),其间有孔虫面貌有明显变化。

界线之下,有孔虫无论数量或种类都较少,且总体面貌具有较浓厚的石炭纪色彩,许多属种常见于苏联中石炭统莫斯科阶,甚至下石炭统维宪阶以及美国宾夕法尼亚系,如 *Palaeotextularia longiseptata* Lipina, *P. gibbosa minima* Lipina, *Climacammina aljutovica* Reitlinger, *Cribrostomum posteximium* Reitlinger, *C. cushmani* Harlton, *Deckerella tenuissima* Reitlinger, *D. clavata* Cushman et Waters, *Globivalvulina kamensis* Reitlinger, *G. bulloides* Brady, *Tetrataxis planolocula* Lee et Chen 等。

界线之上,有孔虫非常丰富,除下面延续上来的分子外,还出现许多新的类型,这些属种常见于我国下二叠统马平阶(传统上将马平阶划归上石炭统)。有些属种是国外下二叠统的常见代表,如 *Palaeotextularia longissima* Reitlinger, *P. licina* Lin, *P. wuanensis* Xia et Zhang, *Climacammina yishanensis* Lin, *C. valvulinoides* Lange, *C. kusjapkulensis* Morozova, *C. wenxiuensis* Wang, *Cribrogenerina prosphaerica* Wang, *C. celebrate* Lin, *C. casta* Lin, *C. inepta* Lin, *Deckerella elegans* Morozova, *Tetrataxis schellwieni* Ozawa, *Nodosaria talimuensis* Han, *N. sinensis* Xia et Zhang 等。纵观界线之上有孔虫动物群的面貌,二叠纪的色彩占主导地位。这正是下二叠统马平阶与上石炭统中甲阶有孔虫动物群的区别所在。

四、属种描述

砂盘虫科 *Ammodiscidae* Reuss, 1862

球旋虫属 Genus *Glomospira* Rzeha, 1855

大初房球旋虫(新种) *Glomospira megaprolocula* sp. nov.

(图版 1, 图 2, 3)

壳由第二管状房室围绕初房不规则绕旋而成。壳圈少, 2—3 圈, 切面上常为不规则三角

形。壳径 0.66—0.79mm。壳壁为暗色细粒状层。初房大而圆,内径 0.20—0.22mm。

比较 新种以壳圈少,初房大为特征,与 *Glomospira vulgaris* Lipina 略相似,但后者壳圈多,初房则小得多。

产地层位 沙县高地;上石炭统 *Glomospira megaprolocula* 带。

似节房虫科 *Nodosinellidae* Rhumber, 1895

郎格虫属 *Genus Langella* Lange, 1925

拟穿孔郎格虫(新种) *Langella paraperforata* sp. nov.

(图版 1, 图 11, 12)

单列,纵切面近陀螺形,始端圆,末端宽弧形,侧边微外拱。4 个房室,略超覆,房室呈弯月形。壳高 0.40—0.55mm,壳宽 0.29—0.38mm。隔壁上斜弧形,末端膨大。壳壁多层状,壁厚可达 0.047mm。口孔位中央,孔大。缝合线平。初房圆,外径 0.07—0.12mm。

比较 新种与 *Langella perforata* Lange 较相似,但新种个体比后者小得多,壳室也少,长与宽比值亦较小。

产地层位 顺昌半山;下二叠统 *Palaeotextularia fujianensis*-*Multidiscus* 带。

古串珠虫科 *Palaeotextularidae* Galloway, 1933

古串珠虫属 *Genus Palaeotextularia* Schubert, 1921

福建古串珠虫(新种) *Palaeotextularia fujianensis* sp. nov.

(图版 1, 图 15—17)

壳小,膨凸,双列,3—3.5 对房室,房室呈半球形至球形,增大迅速。正模标本壳高 0.28mm,宽 0.21mm,终室高 0.10mm。隔壁圆弧形,长,伸达中部,末端上翘,与对侧隔壁叠覆排列,但不连接。壳壁由暗色细粒外层及透明纤维状内层构成。缝合线明显下凹。初房圆,外径 0.03mm。

比较 新种与 *Palaeotextularia gibbosa minima* Lipina 略相似,但后者个体较大,房室凸度较小,且隔壁末端不上翘。

产地层位 龙岩中甲,沙县高地,顺昌半山;下二叠统 *Palaeotextularia fujianensis*-*Multidiscus* 带。

龙岩古串珠虫(新种) *Palaeotextularia longyanensis* sp. nov.

