

贵阳附近下二叠统双切尾虫亚科 三叶虫的一新属

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内 容 提 要

本文描述了贵阳西北郊探矿厂对面山坡上发现的早二叠世晚期茅口组双切尾虫亚科三叶虫的 1 新属——棘菲利普虫属 (*Acanthophillipsia*), 计 4 新种: *Acanthophillipsia guiyangensis*, *A. abrota*, *A. abnormis* 和 *A. (?) granurosa*, 丰富了我国二叠纪三叶虫动物群的资料, 对研究二叠纪三叶虫的分类、演化和古生物地理分区都具有一定的意义。

关键词 二叠纪 三叶虫

我国南方海相二叠纪地层不仅发育完整, 出露良好, 而且各种岩石类型的沉积都有, 是研究各门类海相化石的理想区域, 然而对二叠纪三叶虫的研究目前还仅仅是一个开端。

有关我国二叠纪三叶虫的研究和报道, 近十年来有了较大的进展, 经前人和钱义元(1977, 1981), 尹恭正(1978), 张全忠、鞠天吟(1982), 周天梅(1986)等人的研究共发现了 6 属(亚属), 19 种, 它们是 *Pseudophillipsia (Pseudophillipsia) obtusicauda* (Kayser, 1883), *Ps. (Ps.) chongqingensis* Lu, 1974, *Ps. (Ps.) qinglongensis* Qian, 1977, *Ps. (Ps.) anshunensis* Qian, 1977, *Ps. (Ps.) reggorcaqaensis* Qian, 1981, *Ps. (Ps.) subcircularis* Qian, 1977, *Ps. (Ps.) shangaoensis* Zhang, 1982, *Ps. (Ps.) wuweiensis* Zhang, 1982, *Ps. (Ps.) tongluensis* Ju, 1982, *Ps. (Ps.) yunanxiensis* Liu, 1982, *Pseudophillipsia (Carniphillipsia) pyriformis* Qian, 1977, *Ps. (C.) triangulata* Ju, 1982, *Ps. (C.) mengshanensis* Zhang, 1982, *Acropyge multisegmenta* Qian, 1977, *A. brevica* Yin, 1978, *Paraphillipsia sinensis* Zhou, 1986, *Weania guangxiensis* (Zhou, 1986) (= *Nipponaspis guangxiensis* Zhou, 1986), *Cheiropyge himalayensis* Diener, 1897, *C. (?) gaoanensis* (Zhang, 1982) (= *Brachymetopus (Brachymetopus) gaoanensis* Zhang, 1982)。除了最后的两个种属 *Brachymetopidae* 科外, 其余的种都属 *Phillipsiidae* 科。

本文描述的三叶虫是非利浦虫科双切尾虫亚科的 1 个新属, 共有 4 新种即 *Acanthophillipsia guiyangensis* gen. et sp. nov., *A. abrota* gen. et sp. nov., *A. abnormis* gen. et sp. nov., *A. (?) granurosa* gen. et sp. nov.。这一发现对于二叠纪三叶虫的分类、演化和古

生物地理分区都具有一定的意义。

这里描述的三叶虫标本是笔者于1984、1985年在贵阳近郊的探矿厂对面的小山脚下采集的,三叶虫保存在下二叠统茅口组上部的灰黄色、紫红色、杂色硅质、粉砂质泥岩中,除三叶虫外,尚有腕足类、鲕、腹足类等化石,现将这一剖面介绍如下:

上二叠统龙潭组:灰黄色页岩

下二叠统茅口组第二段

- | | |
|--|-----|
| 12.灰白色粘土岩。 | 3m |
| 11.灰黑色、风化后呈灰白至灰色薄层硅质岩。 | 5m |
| 10.灰、深灰白色薄层灰岩夹薄层硅质岩及少量钙质页岩,含腕足类化石碎片。 | 22m |
| 9.灰、浅灰色中厚层灰岩、底部夹硅质岩。含鲕 <i>Codonofusiella</i> sp., <i>Reichelina</i> sp. 及腕足类 <i>Marginifera</i> sp., <i>Leptodus</i> sp., <i>L. tenuis</i> Waagen, <i>Gubleria huangi</i> Wang et Ching, <i>Spinomarginifera</i> sp. | 12m |
| 8.剧烈风化硅质岩。含腕足类 <i>Spinomarginifera</i> sp., <i>Tyloplecta</i> cf. <i>yangtzeensis</i> (Chao)。 | 2m |
| 7.灰黄、紫红、杂色硅质、粉砂质泥岩,产腕足类 <i>Terebratuloides depressa</i> Waagen, <i>Neochonetes substrophomenoides</i> (Huang), <i>Tyloplecta yangtzeensis</i> (Chao), <i>Trasennatia</i> sp., <i>Marginifera</i> sp. 及三叶虫 <i>Acanthophillipsia guiyangensis</i> gen. et sp. nov., <i>A. abrota</i> gen. et sp. nov., <i>A. abnormis</i> gen. et sp. nov., <i>A. (?) granurosa</i> gen. et sp. nov. | 3m |
| 茅口组第一段 | |
| 6.灰、深灰色厚层状灰岩,含鲕 <i>Schwagerina</i> sp., <i>Eoverbeekina</i> sp. | 26m |
| 5.深灰色厚层块状灰岩,含鲕 <i>Schwagerina</i> sp., <i>Chusenella</i> sp. | 14m |
| 4.灰色厚层至块状灰岩,偶含白云质团块。含鲕 <i>Schwagerina</i> sp., <i>Parafusulina</i> cf. <i>splendens</i> Dunber et Skinner (未见底)。 | |

本文图版所用三叶虫照片由胡尚卿摄制,任玉皋清绘插图,笔者在此一并致谢。

化 石 描 述

菲利普虫科 Family Phillipsiidae (Oehlert, 1886) G. Hahn, R.
Hahn et Brauckmann, 1980

双切尾虫亚科 Subfamily Ditomopyginae Hupé, 1953

棘菲利普虫(新属) *Acanthophillipsia* gen. nov.

等尾型三叶虫。头部和尾部长满了棘状的刺。头鞍凸起,向前扩大,呈棒槌状,前端宽圆,伸达前边缘沟。前面的头鞍沟(S₂—S₄)消失,后一对头鞍沟深,在内端分叉并形成深的凹陷区,前支在中部相连,后支短且不与颈沟相连。前颈环叶发育,但较颈环窄、低,前侧颈环叶(L₁)并不与颈环中叶完全分开。眼叶长大,新月形,向外凸出明显,前后端靠近头鞍。眼长,呈极窄的凹陷区,眼沟极深。固定颊极窄。活动颊宽,颊刺极短或消失。尾部半圆形至半椭圆形,中轴长而凸起,横切面近乎半圆形,分18—21节,肋部分10—13对肋脊。肋沟及轴环沟极深,间肋沟极浅,仅在内核上可见。尾边缘极窄,尾边缘沟浅。

讨论 新属就其头部和尾部的一般形态与伊朗中部中二叠世的 *Iranaspidion* Kobayashi et Hamada, 1978 和阿富汗早二叠世的 *Hentigia* Haas, G. Hahn and R. Hahn, 1980 都有些相似,特别是两者成年期早期的标本(Kobayashi and Hamada, 1978: fig. 3; Kobayashi and Hamada, 1984: pl. 14, fig. 3a—b; Haas, G. Hahn and R. Hahn, 1980: Taf. 2, Fig.