(图版 1, 图 23)

壳小,狭锥形,侧边平直。双列,4.5 对渐增大的房室,房室高度大。壳高 0.53mm,壳宽 0.28mm,终室高 0.14mm。隔壁长,伸达中部,上斜,近直,末端略膨大。壳壁由暗色细粒外层及透明纤维状内层组成。缝合线平。

比较 新种与 *Palaeotextularia simplex* Morozova 的形态相似,但后者个体更小,房室低,缝合线深凹。以此可与本种区别。

产地层位 龙岩中甲,沙县高地;上石炭统 *Glomospira megaprolocula* 带,下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。

梯状虫属 Genus *Climacammina* Brady, 1873**经洋梯状虫(新种) *Climacammina jingyangensis* sp. nov.**

(图版 I, 图 27)

壳宽圆锥形。早期双列, 4 对迅速增大的房室, 高 0.96mm, 宽 1mm, 隔壁长, 直, 伸达中部, 随壳体伸长略变短, 末端膨大下钩。口孔单一。晚期单列, 2 个带状房室, 最末一个房室显著变宽, 且口面突起, 筛状口孔, 隔壁很短。壳总长 1.6mm, 宽 1.23mm, 终室高 0.28mm。壳壁由薄的暗色细粒外层及较厚的透明纤维状内层组成。缝合线内凹。

比较 新种以宽圆锥形, 双列高度大, 房室排列宽松及单列房室少, 终室突然增宽膨凸为特点。以此区别于该属的已知种。

产地层位 龙岩中甲; 上石炭统 *Glomospira megaprolocula* 带。

沙县梯状虫(新种) *Climacammina shaxianensis* sp. nov.

(图版 I, 图 34, 35)

壳长圆锥形。早期双列, 6—7 对依次增大的房室。晚期单列, 4 个高度近等、宽度渐增的带状房室。双列变单列时, 宽度明显变小。早期隔壁长, 单口孔, 晚期隔壁短, 末端膨大下钩, 筛状口孔。壳壁由暗色细粒外层及透明纤维状内层构成。缝合线明显下凹。正模标本双列长 1.32mm, 宽 1.07mm, 壳总长 2.32mm, 总宽 1.27mm。初房椭圆形, 长径 0.27mm, 短径 0.19mm。

比较 新种外形与 *Climacammina aplicatula* Reitlinger 相似, 但后者双列期较短, 不超过总长的一半。新种与 *Climacammina huangjiangensis* Lin 相比, 后者双列房室比前者少得多。

产地层位 沙县高地, 龙岩中甲; 上石炭统 *Glomospira megaprolocula* 带, 下二叠统 *Palaeotextularia longissima*—*Cribrogenerina prosphaerica* 带。

箭形梯状虫(新种) *Climacammina belemnites* sp. nov.

(图版 II, 图 1)

壳似箭形。早期双列, 宽圆锥形, 3 对增大较快的房室。晚期单列, 筒状, 6 个高度近等, 宽度微增的带状房室。双列变单列时, 宽度明显变小。早期隔壁直长, 伸达中部, 晚期隔壁短, 末端膨大略下钩, 口面平, 口孔 4 个左右。双列长 0.93mm, 宽 1.0mm, 壳总长 2.37mm, 总宽 1.25mm。壳壁两层, 暗色细粒外层和透明纤维状内层。缝合线明显下凹。初房卵形, 外径 0.32—0.25mm。

比较 新种的外形与 *Climacammina tudicla* Lange 较相似, 但后者个体大得多, 且单列期房室也更多。与 *Climacammina valvulinoides* Lange 相比, 后者双列期房室较多, 单列期房室宽度增大较快。

产地层位 沙县高地, 龙岩中甲; 下二叠统 *Palaeotextularia longissima*—*Cribrogenerina prosphaerica* 带。

筛口虫属 Genus *Cribrostomum* Moeller, 1879**高地筛口虫(新种) *Cribrostomum gaodiensis* sp. nov.**

(图版 II, 图 12)

双列,纵切面宽楔形,始端尖,顶角约 60° , 7 对迅速增长的房室。隔壁略弧形,末端膨大下钩,早期大,伸达中部,后期略变短。前 5.5 对房室单一口孔,最后两室筛状口孔。壳壁双层,暗色细粒外层及透明纤维状内层,壁厚 0.07mm。缝合线微凹。壳高 1.33mm,宽 1.20mm。初房圆而小。

比较 新种的外形与 *Cribrostomum cushmani* Harlton 较相似,但后者壳体更宽,壳室低平。

产地层位 沙县高地;下二叠统 *Palaeotextularia longissima*-*Cribronerina prosphaerica* 带。

节房虫科 Nodosaridae Ehrenberg, 1838**节房虫属 Genus *Nodosaria* Lamarck, 1812****奇科节房虫(新种) *Nodosaria qikensis* sp. nov.**

(图版 III, 图 32)

壳圆锥形,单列,8 个房室组成。前 3 室呈扁长方形,后 4 室增大较快,近正方形。壳高 0.35mm,宽 0.11mm,终室高 0.09mm。隔壁平。壳壁由暗色内层和透明状外层构成。缝合线近平。初房内径 0.03mm。

比较 新种与 *Nodosaria delicata* Wang 较相似,但后者房室均匀增长,且初房大于第二房室。

产地层位 顺昌半山;下二叠统 *Palaeotextularia fujianensis*-*Multidiscus* 带。

顺昌节房虫(新种) *Nodosaria shunchangensis* sp. nov.