3,6) 亦显示出在后一对头鞍沟的内端和头鞍前叶的后部有 1 个较深的凹陷区, 前颈环侧叶 (L_1) 并不与中叶完全分开、活动颊刺不发育, 尾部的肋沟和轴节沟比较深宽, 且头部和尾部表面都具有小的瘤点装饰。新属的模式种和 *Iranaspidion* 的模式种 *Iranaspidion sagittalis* Kobayashi et Hamada (1978: p. 158, figs. 1—4; 1984:67—69, pl.14, figs. 1—4) 相比, 新属的头鞍前叶凸起更高, 呈椭球状, 而后者呈次方形; 头鞍前叶的后部平直, 而后者裂开形成 1 条纵向的头鞍前叶后部中沟; 头鞍前颈环侧叶并不与中叶分开, 而后者的前颈环侧叶与中叶完全分开, 并且呈现出两个凸起的大瘤; 眼叶长大, 向外凸出明显, 面线后支段 $\sigma - \zeta$ 极短或缺失, 而后者眼叶呈中等大小, 面线后支段 $\sigma - \zeta$ 较长; 眼极窄长呈 1 凹陷区, 而后者眼凸起, 呈新月形; 活动颊刺退化, 而后者具长的颊刺; 新属尾边缘极窄, 且无清楚的尾边缘沟, 而后者尾边缘宽, 尾边缘沟深; 新属的头部和尾部表面的装饰呈棘状刺, 而后者为瘤泡状。新属的模式种与 *Hentigia* Haas, G. Hahn et R. Hahn 的模式种 *H. bulbops* (Haas, G. Hahn and R. Hahn, 1980: 83—100, Taf. 1. Fig. 1—4; Taf. 2, Fig. 1—16; Taf.3, Fig. 1—8; Taf. 4, Fig.1—14; Abb. 5—22) 相比, 后者头鞍前叶头鞍沟 (S_2-S_4) 发育, 前颈环叶三分明显, 前颈环侧叶 (L_1) 发育, 眼凸起呈肾形, 尾部分节略少 (17—20 个轴环, 9—11 对肋脊), 尾边缘宽, 尾边缘沟较深, 头盖及尾部表面仅具瘤泡状装饰。新属就其头部和尾部表面的棘状刺装饰来看, 与早、中石炭世的 *Eocyphinium* Reed, 1942 (模式种 *E. clitheroense* Reed, 1942) (Osmolska, 1970:96—97, pl.13, Fig. 1,5) 很相似, 但后者头鞍向前扩大不十分明显, 头鞍沟 (S_1-S_3) 发育, 而前颈环叶不发育, 眼和眼叶短小, 面线后支段 $\sigma - \zeta$ 通常发育, 尾部分节较少 (具 14—17 个轴环和 10—14 对肋脊), 不具有明显的尾边缘。就其尾部分节较多及头鞍具有较低的前颈环叶等特征新属与 *Pseudophillipsia* (*Carniphillipsia*) G. Hahn et Brauckmann, 1975 亦有些相似, 例如新属的模式种与 *Pseudophillipsia* (*Carniphillipsia*) *savensis* G. Hahn, R. Hahn et Romovs (1977: 147—148, Taf. 2, Fig. 15 a—b; Abb. 3d, 5a—b) 都具有向前扩大的头鞍, 头鞍前叶无头鞍沟, 前颈环叶虽然低, 但无分离的前颈环侧叶 (L_1), 前边缘沟深, 前边缘凸起, 眼叶较长大, 但新属的模式种背沟较深宽, 面线前支短, 向外分散的角度小, 眼叶向外凸出明显, 眼极窄, 呈窄长的凹陷区, 眼沟极深, 活动颊无颊刺, 且表面布满了棘状刺, 尾部虽然分节较多, 但轴节沟及肋沟极宽深, 此外尾边缘极窄, 表面也布满了棘状小刺, 两者容易区别出来。新属就其头鞍微向前扩大, 具有前颈环叶, 面线前支向外分散角度较小, 尾部呈半椭圆形等特点与 *Ditomopyge* Newell, 1931 也有些相似, 所不同的是新属的头鞍前叶后侧和后部有 1 个较深的凹陷区, 前颈环叶较头鞍和颈环低, 前边缘沟深, 前边缘窄而凸起, 头部及尾部表面具有棘状刺, 尾部的肋沟及轴环沟极宽深, 分节也较多, 两者易于区别。值得注意的是 *Ditomopyge* 的一些种, 如 *D. decurtata* (Gheyselinck, 1937) (Grant, 1966: pl. 13, figs. 4 a—c); *D. bjornensis* Ormiston (1973: 131—133, pl.16, figs. 1—3, 5,7); *D. yungchangensis* Wang (1937:361—367 页, 图版 1, 图 1a—b, 2a—b, 3,4a—c), 其尾轴节上也有横向排列的一列小瘤, 甚至头盖上还有粉瘤, 因此新属有可能是从晚石炭世 *Ditomopyge* 的某些种演化而来的。

模式种 *Acanthophillipsia guiyangensis* gen. et sp. nov.

时代分布 贵州; 早二叠世。

贵阳棘非利普虫(新属、新种) *Acanthophillipsia guiyangensis*

gen. et sp. nov.

(图版 1, 图 1—11; 插图 1)

除了属的一般特征外,还具有以下的特征:头鞍较短而宽,均匀向前扩大,似棍棒状,前叶似球状。边缘沟深,边缘凸起,其外部具有与边缘平行的 5 至 6 条脊线,内部具 1 至 2 排极小的棘状刺。头部表面的棘状刺大而少。尾部平缓凸起,半圆形至半椭圆形,中轴分 19 至 20 节,肋部具 11 对肋脊,每对肋脊上只具有 1 排较大的瘤刺。

描述 共有 5 块头盖外模及模型, 2 块活动颊外模及模型, 2 块尾部外模及模型及 1 块不完整的尾部内核。头鞍中等凸起, 均匀向前扩大, 呈棍棒状, 前缘宽圆, 伸达前边缘沟, 在 γ 稍前方达最大宽度, 在 δ 相对位置处略向内收缩。头鞍前叶呈球形, 最大高度在中后部, 侧头鞍沟 (S_2-S_4) 消失。后一对头鞍沟深而宽, 在内端分叉, 前支深并在中部相连, 后支短浅, 不与颈沟相连。前颈环较颈环窄而低, 向两侧明显倾斜, 前颈环侧叶和中叶三分不明显, 它们之间仅仅由于表面瘤刺的大小不同和凸起的高度不同而微弱地显示出来, 侧前颈叶通常低, 其上的瘤刺很小。颈沟深, 中部微向前弯曲。颈环凸起, 中部比两侧略宽, 向两侧的背沟方向强烈倾斜。前边缘沟深, 但两侧与侧边缘沟不相连。前边缘凸起, 内部有 1 至 2 排很小的棘状刺, 外部有 5 至 6 条与边缘大致平行的脊线。从侧视看, 头鞍自前颈环起成缓坡逐渐向上升高, 至中后部达到最大高度后即向前下倾, 成 1 陡坡与前边缘沟相接。背沟宽而深。固定颊很窄。面线前支段 $\beta-\gamma$ 直, 紧靠背沟, 几乎与背沟平行向前延伸, 至前边缘沟后成 1 钝角向内切前边缘于头盖的前侧方; 面线后支段 $\epsilon-\zeta$ 极短。眼

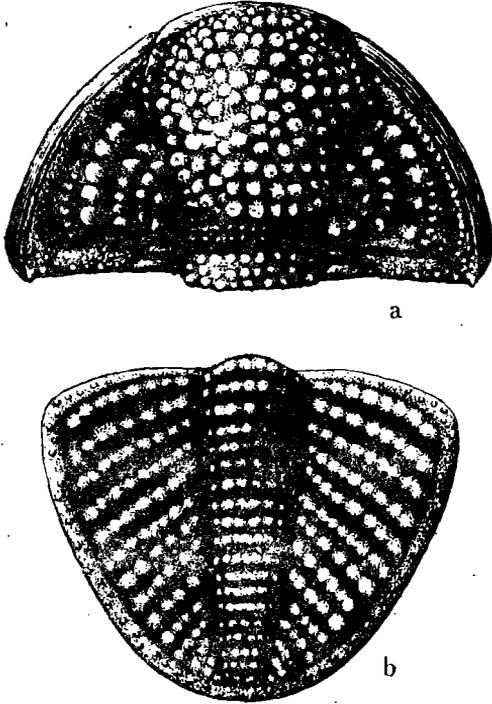


插图 1 *Acanthophillipsia guiyangensis* gen. et sp. nov.

a. 头部, $\times 5$; b. 尾部, $\times 3.5$

叶长大、凸起呈新月形, 位于头鞍相对位置的中后部, 前后端均靠近背沟, 后端几乎达颈沟的水平位置, 中部强烈向外凸出, δ 明显地凸出在 β 纵长线之外。固定颊后边缘凸起, 横向较宽, 纵向较窄, 后边缘沟窄而清楚。

活动颊宽大, 颊刺极短, 几乎消失。眼极窄长, 在固定颊和活动颊之间形成 1 个窄长的凹陷区, 小眼粒不清楚。眼与活动颊颊区之间由深的眼沟分开。侧边缘沟宽深, 侧边缘宽而凸起, 呈陡坡向外倾斜, 其内部有两排极小的瘤, 外部有 6—7 条与边缘平行的脊线。头鞍、颈环、眼叶和活动颊颊区上都有较大的棘状刺, 其中正模标本的头鞍前叶上大约有 70—80 个大的棘状刺, 眼叶上大约有 9—15 个大的棘状刺, 活动颊颊区上大约有 6—10 个大的棘状刺, 此外还有许多小的棘状刺和瘤分布在边缘地带。

尾部半圆形至半椭圆形,中等凸起,宽度略大于其长度,宽与长之比约为 1.25 至 1.30。中轴长而凸起,轴节沟深陷,分 19—20 个轴节。中轴的宽度与肋部的宽度几乎相等或略窄,纵向三分现象在前 11—12 个轴节较明显,分宽而凸起高的中叶和窄而低的侧叶,侧叶自前向后变窄,直至消失,侧叶上具 1 至 2 个小瘤,中叶上具 1 排 5—7 个较大的瘤刺。轴节横切面呈圆弧状,中叶约占整个中轴宽度的 3/5。后关节半环清楚,前关节半环窄。背沟宽深。从后部看,肋部自背沟起向外呈缓坡上升,至中外部又急剧地向边缘倾斜。肋沟宽深,间肋沟极浅而窄,仅在外皮脱落的内核上可见。肋部具 10—11 对肋脊。每个肋脊上具有一排 1 至 9 个大的棘状瘤刺。尾边缘窄而平缓凸起,其外缘呈较陡的坡度向下倾斜,其上具有小的瘤点装饰。

产地层位 贵州贵阳探矿厂;早二叠世茅口组上部。

度量 (mm)

| 标本登记号 | 头盖长 | 头鞍长 | 头鞍最大宽 | 前颈环长 | 颈环长 | $\gamma-\gamma$ 宽 | $\delta-\delta$ 宽 | $\epsilon-\epsilon$ 宽 |
|------------|------|------|-------|-------|-----|-------------------|-------------------|-----------------------|
| GPIN96470* | 11.0 | 8.3 | 6.0 | 0.8 | 2.2 | 6.4 | 10.0 | 6.4 |
| 96471 | 8.3 | 6.3 | 5.2 | 0.7 | 1.6 | 5.8 | 8.0 | 5.8 |
| 96473 | 8.2 | 6.1 | 5.0 | 0.8 | 1.5 | 5.7 | 8.0 | 5.7 |
| 96474 | 11.8 | 9.3 | 7.8 | 1.1 | 1.8 | 8.3 | 11.3 | 7.5 |
| 96475 | 7.8 | 5.8 | 4.8 | 1.0 | 1.2 | 5.2 | 7.0 | 5.0 |
| | 尾长 | 尾最大宽 | 尾轴长 | 尾轴最大宽 | 轴节数 | 肋脊对数 | | |
| 96472 | 7.6 | 9.6 | 6.4 | 2.7 | 19 | 11 | | |
| 96479 | 12.0 | 14.0 | 11.0 | 4.2 | 19 | 11 | | |
| 96480 | 9.0 | 13.0 | 8.3 | 4.2 | 20 | 10—11 | | |

* Holotype

优美棘非利普虫(新属、新种) *Acanthophillipsia abrota* gen. et sp. nov.

(图版 II, 图 1—9; 图版 III, 图 5—8; 插图 2)

头鞍前叶较长,向前扩大明显,似椭球状。头盖及活动颊边缘外部的脊线不明显。头部表面的瘤刺小而密集。尾部较长,半椭圆形,中轴分 19—21 节,由两侧的纵沟将中轴清楚地三分,其中侧部具有 1—3 个小瘤刺;肋部由 11—13 对肋脊组成,每个肋脊上具有 2—3 排小的棘状刺。

描述 共有 4 块头盖外模及模型,1 块头盖内核,3 块尾部内核及 5 块尾部外模及模型。头鞍中等凸起,呈棍棒状,较长,向前微扩大,至头鞍前侧角达到最大宽度。头鞍前叶呈椭球状,前面的头鞍沟 (S_2-S_4) 消失。后一对头鞍沟深陷,自眼叶前端相对位置的背沟处向后内方急剧斜伸,然后在内端分叉,后支短,向后内侧斜伸,但不与颈沟相连,前支深陷,平伸并在头鞍中部相连。前颈环叶较头鞍和颈环略低,呈浅的凹字形,前颈侧叶 (L_1) 与中叶没有分开。前颈环叶中部凸起较两侧高,后缘几乎与颈沟形成垂直的陡坎,前缘向后 1 对头鞍沟倾斜,两侧向背沟方向形成较陡的倾斜面。颈沟深,中部微向前弯曲。颈环中部凸起高,向背沟急剧倾