(图版 III, 图 35)

单列,纵切面尖楔形,由 8 个增大迅速的房室组成,壳室呈“鼓”形。壳高 0.28mm,壳宽 0.11mm,终室高 0.06mm。隔壁平直。壳壁薄,由透明状外层和暗色线状内层构成。缝合线微凹。初房小。

比较 新种以纵切面尖楔形,壳室增长快并呈长方形为特点,以此区别于其它已知种。

产地层位 顺昌半山;下二叠统 *Palaeotextularia fujianensis*-*Multidiscus* 带。

中甲节房虫(新种) *Nodosaria zhongjiaensis* sp. nov.

(图版 III, 图 39)

壳长,尖锥状,单列,12 个房室,前 8 个房室缓慢增大,呈长方形,后 4 个房室迅速增大,尤其是终室特别大,高等于宽。壳高 0.62mm,壳宽 0.15mm,终室高 0.15mm。隔壁平。壳壁由透明放射外层和暗色细粒内层构成,壁厚 0.01mm。缝合线微下凹。初房圆形,直径大于 2、3 房室。

比较 新种与 *Nodosaria sinensis* Xia et Zhang 较相似, 但后者壳体大, 隔壁略呈弧形, 终室增大不明显。

产地层位 龙岩中甲; 下二叠统 *Palaeotextularia fujianensis*-*Multidiscus* 带。

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FORAMINIFERAL FAUNA FROM LATE LATE CARBONIFEROUS AND EARLY PERMIAN OF WEST FUJIAN

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Summary

This paper first systematically reports the foraminiferal fauna of Upper Carboniferous Zhong-jian Stage to Lower Permian Gaodian Stage in Fujian. The collection covers a total of 20 genera and 116 species, including 11 new species, with all species listed in the table. Five zones have been recognized in ascending order as follows:

Gaodian Stage

5. *Palaeotextularia fujianensis*-*Multidiscus* Zone;

Mapingian Stage

4. Interval-Zone;

3. *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* Zone;
Zhongjian Stage
2. *Glomospira megaprolocula* Zone;
1. *Bradyina crassispira* Zone

It would be helpful to further make clear the features of the foraminiferal fauna in the period and provide material available for dividing the Carboniferous-Permian boundary.

DESCRIPTION OF NEW SPECIES

Family Ammodiscidae Reuss, 1862

Genus *Glomospira* Rzehal, 1855

Glomospira megaprolocula sp. nov.

(Pl. I, figs. 2, 3)

Section of test irregularly triangular. Second tubular chamber irregularly coiled. Whorls small, 2 to 3 in number. Diameter of test 0.66 to 0.79 mm. Wall single-layered, dark, finely granular. Proloculus large, round, with an inner diameter of 0.20 to 0.22 mm.

Remarks This species is similar to *Glomospira vulgaris* Lipina, but differs in the smaller number of whorls and large proloculus.

Locality and Horizon Gaodi of Shaxian. *Glomospira megaprolocula* Zone, Upper Carboniferous.

Family Nodosinellidae Rhumbert, 1895

Genus *Langella* Lange, 1925

Langella paraperforata sp. nov.

(Pl. I, figs. 11, 12)

Test turbinate, uniserial, with proximal end rounded, and distal end broadly arched, slightly arched laterally. Chambers numbering four, moony and weakly overlapped. Test with a height of 0.40 to 0.55 mm and a width of 0.29 to 0.38 mm. Septa curved, expanded at the end. Wall with numerous layers, 0.047 mm in thickness. Aperture large. Sutures flattened. Proloculus round, 0.07 to 0.12 mm in diameter.

Remarks The present species is similar to *Langella perforata* Lange, but differs in its much smaller size, smaller number of chambers and smaller ratio of length to width.

Locality and Horizon Banshan of Shunchang. *Palaeotextularia fujianensis*-*Multidiscus* Zone, Lower Permian.

Family Palaeotextularidae Galloway, 1933

Genus *Palaeotextularia* Schubert, 1921

Palaeotextularia fujianensis sp. nov.

(Pl. I, figs. 15—17)

Test small, convex, biserial, developed rapidly, and consisting of 3 to 3.5 pairs of hemispherical to spherical chambers. Apertural face convex. Typical species with a height of 0.28 mm and a width of 0.21 mm; last chamber 0.10 mm in height. Septa curved, long, extending to and even beyond the median line, warped at the ends. Wall with two layers; outer layer dark, finely granular while inner layer hyaline-radial. Sutures strongly depressed. Proloculus round, 0.03 mm in diameter.