斜,中部比两侧略宽(纵向)。前边缘沟窄而清楚。前边缘较宽而平缓凸起,前缘向前急剧倾斜,其上有2—3列垂直向上生长的棘状小刺,其外部的脊线不清楚。从侧视看,颈环微向前倾斜,至颈沟处急剧下倾,使颈沟呈V字谷,前颈环在头鞍前叶和颈环之间形成1个窄而低的平地,然后头鞍呈缓坡上升至眼叶中前部相对位置处达到最大高度,以后平缓下降,呈缓坡与前边缘相接。背沟深,在眼叶相对位置处明显地升高,向前向后急剧下降。固定颊极窄。面线前支段 β — γ 较长,靠近背沟,后支段 ε — ζ 短,向侧后方斜伸。眼叶长而宽,凸起较高,呈新月形,前后端都靠近背沟,后端达前颈环相对位置的中后部。 δ 明显地凸出在 β 的纵长线之外。固定颊后边缘平缓凸起,其上仍生长有棘状小刺。头盖表面布满了中等大小及小的与表面几乎垂直的棘状小刺,其中正模标本的头鞍前叶约有120—130个棘状小刺,眼叶上具有40个左右的小刺。

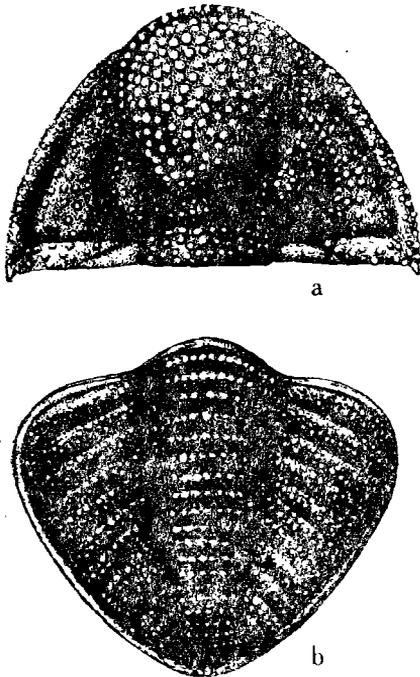


插图2 *Acanthophillipsia abrosa* gen. et sp. nov.

a. 头部, $\times 6$; b. 尾部, $\times 2.8$

活动颊宽大,颊角圆润。眼窄长,凹下,小眼粒不清楚,代之以1排由17—18个小的棘状凸起。眼沟极窄而深。颊区平缓凸起,向侧边缘沟和后边缘沟倾斜,其上具有4至5列大约有60个小的棘状刺。后边缘沟宽而深,后边缘平缓凸起,其上布满了小的瘤。侧边缘沟宽深,向颊角方向变浅,外边缘凸起,向颊角方向变宽,向外急剧倾斜,其上有2至3排小的瘤刺。

尾部长,半椭圆形,平缓凸起,宽与长之比约为1.16。中轴长而凸起,横切面呈半圆形,轴节沟深而宽,分19—21个轴环节。中轴向后均匀收缩,后缘伸达后边缘沟,与后边缘沟形成1个小的陡坎。中轴为纵沟清楚地三分,中叶宽而凸起,由前向后收缩缓慢,侧叶窄而低,向后收缩明显,至第14个轴环以后,侧叶基本消失。每个轴环节的中叶上具有1至2排8—14个中等大小的瘤刺,瘤刺数由前向后逐渐减少。前3个侧叶上通常有3个小瘤刺,第4至第6个侧叶上有2个小瘤刺,以后的侧叶上有1个小瘤刺。后关节半环清楚,前关节半环向前强烈拱曲。背沟宽而深。肋部自背沟向外呈缓坡上升,至中外部向边缘沟倾斜。肋沟深宽,间肋沟消失。肋部具11—13对肋脊,在前二对肋脊上有3—4排小的瘤刺,在第3至第6对肋脊上有2—3排小的瘤刺,在以后的肋脊上具1—2排小的瘤刺。尾边缘沟浅。尾边缘窄而平缓凸起,其上亦有稀少的小瘤。腹边缘较宽,其上有7—8条与边缘平行的阶梯状脊线。

比较 新种与模式种相比,一个显著的特点是头部和尾部表面的瘤刺小而多,其次是头鞍较长,头鞍前叶呈椭球状,头鞍的最大宽度在头鞍的前侧角,活动颊较宽,其边缘上具2—3排瘤刺,但不见有5—6条脊线。尾部较长,尾轴向后收缩较快,中轴的侧叶上具有1—3个小瘤刺。

产地层位 贵州贵阳探矿厂,早二叠世茅口组上部。

度量 (mm)

| 标本登记号 | 头盖长 | 头鞍长 | 头鞍最大宽 | 前颈环长 | 颈环长 | $r-r$ 宽 | $\delta-\delta$ 宽 | $\varepsilon-\varepsilon$ 宽 |
|-------------|------|------|-------|-------|-----|---------|-------------------|-----------------------------|
| GPIN 96481* | 7.8 | 6.0 | 5.0 | 0.8 | 1.0 | 4.7 | 6.7 | 4.2 |
| 96482 | 6.6 | 5.1 | 3.6 | 0.7 | 0.9 | 3.4 | 5.4 | 3.1 |
| 96484 | 7.0 | 5.2 | 4.0 | 0.7 | 1.0 | 3.9 | 6.1 | 3.2 |
| 96489 | — | — | 7.0 | — | — | — | — | — |
| 96490 | 10.0 | 8.0 | 5.0 | 0.8 | 1.6 | 6.6 | 9.6 | 7.2 |
| | 尾长 | 尾最大宽 | 尾轴长 | 尾轴最大宽 | 轴节数 | 肋脊数 | | |
| 96483 | 4.1 | 5.0 | 3.7 | 1.6 | 19 | 11 | | |
| 96485 | 8.4 | 10.4 | 8.8 | 4.1 | 19 | 12 | | |
| 96486 | 10.4 | 11.4 | 9.6 | 4.2 | 19 | 11 | | |
| 96487 | 10.5 | 12.5 | 10.0 | 4.3 | >17 | 11—12 | | |
| 96488 | 14.0 | 16.5 | 13.5 | 6.0 | 21 | 12—13 | | |
| 96491 | — | 17.5 | — | 7.0 | >19 | >11 | | |
| 96492 | — | 17.0 | — | 6.2 | >15 | >10 | | |
| 96493 | 4.1 | 4.9 | 3.9 | 1.6 | 19 | 11 | | |

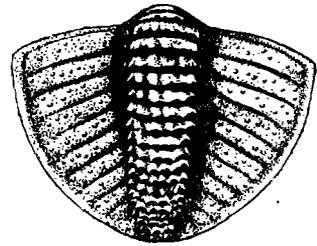
* Holotype

反常棘非利普虫(新属、新种) *Acanthophillipsia abnormis* gen. et sp. nov.