Remarks The present species is similar to *Palaeotextularia gibbosa minima* Lipina, but the latter has a greater dimension, smaller convexity of chambers and unwarped ends of septa.

Locality and Horizon Zhongjia of Longyan, Gadi of Shaxian, Banshan of Shunchang. *Palaeotextularia fujianensis*-*Multidiscus* Zone, Lower Permian.

***Palaeotextularia longyanensis* sp. nov.**

(Pl. I, fig. 23)

Test small, narrowly cuneate, biserial with lateral surfaces flattened, consisting of 4.5 pairs of chambers, uniformly increasing; chambers high. Test with a height of 0.53 mm and a width of 0.28 mm; last chamber 0.14 mm in height. Septa nearly straight, long, inclined, extending to the median, with slightly thickened ends; wall with two layers: outer layer dark, granular; inner layer hyaline-radial. Sutures flattened.

Remarks The present species is similar to *Palaeotextularia simplex* Morozova in shape, but the latter has a smaller size, low chambers, and strongly depressed sutures.

Locality and Horizons Zhongjia of Longyan. *Glomospira megaprolocula* Zone, Upper Carboniferous; *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* Zone, Lower Permian.

Genus *Climacammina* Brady, 1873

***Climacammina jingyangensis* sp. nov.**

(Pl. I, fig. 27)

Test broadly cuneate. In early stage, test biserial, with 4 pairs of rapidly developed chambers. Septa straight, long, extending to median and gradually shortened with growth of test, with clavate thickenings at the ends. Aperture simplex. In later stage, test uniserial, carrying 2 chambers, with the last chamber strongly widened. Apertural surface convex. Aperture cribrate. Septa very short. Test 1.6 mm in total length and 1.23 mm in width; last chamber 0.28 mm in height, biserial portion 0.96 mm in length and 1 mm in width. Wall with two layers: outer layer thin, dark granular; inner layer thicker, with light-colored crystals. Sutures depressed.

Remarks The present species is characterized by its broadly cuneate shape, greater height of biserial portion loosely ranged chambers, smaller number of chambers in the uniserial portion and abruptly expanded last chamber, and can be distinguished from other known species of the genus.

Locality and Horizon Zhongjia of Longyan. *Glomospira megaprolocula* Zone, Upper Carboniferous.

***Climacammina shaxianensis* sp. nov.**

(Pl. I, figs. 34, 35)

Test elongately cuneate. In biserial stage, test with 6 to 7 pairs of chambers developed gradually. In the uniserial stage, test with 4 chambers nearly equal in height and gradually increasing in width. From biserial stage to uniserial stage, width obviously reduced. Septa long, with thickenings at the ends in biserial portion, whereas short and hook-like in uniserial portion. Aperture cribrate. Typical specimen 2.32 mm in total length and 1.27 mm in width. Biserial portion 1.32 mm in length and 1.07 mm in width. Wall with two layers: outer layer dark, granular; inner layer hyaline-radial. Sutures strongly depressed. Proloculus oval 0.27 mm in length; and 0.19 mm in width.

Remarks The present species is similar to *Climacammina applicatula* Reitlinger in shape, but in the latter, the biserial portion is shorter, less than a half as long as the test. It can be compared

with *Climacamina huangjiangensis* Lin, in biserial stage, but the latter has much less chambers.

Locality and Horizons Gaodi of Shaxian, Zhongjia of Longyan. *Glomospira megaprolocula* Zone, Upper Carboniferous; *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* Zone, Lower Permian.

***Climacamina belemnites* sp. nov.**

(Pl. II, fig. 1)

Test sagittal. In biserial portion, test broadly cuneate, with 3 pairs of chambers developed rapidly. In uniserial portion, test cylindrical-shaped, with 6 chambers nearly equal in height, and slightly increasing in width. From biserial stage to uniserial stage, width obviously reduced. Septa straight, long extending to median in biserial stage, whereas short and hook-like at the ends in uniserial stage. Apertural face flattened. Apertures about four in number. Test 2.37 mm in total length and 1.25 mm in width. Biserial portion 0.93 mm in length and 1.0 mm in width. Wall with two layers: outer layer dark, granular; inner layer hyaline-radial. Sutures strongly depressed. Proloculus oval, 0.32 mm in length and 0.25 mm in width.

Remarks The present species is similar to *Climacamina tudicla* Lange in shape, but the latter is much larger, with more chambers in uniserial portion.

Locality and Horizon Gaodi of Shaxian, Zhongjia of Longyan. *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* Zone, Lower Permian.

Genus *Cribrostomum* Moeller, 1879

***Cribrostomum gaodiensis* sp. nov.**

(Pl. II, fig. 12)

Test broadly cuneate, with a vertex angle of 60°, biserial, with 7 pairs of chambers developed rapidly. Septa slightly curved, long extending to median in early stage, but slightly shortened, with hook-like thickenings at the ends in later stage. Aperture cribrate in the last 2 chambers. Test with a height of 1.33 mm and a width of 1.20 mm. Wall with two layers, 0.07 mm in thickness; outer layer dark, granular while inner layer hyaline-radial. Sutures slightly depressed. Proloculus small and round.