(图版 III, 图 9, 10; 插图 3)

尾部中轴强烈凸起, 纵向三分, 由深而宽的轴节沟将中轴分为 18—19 个轴节, 每个轴节中叶有 6 个横向排列的棘状小刺, 肋部肋脊较宽, 表面的瘤点小而稀少。尾边缘极窄, 向外呈陡坡下倾, 其上有 6—7 条与边缘平行的脊线。

描述 有 1 块尾部及部分胸节的内核标本和 1 块尾部及部分胸节的外模及其模型。尾部凸起, 近乎半椭圆形, 宽略大于长, 两者之比约为 1.2。中轴比肋部略窄, 强烈凸起在肋部之上, 向后微收缩, 后端宽圆。前关节半环呈明显的新月形。中轴纵向三分明显, 中部宽, 强烈拱起, 两侧低平, 微向背沟倾斜, 由宽而深的轴环沟将中轴分成 18—19 个轴节, 每个轴环节的中叶上有 6 个棘状瘤刺, 前 8 至 9 个轴环的侧叶上亦有 1 个很小的瘤。背沟宽而深。肋部比轴部略宽, 由窄而深的肋沟将肋部分成 10—11 对较宽的肋脊。从后视看, 肋部自背沟向外升高, 但至肋部的 1/3 处急剧向外倾斜。边缘沟不清楚。边缘极窄, 成陡坎向外向下倾斜, 在其外侧的边缘上具 6—7 条脊线。肋脊上具有稀少的小瘤点。在其保存为内核的情况下, 可见极窄的间肋沟及中等宽度的腹边缘, 并在其上见有 6—7 条阶梯状脊线。

插图 3 *Acanthophillipsia abnormis* gen. et sp. nov.尾部, $\times 2.8$

与尾部在一起的胸部共有 7 个不完整的胸节。背沟深。中轴强烈拱起, 横切面几乎成半圆形, 每个轴环节都有 1 个前关节半环, 但略低于后关节半环, 且光滑无装饰。中部略窄于(纵向)后关节半环, 向两侧很快成圆弧状下倾并尖灭。后关节半环呈圆拱形, 强烈凸起, 纵向的长度几乎相等, 向背沟呈圆弧状急剧下倾, 其上有许多小瘤装饰, 关节半环沟清楚。肋部比轴部略宽(横向), 靠近轴的 2/5 微向上升高, 外部的 3/5 弯曲向下倾斜, 外端圆润。

比较 新种与模式种 *Acanthophillipsia guiyangensis* 相比,中轴凸起较高,肋沟窄,肋脊宽,无尾边缘沟,且肋脊上的瘤点少而小。新种和 *Acanthophillipsia abrota* 相比,尾部较短,尾轴向后收缩较慢,肋脊较宽而平坦,其上仅有稀少的小瘤,两者易于区别。新种就其尾部的外形、凸度、分节数与阿富汗早二叠世早期所产的 *Hentigia* 的模式种 *H. bulbops* Haas, G.Hahn et R. Hahn (1980:83—100, Taf.1, Fig. 1—4; Taf. 2, Fig. 1—16; Taf. 3, Fig. 1—8; Taf.4, Fig. 1—14; Abb. 5—22) 的尾部也较相似,所不同的是新种的尾边缘沟不显,尾边缘很窄,尾轴环节上长有 1 列横向排列 6 个棘状刺,尾轴纵向三分明显,在两侧叶上还有 1 个小瘤,此外在尾边缘的外侧部还具有 6—7 条脊线。

就其尾部外形,肋沟窄,肋脊较宽,尾边缘沟不显等特征来看,新种与 *Ditomopyge* 某些种的尾部也很相似,如 *Ditomopyge decurtata* (Gheyselinck, 1937) (Grant, 1966: pl. 13, fig.4; Owens, 1983:pl.4, figs. 1—2); *Ditomopyge bjornensis* Ormiston (1973: 131—133, pl.16, figs. 1—3, 5,7) 与两者的区别是新种的尾轴和肋部分节较多,轴环沟及背沟极宽而深,每个轴环上有 6 个棘状刺,而 *Ditomopyge* 的这 2 个种尾轴环上仅有很小的瘤,此外,新种的边缘极窄,也容易和它们相区别。

产地层位 贵州贵阳探矿厂;早二叠世茅口组上部。

度量 (mm)

| 标本登记号 | 尾长 | 尾最大宽 | 尾轴长 | 尾轴最大宽 | 轴节数 | 肋脊数 |
|-------------|------|------|------|-------|-----|-----|
| GPIN 96499 | 11.8 | 14.0 | 10.5 | 4.3 | 18 | 11 |
| GPIN 96500* | 10.5 | 13.0 | 10.0 | 4.0 | 18 | 11 |

* Holotype

**瘤状棘非利普虫(?) (新属、新种) *Acanthophillipsia* (?) *granulosa*
gen. et sp. nov.**

(图版 I, 图 12; 图版 III, 图 1—4; 插图 4)

头鞍前叶呈梨形,前缘与前边缘愈合,两者仅为一浅的前边缘沟分开。背沟深,在颈沟之前向前扩张,至 δ 相对位置处又向前收缩,在眼叶之前形成 1 个深的前坑,然后又向前强烈扩张。头盖上具有瘤疱状装饰。

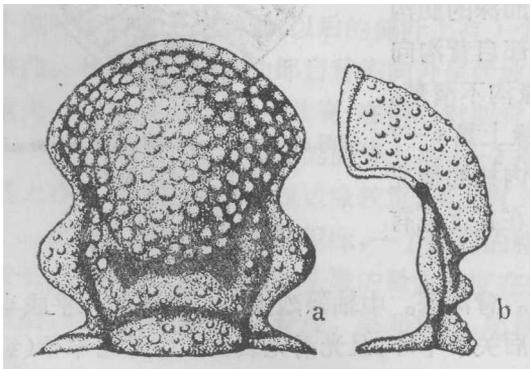


插图 4 *Acanthophillipsia* (?) *granulosa* gen. et sp. nov.

a. 头盖, 正视, $\times 5$; b. 头盖, 侧视, $\times 3.5$

描述 共有 5 块头盖内核标本。头鞍梨形,前部明显地向前扩大,在其前侧角达到最大宽度。头鞍强烈凸起,其前叶的后部凸起最高,向前倾斜,前缘与向前下方倾斜的前边缘愈合,两者之间仅为 1 浅的前边缘沟分开。前叶的侧头鞍沟 (S_2-S_4) 消失。后一对头鞍沟近背沟处浅,内端分叉,在分叉处形成宽而深的坑,前支宽深,在中部相连,后支亦宽深,但不与颈沟相连。前颈环叶窄(纵向)长,但略低于头鞍前叶后部和颈环,靠颈沟处凸起最高,与颈沟几乎形成 1 个垂直的陡坎,向