Remarks The present species is similar to *Cribrostomum cushmani* Harlton in shape, but the latter is wider, with low and flattened chambers.

Locality and Horizon Gaodi of Shaxian. *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* Zone, Lower Permian.

Family Nodosaridae Ehrenberg, 1838

Genus *Nodosaria* Lamark, 1812

***Nodosaria qikensis* sp. nov.**

(Pl. III, fig. 32)

Test small, narrowly cuneate, uniserial with 8 chambers. Initial three chambers rectangular, while later chambers nearly square, developed rapidly. Test 0.35 mm in height and 0.11 mm in width; last chamber 0.09 mm in height. Septa flat. Wall with two layers: inner layer dark; outer layer light-colored. Sutures nearly flattened. Inner diameter of proloculus 0.03 mm.

Remarks The present species is similar to *Nodosaria delicata* Wang in shape; but in the

later, the chambers are developed uniformly, and the proloculus is larger than the second chamber.

Locality and Horizon Banshan of Shunchang. *Palaeotextularia fujianensis*-*Multidiscus* Zone, Lower Permian.

Nodosaria shunchangensis sp. nov.

(Pl. III, fig. 35)

Test small, uniserial, cuneate, with 8 chambers which are drum-shaped, expanded rapidly. Test 0.28 mm in height and 0.11 mm in width; last chamber 0.06 mm in height. Septa flat, straight. Wall thin, with two layers: outer layer light-colored; inner layer dark, hyaline. Sutures slightly depressed. Proloculus small.

Remarks The present species is characterized by its small test, drum-shaped and rapidly developed chambers, and can be distinguished from other known species of the genus.

Locality and Horizon Banshan of Shunchang. *Palaeotextularia fujianensis*-*Multidiscus* Zone, Lower Permian.

Nodosaria zhongjiaensis sp. nov.

(Pl. III, fig. 39)

Test long cuneate, uniserial, totally with 12 chambers: preceding 8 chambers rectangular, developed slowly; later 4 chambers expanded rapidly; with the last chamber especially large, nearly square. Test 0.62 mm in height and 0.15 mm in width; last chamber 0.15 mm in height. Septa flat. Wall with two layers, 0.01 mm in thickness: outer layer light, hyaline-radiate; inner layer dark, finely granular. Sutures slightly depressed. Proloculus round, larger than the second and third chambers in dimension.

Remarks The present species is similar to *Nodosaria sinensis* Xia et Zhang, but the latter is larger, with septa slightly curved, and the last chamber not expanded abruptly.

Locality and Horizon Zhongjia of Longyan. *Palaeotextularia fujianensis*-*Multidiscus* Zone, Lower Permian.

图 版 说 明

标本均保存于福州大学地质科学研究所。说明中斜线上方为登记号,下方为采集号。

图 版 I

1. *Glomospira regularis* Lipina
切面, ×100, 11051/FZ II-61-1. 龙岩中甲, 下二叠统 *Palaeotextularia fujianensis*-*Multidiscus* 带。
- 2, 3. *Glomospira megaprolocula* sp. nov.
切面, ×25, 11052/SG 30205-4 (Holotype), 11053/SG 30205-6. 沙县高地, 上石炭统 *Glomospira megaprolocula* 带。
4. *Tuberitina collosa* Reitlinger
纵切面, ×40, 11054/ZK 401-31(34). 顺昌半山, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。
- 5, 6. *Eotuberitina reitlingerae* K. M. -Maclay
纵切面, ×40, 11055/SG 30219-10, 11056/SG 30205-12. 沙县高地, 上石炭统 *Glomospira megaprolocula* 带; 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。
7. *Neotuberitina maltavkini* Mikhailov
纵切面, ×40, 11057/FZ III-12-1. 龙岩中甲, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。
8. *Neotuberitina minima* Suleimanov

- 纵切面, $\times 40$, 11058/SBI-7(88)。沙县高地, 下二叠统 *Palaeotextularia fujianensis*-*Multidiscus* 带。
9. *Geinitzina* cf. *multicamerata* Lipina
纵切面, $\times 50$, 11059/LZ IV-6-16-(1)。龙岩中甲, 层位同上。
10. *Geinitzina spandeli plana* Lipina
纵切面, $\times 70$, 11060/FZ II-59-10。产地层位同上。
- 11, 12. *Langella paraperforata* sp. nov.
纵切面, $\times 70$, 11061/SBI 22 (Holotype), 11062/SBI-12-8(Paratype)。顺昌半山, 层位同上。
- 13, 14. *Palaeotextularia longissima* Reitlinger
纵切面, $\times 25$, 11063/SG 30219-17, 11064/SQ II-6(218)。沙县高地, 顺昌半山; 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。
- 15—17. *Palaeotextularia fujianensis* sp. nov.
 $\times 70$, 15. 侧切面, 16. 纵切面, 17. 纵切面, 11065/FZ II-61-1, 11066/FZ II-54-4 (Paratype), 11067/FZII-61-1 (Holotype)。龙岩中甲, 沙县高地, 顺昌半山; 下二叠统 *Palaeotextularia fujianensis* -*Multidiscus* 带。
18. *Palaeotextularia gibbosa minima* Lipina
纵切面, $\times 25$, 11068/Hb 30220-4。沙县高地, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。
19. *Palaeotextularia longiseptata crassa* Lipina
纵切面, $\times 25$, 11019/SG 30215-5。产地层位同上。
- 20—22. *Palaeotextularia longiseptata* Lipina
纵切面, $\times 25$, 11070/Hb 30220-8, 11071/Hb 30215, 11072/LZF-10-2。沙县高地, 龙岩中甲。层位同上。
23. *Palaeotextularia longyanensis* sp. nov.
纵切面, $\times 25$, 11073/FZI-29-8。龙岩中甲, 上石炭统 *Glomospira megaprolocula* 带, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。
24. *Palaeotextularia* cf. *licina* Lin
纵切面, $\times 30$, 11074/FZIII-12-10。龙岩中甲, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。
25. *Climacamina aljutovica* Reitlinger
纵切面, $\times 25$, 11075/SG 30216-2。沙县高地, 层位同上。
26. *Climacamina yishanensis* Lin
纵切面, $\times 25$, 11076/SQ VI-5-2。顺昌半山, 层位同上。
27. *Climacamina jingyangensis* sp. nov.
纵切面, $\times 25$, 11077/FZ II-4-2 (Holotype)。龙岩中甲, 上石炭统 *Glomospira megaprolocula* 带。
- 28, 29. *Climacamina kusjapkulensis* Morozova
纵切面, $\times 25$, 11078/ZH-25-4, 11079/SG 30215-9。龙岩中甲, 沙县高地; 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。
30. *Climacamina elegantula* Reitlinger
纵切面, $\times 25$, 11080/FZII-12-1-2。龙岩中甲, 层位同上。
31. *Climacamina wenxiuensis* Wang
纵切面, $\times 25$, 11081/SG 30219-2。沙县高地, 层位同上。
32. *Climacamina huangjiangensis* Lin
纵切面, $\times 25$, 11082/SG 30219-8。产地层位同上。
33. *Climacamina valvulinoides* Lange
纵切面, $\times 25$, 11083/SQVI-5(224)。顺昌半山, 层位同上。
- 34, 35. *Climacamina shaxianensis* sp. nov.
纵切面, $\times 25$, 11084/SG 30214, 11085/SG 30219-2 (Holotype)。沙县高地, 龙岩中甲; 上石炭统 *Glomospira megaprolocula* 带, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。

图 版 II

1. *Climacamina belemnites* sp. nov.
纵切面, $\times 25$, 11086/SG 30210-14 (Holotype)。产地同上, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。
2. *Climacamina gigas oviformis* Morozova
纵切面, $\times 25$, 11087/LZFB 5-1。龙岩中甲, 层位同上。
3. *Climacamina ivanovae* Reitlinger
纵切面, $\times 25$, 11088/SG 30218-16。沙县高地, 层位同上。
4. *Climacamina siloforme* Lee et Chen