前平缓下倾,但向背沟方向急剧下倾,形成 1 个陡坡,前颈环侧叶 (L_1) 窄长(纵向),并不与中叶分开,向后侧的背沟方向形成一陡坡。颈环中部凸起高,向两侧变窄并急剧下倾,在背沟处形成 1 对深陷的凹坑。前边缘窄,几乎形成 $70^\circ-80^\circ$ 的倾角向前下方倾斜。背沟宽而深,自颈环两侧逐渐向前扩大,至 δ 相对位置处又向前收缩,并在眼叶相对位置的前部形成 1 对深陷的前坑,然后又向前明显扩大,使头鞍形成 1 个钝圆的前侧角。固定颊极窄。面线前支段 $\beta-\gamma$ 长,紧靠背沟,与背沟平行向前延伸;后支段 $\epsilon-\zeta$ 极短,与背沟近乎平行。眼叶长大,凸起呈新月形,后缘达前颈环中部的相对位置。 δ 明显地凸出在 β 纵长线之外。固定颊后边缘窄而凸起。头盖表面除了头鞍中部的瘤较大外,布满了中等大小及小的瘤。

比较 新种就其头盖、头鞍的凸度及一般形态,眼叶的大小和表面的瘤状装饰,可归于 *Acanthophillipsia* 属之中,但是新种的头鞍在 γ 相对位置处明显地向内收缩,头鞍前缘与前边缘愈合,在眼叶前方的背沟处具深而圆的前坑,与 *Acanthophillipsia* 属内其余的种都不相同,而与 *Pseudophillipsia (Carniphillipsia)* G.Hahn et Brauckmann, 1975 及 *Ditomopyge* Newell, 1931 都有些相似。新种与 *Pseudophillipsia (Carniphillipsia)* 的模式种 *Ps. (C.) ogivalis* Gauri (1965: 13—17, Taf. 1, Fig. 1—7; Abb. 3—4; G. Hahn and R. Hahn, 1987: 593—594, Taf. 4, Fig. 1—6; Abb. 20—21) 的主要区别为新种的前颈环侧叶并不完全与中叶分开,头盖及头鞍的凸度较大,眼叶向外凸出明显,面线前支段 $\beta-\gamma$ 紧靠背沟,向外分散的角度很小,以及表面具有强烈的瘤状装饰,两者易于区分。新种与产于美国中部内布拉斯加州东南部早二叠世所产的 *Ditomopyge wheitei* (Pabian et Fagerström) (Pabian and Fagerström, 1972: 814—815, pl. 1, figs. 14—19; text-figs. 13—16), 在其头鞍的形状、凸度及面线的历程上都很相似,但美国的种头鞍较长,前颈环叶三分明显,面线前支段 $\beta-\gamma$ 长,眼叶较短,位置靠后,表面无大的瘤点装饰。新种就其头盖上的装饰来看更接近于 *Acanthophillipsia abrota* sp. nov., 两者的主要区别是前者在 γ 处头鞍明显地向内收缩,在眼叶相对位置前方的背沟内有 1 对深陷的前坑,头鞍呈梨形,前侧角明显地向两侧扩大,且其壳面装饰为瘤疱状,不象后者那样呈棘状小刺。

产地层位 贵州贵阳探矿厂,早二叠世茅口组上部。

度量 (mm)

| 标本登记号 | 头盖长 | 头鞍长 | 头鞍最大宽 | 前颈环长 | 颈环长 | $\gamma-\gamma$ 宽 | $\delta-\delta$ 宽 | $\epsilon-\epsilon$ 宽 |
|------------|------|------|-------|------|-----|-------------------|-------------------|-----------------------|
| GPIN 96494 | 6.3 | 5.4 | 3.9 | 0.6 | 0.9 | 3.9 | 5.6 | 3.9 |
| 96495* | 11.0 | 9.4 | 7.3 | 1.1 | 1.6 | 7.0 | 10.0 | 7.1 |
| 96496 | 12.3 | 10.5 | 8.5 | 1.0 | 1.8 | 8.8 | 11.5 | 7.1 |
| 96497 | 9.4 | 8.1 | 6.0 | 0.8 | 1.3 | 6.2 | — | 5.4 |
| 96498 | 7.4 | 6.2 | 5.0 | 0.7 | 1.2 | 4.8 | — | 4.4 |

* Holotype

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ON A NEW GENUS *ACANTHOPHILLIPSIA* OF *DITOMOPYGINAE* HUPÉ, 1953 FROM LOWER PERMIAN OF GUIYANG, SOUTH CHINA

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Summary

A series of preliminary reports on Permian trilobites from South China have been successively published by Qian (1977), Yin (1978), Zhang *et al.* (1982), Zhou (1986) and others up to now, with the description of totally 19 species belonging to 6 genera (or subgenera), namely: *Pseudophillipsia* (*Pseudophillipsia*) *obtusicauda* (Kayser, 1883), *Ps.* (*Ps.*) *chongqingensis* Lu, 1974, *Ps.* (*Ps.*) *qinglongensis* Qian, 1977, *Ps.* (*Ps.*) *anshunensis* Qian, 1977, *Ps.* (*Ps.*) *subcircularis* Qian, 1977, *Ps.* (*Ps.*) *shang-*

gaoensis Zhang, 1982, *Ps. (Ps.) wuweiensis* Zhang, 1982, *Ps. (Ps.) tongluensis* Ju, 1982, *Ps. (Ps.) yunnanxiensis* Liu, 1982, *Pseudophillipsia (Carniphillipsia) pyriformis* Qian, 1977, *Ps. (C.) triangulata* Ju, 1982, *Ps. (C.) mengshanensis* Zhang, 1982, *Acropyge multisegmenta* Qian, 1977, *A. brevica* Yin, 1978, *Paraphillipsia sinensis* Zhou, 1986, *Weania guangxiensis* (Zhou, 1986) (= *Nipponaspis guangxiensis*), *Cheiropyge himalayensis* Diener, 1897 and *C. (?) gaoanensis* (Zhang, 1982) [= *Brachymetopus (Brachymetopus) gaoanensis* Zhang, 1982]. Among them, the last two species belong to the family Brachymetopidae Prantl et Pribyl, 1950, while the others to the family Phillipsiidae Oehlert, 1886.

The trilobites described in the present paper come from the greyish yellow to purple siliceous and silty mudstone in the upper part of the Lower Permian (approximately Wordian) Maokou Formation near Guiyang, Guizhou, including 4 new species of *Acanthophillipsia*, namely, *A. guiyangensis* sp. nov., *A. abrota* sp. nov., *A. abnormis* sp. nov. and *A. (?) granulosa* sp. nov.

All the materials are housed in Nanjing Institute of Geology and Palaeontology, Academia Sinica.

Family Phillipsiidae Oehlert, 1886

Subfamily Ditomopyginae Hupé, 1953

Acanthophillipsia gen. nov.