- 纵切面, $\times 25$, 11089/Hb 30219-6。产地层位同上。
5. *Cribrogenerina ovovata* Nie et Shong
纵切面, $\times 25$, 11090/FZ II-2F-3。龙岩中甲, 上石炭统 *Glomospira megaprolocula* 带。
 6. *Cribrogenerina nana* Lin
纵切面, $\times 25$, 11091/FZ II-12-3。龙岩中甲, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。
 7. *Cribrogenerina permica* Lange
纵切面, $\times 25$, 11092/中甲 III-2A-1。产地层位同上。
 8. *Cribrogenerina prosphaerica* Wang
纵切面, $\times 25$, 11093/SG 30219-12。沙县高地, 层位同上。
 9. *Cribrogenerina cylindrica* Lin
纵切面, $\times 25$, 11094/ZH-27-1。龙岩中甲, 下二叠统间隔带。
 10. *Cribrogenerina celebrata* Lin
纵切面, $\times 25$, 11095/SBI-7(116)。顺昌半山, 层位同上。
 11. *Cribrogenerina inepta* Lin
纵切面, $\times 25$, 11096/中甲 I-8A-1。龙岩中甲, 上石炭统 *Glomospira megaprolocula* 带。
 12. *Cribrostomum gaudiensis* sp. nov.
纵切面, $\times 25$, 11097/SGI 2-1(SH-16) (Holotype)。沙县高地, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。
 13. *Cribrostomum lucilleae* Harlton
纵切面, $\times 25$, 11098/SG 30213-5。产地层位同上。
 14. *Cribrostomum posteximium* Reitlinger
纵切面, $\times 25$, 11099/LZF-13-7。龙岩中甲, 层位同上。
 15. *Cribrostomum bradyi* Moeller
纵切面, $\times 25$, 11100/F 26上-7。宁化泉下, 上石炭统 *Bradyina crassispira* 带。
 16. *Cribrostomum eximium* Eichwald
纵切面, $\times 25$, 11101/FZ II-19-4。龙岩中甲, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。
 17. *Deckerella dvinensis* Reitlinger
纵切面, $\times 25$, 11102/SG 1010-4。沙县高地, 层位同上。
 18. *Deckerella delicatula* Wang
纵切面, $\times 25$, 11103/SG 30205-8。沙县高地, 上石炭统 *Glomospira megaprolocula* 带。
 19. *Deckerella elegans* Morozova
纵切面, $\times 25$, 11104/SG 30214-2。沙县高地, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。
 20. *Deckerella clavata* Cushman et Waters
纵切面, $\times 40$, 11105/FZII-19-1。龙岩中甲, 层位同上。
 21. *Deckerella media* Morozova
纵切面, $\times 25$, 11106/LZF-19-1。产地层位同上。
 - 22, 23. *Deckerella tenuissima* Reitlinger
纵切面, $\times 25$, 11107/SG 30215-19, 11108/FZ II-1-2。沙县高地, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带; 龙岩中甲, 上石炭统 *Glomospira megaprolocula* 带。
 24. *Tetrataxis* sp.
纵切面, $\times 25$, 11109/ZH 21F-1。龙岩中甲, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。
 25. *Tetrataxis angusta serpukhovensis* Reitlinger
纵切面, $\times 25$, 11110/ZH 19A-1。产地层位同上。
 26. *Tetrataxis maxima* Schellwien
纵切面, $\times 25$, 11111/SG 30215-20。沙县高地, 层位同上。
 - 27, 32. *Tetrataxis eomaxima* Putrji
纵切面, $\times 25$, 11112/ZH 19A-4-3, 11117/SBI-18。龙岩中甲, 顺昌半山; 层位同上。
 28. *Tetrataxis lata* Bogush et Jeferev
纵切面, $\times 25$, 11113/FZ II-20-2。龙岩中甲, 层位同上。
 29. *Tetrataxis aculeata* Wang
纵切面, $\times 25$, 11114/FZ II-4-1。龙岩中甲, 上石炭统 *Glomospira megaprolocula* 带。
 30. *Tetrataxis schellwieni* Ozawa
纵切面, $\times 25$, 11115/FZ II-22-2。龙岩中甲, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。

erica 带。

31. *Tetrataxis irregularis* Morozova

纵切面, $\times 25$, 11116/SQ 401-42-①。顺昌半山, 层位同上。

33. *Tetrataxis conica* Ehrenberg

纵切面, $\times 25$, 11118/SG 30205-11。沙县高地, 上石炭统 *Glomospira megaprolocula* 带。

34. *Tetrataxis* cf. *laibinensis* Lin

纵切面, $\times 25$, 11119/中甲 I-8A-10。龙岩中甲, 层位同上。

图 版 III

1, 2. *Bradyina crassispira* Lin

1. 纵切面, 2. 横切面, $\times 25$, 11120/QF 34-17, 11121/F 26-1。宁化泉下, 上石炭统 *Bradyina crassispira* 带。

3, 4. *Bradyina lucida* Morozova

3. 横切面, 4. 纵切面, $\times 25$, 11122/SG 30221-4, 11123/SG 30215-16。沙县高地, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。

5. *Bradyina compressa minima* Morozova

纵切面, $\times 40$, 11124/ZH 19A-4。龙岩中甲, 层位同上。

6. *Bradyina shanxiensis* Xia et Zhang

纵切面, $\times 40$, 11125/F 26上-8。宁化泉下, 上石炭统 *Bradyina crassispira* 带。

7. *Bradyina lepida* Reitlinger

纵切面, $\times 25$, 11126/SQ VI-4-2(25)。顺昌半山, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。

8. *Bradyina samarica grandis* Reitlinger

纵切面, $\times 25$, 11127/QF 31-3。宁化泉下, 上石炭统 *Bradyina crassispira* 带。

9-11. *Bradyina samarica* Reitlinger

9. 纵切面, 11, 10. 横切面, $\times 25$, 11128/Hb 30215-4, 11130/SG 30215-9, 11129/QF 32-5。沙县高地, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带; 宁化泉下, 上石炭统 *Bradyina crassispira* 带。

12, 13. *Plectogyrta devexa* Rauser-Cernoussova

12. 横切面, 13. 纵切面, $\times 40$, 11131/ZH 18-3, 11132/中甲 III-2C-1。龙岩中甲, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。

14, 15. *Globivalvulina bulloides* Brady

14. 横切面, 15. 纵切面, $\times 40$, 11133/FZI-20-3, 11134/SG 30210-19。龙岩中甲, 上石炭统 *Glomospira megaprolocula* 带; 沙县高地, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。

16. *Globivalvulina graeca* Reichel

横切面, $\times 40$, 11135/SG 30205-3。沙县高地, 上石炭统 *Glomospira megaprolocula* 带。

17. *Globivalvulina kantharensis* Reichel

横切面, $\times 40$, 11136/SG 30205-18。产地层位同上。

18, 19. *Globivalvulina kamensis* Reitlinger

18. 横切面, 19. 纵切面, $\times 40$, 11137/SQ III-15-12, 11138/SG 30223-1。顺昌半山, 沙县高地; 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。

20. *Globivalvulina minima* Reitlinger

纵切面, $\times 40$, 11139/SQ II-15-11。顺昌半山, 下二叠统 *Palaeotextularia fujianensis*-*Multidiscus* 带。

21. *Multidiscus* sp.

纵切面, $\times 70$, 11140/SQ II-16-10。产地层位同上。

22. *Multidiscus robustatus* Lin

纵切面, $\times 40$, 11141/ZK 401-46-2。产地层位同上。

23, 24. *Pseudoglandulina lepida* Wang

纵切面, $\times 70$, 11142/SBI-12-5, 11143/SBI21。产地层位同上。

25. *Pseudoglandulina conica* K. M.-Maclay

纵切面, $\times 70$, 11144/FZ II-61-1。龙岩中甲, 层位同上。

26. *Pseudoglandulina paraconica* K. M.-Maclay

纵切面, $\times 70$, 11145/SBI 23。顺昌半山, 层位同上。

27. *Nodosaria* sp.1

纵切面, $\times 70$, 11146/SBI-12。产地层位同上。

28. *Nodosaria* cf. *quasiopima* Lin

纵切面, $\times 70$, 11147/SBI-12-7。产地层位同上。

29. *Nodosaria mirabilis* Lipina

- 纵切面, $\times 70$, 11148/FZ II-60-5。龙岩中甲, 层位同上。
30. *Nodosaria parva* Lipina
纵切面, $\times 70$, 11149/SBI-12-11。顺昌半山, 层位同上。
31. *Nodosaria paifengensis* Wang
纵切面, $\times 70$, 11150/SQ III-15-11。产地层位同上。
32. *Nodosaria qikensis* sp. nov.
纵切面, $\times 70$, 11151/ZK 401-45-① (Holotype)。产地层位同上。
33. *Nodosaria* sp. 2
纵切面, $\times 70$, 11152/SBE(2)。产地层位同上。
34. *Nodosaria delicata* Wang
纵切面, $\times 70$, 11153/FZ II-39-9。龙岩中甲, 层位同上。
35. *Nodosaria shunchangensis* sp. nov.
纵切面, $\times 70$, 11154/SQ II-16-10 (Holotype)。顺昌半山, 层位同上。
36. *Nodosaria yishanensis* Lin
纵切面, $\times 70$, 11155/SQ III-15-11。产地层位同上。
37. *Nodosaria* cf. *sinensis* Xia et Zhang
纵切面, $\times 70$, 11156/FZ II-61-2。龙岩中甲, 层位同上。
38. *Nodisaria sinensis* Xia et Zhang
纵切面, $\times 40$, 11157/中甲1-9A-5。龙岩中甲, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。
39. *Nodosaria zhongjiaensis* sp. nov.
纵切面, $\times 70$, 11158/FZ II-37-1 (Holotype)。龙岩中甲, 下二叠统 *Palaeotextularia fujianensis*-*Multidiscus* 带。
40. *Nodosaria talimuensis* Han
纵切面, $\times 40$, 11159/SG 30219-7。沙县高地, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。
- 41, 42. *Plectogyra bashkirica* Morozova
41. 纵切面, 42. 横切面, $\times 40$, 11160/SQ III-15-11, 11161/SQ III-15-8。顺昌半山, 下二叠统 *Palaeotextularia fujianensis*-*Multidiscus* 带。
43. *Plectogyra* cf. *perlucida* Lin
纵切面, $\times 40$, 11162/ZK 401-45-1。产地层位同上。
44. *Plectogyra* sp.
横切面, $\times 28$, 11163/LF IV-5-7。龙岩中甲, 下二叠统 *Palaeotextularia longissima*-*Cribrogenerina prosphaerica* 带。

Foraminiferal Fauna from Late Late Carboniferous and Early Permian
of West Fujian

Plate I