Diagnosis: Exoskeleton with thorn-like spines. Genal angle of librigenae pointed or with a very short spine. Glabella slightly expanded forward, cudgel-like in outline, with broadly rounded anterior margin; anterior lateral glabellar furrows (S2—S4) normally obsolete or absent; posterior lateral glabellar furrow (S1) deeply incised and bifurcated; anterior branches deeply and widely incised, connecting in the middle, while posterior ones short and shallow. Anterior border furrow narrow and deep; anterior border vertical, narrow, attached to glabella. Preoccipital lobe well developed, but lateral preoccipital lobe (L1) undifferentiated. Palpebral lobes large and long (exsag.), crescent, with anterior and posterior ends near the dorsal furrow. Fixed cheeks extremely narrow. Anterior branch of facial sutures parallel to dorsal furrow; posterior branch without well-developed straight section ϵ — ζ . Eyes very long and narrow, forming a narrow depressed area, with eye furrow deeply incised. Pygidium isopygous, semicircular to semielliptical in outline. Rachis long, convex, distinctly tripartite (exsag.), with 18—21 axial rings. Axial ring furrows and pleural furrows broadly and deeply incised. Pleural areas gently convex; with 10—13 pairs of pleural ribs. Interpleural furrows obsolete. Pygidial border extremely narrow; pygidial border furrow shallow.

Discussion: In general outline of cephalon and pygidium, this new genus is very similar to *Iranoaspidion* Kobayashi et Hamada with type species *I. sagittalis* (1978, p. 158, figs. 1—4; 1984, p. 67—69, pl. 14, figs. 1—4) from the Middle Permian of central Iran and to *Hentigia* Haas, G. Hahn et R. Hahn, with type species *H. bulbops* (1980, p. 83—100, Taf. 1, Fig. 1—4; Taf. 2, Fig. 1—16; Taf. 3, Fig. 1—8; Taf. 4, Fig. 1—14; Abb. 5—22) from the Early Permian of Afghanistan. It differs from *Iranoaspidion* mainly in the spinous exoskeleton, the cudgel-shaped glabella, the elliptical global main lobe of glabella which lacks a sagittal incision in its posterior margin, the undifferentiated lateral preoccipital lobe which is divided into two nodes in the latter, the longer and larger palpebral lobes, the extremely narrow and depressed eye areas, the genal angle of librigenae without long genal spines and the narrower pygidial border.

Acanthophillipsia can be distinguished from *Hentigia* by the well-developed lateral preoccipital lobes (L1) and distinctive lateral glabellar furrows (S2—S4) in the latter; the extremely narrowed and depressed eye areas in the former; the less segmented pygidium (with 17—20

axial rings and 9—11 pairs of pleural ribs) and broader pygidial border in the latter; and the spinous exoskeleton in the former. *Eocyphium* Reed, 1942 with the type species *E. clitheroense* (Osmolska, 1970, p. 96—97, pl. 13, figs. 1, 5) also displays such a spinous exoskeleton, but it differs in the less expanded glabella with distinct lateral glabellar furrows (S2—S3), the only weakly pronounced preoccipital lobe, the smaller eyes and palpebral lobes, the posterior branches of facial sutures with longer section ϵ — ζ and the less segmented pygidium (with 14—17 axial rings and 10—14 pairs of pleural ribs). In the pygidial segmentation and the lower preoccipital lobe this genus resembles *Pseudophillipsia* (*Carniphillipsia*) Hahn, G. et Brauckmann, 1975, but can be distinguished from the latter by the deeper dorsal furrow, the shorter and less divergent anterior branches of facial sutures, the longer and larger palpebral lobes, the extremely narrowed and depressed eye areas, the genal angle of librigenae without long genal spines, the spinous exoskeleton, the deeply incised axial ring furrows and pleural furrows on the pygidium and the narrower pygidial border. This genus is allied to *Ditomopyge* Newell, 1931 in the gently expanded glabella, the presence of preoccipital lobe, the less divergent anterior branches of facial sutures and the semi-elliptical pygidium, but differs in the presence of a depressed area behind the main lobe of glabella; the lack of lateral preoccipital lobe; the vertical, upturned anterior border; the narrowed and depressed eye areas; the more deeply incised axial ring furrows and pleural furrows on the pygidium and the spinous exoskeleton.

Type species: *Acanthophillipsia guiyangensis* sp. nov.

Age and distribution: Guizhou, South China; Early Permian.

Acanthophillipsia guiyangensis gen. et sp. nov.

(Pl. I, figs. 1—11, Text-fig. 1)

Diagnosis: Glabella broad, short-cudgel-shaped in outline, gently expanded forward with main lobe spherical. Anterior border vertical, upturned, with one or two rows of smaller spines in inner part and 5—6 terrace lines running parallel to the cephalic margin in outer part; thorn-like spines on the exoskeleton larger in size but less in number. Pygidium semicircular to semielliptical; tachs with 19—20 axial rings; pleural areas with 11 pairs of pleural ribs, and each rib with a row of larger spines.

Locality and horizon: The site of Guiyang Mineral Exploration Factory near Guiyang, Guizhou; upper part of Maokou Formation, Upper Lower Permian (Wordian).

Acanthophillipsia abrota gen. et sp. nov.

(Pl. II, figs. 1—9; Pl. III, figs. 5—8; Text-fig. 2)

Diagnosis: Glabella cudgel-shaped in outline, with main lobe elongated-spherical. Terrace lines on the outer part of cephalic border unclear. Thorn-like spines on the exoskeleton smaller in size, but more in number. Pygidium semielliptical. Rachis clearly tripartite (exsag.) with 19—21 axial rings; each axial ring with 1—3 small spines in lateral part and one or two rows of spines (about 8—14 spines) in central part. Pleural areas with 11—13 pairs of pleural ribs; each rib bearing 2—3 rows of smaller thorn-like spines.

Comparison: This new species differs from the type species mainly in the sculpture on exoskeleton with thorn-like spines smaller in size but more in number; the elongated spherical main lobe of glabella; the broader librigenae with 2—3 rows of smaller thorn-like spines on the inner part of lateral border and the more conspicuously tripartite rachis with 1—3 smaller spines on the lateral part of each axial ring.

Locality and horizon: The same as the preceding species.

***Acanthophillipsia abnormis* gen. et sp. nov.**

(Pl. III, figs. 9, 10; Text-fig. 3)

Diagnosis: Pygidium semicircular. Rachis strongly convex, conspicuously tripartite (exsag.) with 18—19 axial rings, and each axial ring with 6 thorn-like spines; axial ring furrows deeply incised. Pleural areas gently convex, with 11 pairs of broader pleural ribs on which there are only scarce smaller nodes. Pygidial border extremely narrow, steeply downwards, with 6—7 terrace lines on the outer part of pygidial border; border furrow absent.

Comparison: This new species differs from the type species *A. guiyangensis* in having more elevated rachis, narrower pleural furrows, and broader pleural ribs on which there are only scarce smaller nodes and no border furrow.

This new species can be easily distinguished from *A. abrota* by its shorter pygidium, broader and flatter pleural ribs, narrower pleural furrows and scarce smaller nodes on the pleurae.

In general outline, convexity and segmentation of pygidium this new species is similar to the type species of *Hentigia*, *H. bulbops* Haas, Hahn, G. et Hahn, R. (1980, p. 83—100, Taf. 1, Fig. 1—4; Taf. 2, Fig. 1—16; Taf. 3, Fig. 1—8; Taf. 4, Fig. 1—14; Abb. 5—22) from the Early Permian of Afghanistan, but differs mainly in the narrower pygidial border, the absence of border furrow, in particular the more distinctly tripartite rachis on which each axial ring possesses a smaller node in the lateral part and 6 thorn-like spines in the central part, and the pygidial border with 6—7 terrace lines in the outer part.

In the shape of pygidium, narrower pleural furrows, broader pleural ribs this species is closely related to certain taxon of *Diomopyge* Newell, 1931, such as *D. decurtata* (Gheyselinck, 1937) (Grant, 1966, pl. 13, fig. 4; Owens, 1983, pl. 4, figs. 1, 2) and *D. bjornensis* Ormiston (1973, p. 131—133, pl. 16, figs. 1—3, 5, 7), but the former has a multisegmented pygidium, deeply incised axial ring furrows with 6 thorn-like spines in the central part of each axial ring.

Locality and horizon: The same as the preceding species.

***Acanthophillipsia* (?) *granulosa* gen. et sp. nov.**

(Pl. I, fig. 12; Pl. III, figs. 1—4; Text-fig. 4)

Diagnosis: Main lobe of glabella pyriform; anterior margin fused with anterior border; anterior border furrow very shallow. Dorsal furrow deeply incised, gently divergent in front of occipital furrow, then slightly convergent at the level of δ , forming a pair of anterior pits in front of palpebral lobes, and strongly divergent subsequently. Surface of cranidium with numerous pimple-like sculpture.

Comparison: In general outline, convexity of cranidium and glabella, size of palpebral lobes and sculpture on the cranidium the new species can be assigned to *Acanthophillipsia*, but it can be distinguished from all remaining species of this genus by the glabella distinctly constricted at the corresponding position of γ , the anterior margin fused with anterior border and the presence of a pair of anterior pits in front of palpebral lobes. In these features the new species also resembles *Pseudophillipsia* (*Carniphillipsia*) Hahn, G. et Brauckmann, 1975 and *Diomopyge* Newell, 1931, but it differs from the type species of *Pseudophillipsia* (*Carniphillipsia*), *Ps. (C.) ogivalis* Gauri (1965, p. 13—17, Taf. 1, Fig. 1—7; Abb. 3—4; Hahn, G. and Hahn, R., 1987, p. 593—594, Taf. 4, Fig. 1—6; Abb. 20—21) mainly in the incompletely differentiated lateral preoccipital lobe, the less divergent anterior branches of facial sutures (β — γ) and the heavy sculpture.

In the course of facial sutures and the shape of glabella this species is similar to *Diomopyge*

whiei (Pabian et Fagerström) (Pabian and Fagerström, 1972: 814—815, pl. 1, figs. 14—19; text-figs. 13—16) from the Lower Permian of southeastern Nebraska, but the latter has a longer glabella, distinct lateral preoccipital lobes, longer anterior branches of facial sutures (β — γ), shorter palpebral lobes and scarce smaller nodes on the cranidium.

Locality and horizon: The same as the preceding species.

图 版 说 明

标本保存在中国科学院南京地质古生物所;标本产自贵州省贵阳市探矿厂附近,早二叠世茅口组上部。

图 版 I

1—11. *Acanthophillipsia guiyangensis* gen. et sp. nov.

1. 头盖模型 (Latex cast of cranidium), Holotype $\times 5$, 登记号: GPIN 96470.
2. 头盖模型 (Latex cast of cranidium), $\times 5$, 登记号: GPIN 96471.
3. 不完整尾部内核 (Fragmentary internal mould of pygidium), $\times 5$, 登记号: GPIN 96472.
4. 头盖模型 (Latex cast of cranidium), $\times 5$, 登记号: GPIN 96473.
5. 头盖模型 (Latex cast of cranidium), $\times 4$, 登记号: GPIN 96474.
6. 头盖模型 (Latex cast of cranidium), $\times 5$, 登记号: GPIN 96475.
7. 活动颊外模 (External imprint of free cheek), $\times 5$, 登记号: GPIN 96476.
8. 活动颊模型 (Latex cast of free cheek), $\times 5$, 登记号: GPIN 96477.
9. 部分头盖及活动颊模型 (Latex cast of fragmentary cranidium and pygidium), $\times 5$, 登记号: GPIN 96478.
10. 尾部模型 (Latex cast of pygidium), $\times 5$, 登记号: GPIN 96479.
11. 尾部模型 (Latex cast of pygidium), $\times 5$, 登记号: GPIN 96480.

12. *Acanthophillipsia* (?) *granulosa* gen. et sp. nov.

12. 头盖内核 (Internal mould of cranidium), $\times 7$, 登记号: GPIN 96494.

图 版 II

1—9. *Acanthophillipsia abrota* gen. et sp. nov.

1. 头盖模型 (Latex cast of cranidium), Holotype, $\times 6$, 登记号: GPIN 96481.
2. 头盖模型 (Latex cast of cranidium), $\times 7$, 登记号: GPIN 96482.
3. 尾部模型 (Latex cast of pygidium), $\times 7$, 登记号: GPIN 96483.
4. 头盖模型 (Latex cast of cranidium), a. 背视 (Dorsal view), $\times 6$, b. 前视 (Frontal view), $\times 6$, c. 侧视 (Lateral view), $\times 6$, 登记号: GPIN 96484.
5. 不完整尾部模型 (Latex cast of fragmentary pygidium), $\times 5$, 登记号: GPIN 96485.
6. 尾部内核 (Internal mould of pygidium), $\times 5$, 登记号: GPIN 96486.
7. 尾部模型 (Latex cast of pygidium), $\times 4$, 登记号: GPIN 96487.
8. 尾部模型 (Latex cast of pygidium), $\times 4$, 登记号: GPIN 96488.
9. 不完整头部和尾部模型 (Latex cast of fragmentary cephalon and pygidium), $\times 5$, 登记号: GPIN 96489.

图 版 III

1—4. *Acanthophillipsia* (?) *granulosa* gen. et sp. nov.

1. 头盖内核 (Internal mould of cranidium), Holotype, $\times 5$, 登记号: GPIN 96495.
2. 头盖内核 (Internal mould of cranidium), $\times 4$, 登记号: GPIN 96496.
3. 头盖内核 (Internal mould of cranidium), $\times 5$, 登记号: GPIN 96497.
4. 头盖内核 (Internal mould of cranidium), $\times 5$, 登记号: GPIN 96498.

5—8. *Acanthophillipsia abrota* gen. et sp. nov.

5. 头盖内核 (Internal mould of cranidium), $\times 5$, 登记号: GPIN 96490.
6. 尾部内核 (Internal mould of pygidium), $\times 4$, 登记号: GPIN 96491.
7. 不完整尾部模型 (Latex cast of fragmentary pygidium), $\times 4$, 登记号: GPIN 96492.
8. 尾部内核 (Internal mould of pygidium), $\times 7$, 登记号: GPIN 96493.

9, 10. *Acanthophillipsia abnormis* gen. et sp. nov.

9. 尾部及部分胸节内核 (Internal mould of pygidium and partly thorax), $\times 4$, 登记号: GPIN 96499.
10. 部分尾部及胸节模型 (Latex cast of fragmentary pygidium and thorax), Holotype, $\times 4$, 登记号: 96500.

