

云南胴甲鱼类的新发现*

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1962年冬,刘玉海和笔者等在云南武定中泥盆世地层中采获了大批胴甲鱼类化石,其中有些保存相当完好,經初步观察,有不少是过去未曾发现过的材料。本文仅系該批材料部分标本的初步研究,介紹一新科,两新属,三新种,全部材料的研究将另文发表。

工作过程中,承刘宪亭、刘东生二位先生的指导,周明鎮先生的热情鼓励并修改文稿;在野外期間,得到昆明工学院温杰史教授及普地教研組各位先生的大力帮助,在此表示衷心感謝。

胴甲魚綱 Antiarchi

星鱗魚目 Asteriolepidiformes

武定魚科 Wudinolepididae (fam. nov.)

武定魚属 Wudinolepis (gen. nov.)

溫氏武定魚 *Wudinolepis weni*¹⁾ (sp. nov.)

(图版 I, 图 1、2、3、4)

材料: 四个头甲的較完整的內模和外模;一些軀甲的內模和其背、腹、側壁的外模及少量的胸鰭,大約代表十个以上的个体。

正型标本: 一个完整头甲的內、外模。 古脊椎动物与古人类研究所标本登記号: V. 2963. 1.

产地及时代: 云南武定香水庄村东南,中泥盆世。

特征: 个体很小,全背长(头长+軀甲背长)尚不足 20 毫米的小型胴甲鱼类。头长、軀甲长和胸鰭长度之間的比例基本与 *Bothriolepis* 者一致。头甲和軀甲的背、側壁均具有左右对称,排列規則的稜嵴(图版 I, 图 2、3、4)。

头甲六边形,寬大于长,眶孔中位,大小中等。眶前部十分低平,不象一般沟鳞魚那样向上拱起,在圍繞眶孔的前、側部,形成一半圓形的环眶嵴(circle-orbital ridge)。头部紋飾向前直达吻緣。眶后部显著隆起,明显地高于眶前部(图版 I, 图 2)。

头甲的吻緣較后緣稍长,自前側角高度向前突伸,但其中間的主要部分則很平直。关节緣(obstantic margin)很长,約与側緣长度相等,后側角(postero-lateral corner)恰好与眶孔側緣的中部相对。側緣較短,上噴水突(supraspiracular process)等均发育。后緣中部的頸关节区(obtected nuchal area)向后突伸,呈尖端朝后的三角形。

眶前凹(preorbital recess)完全不发育。眶孔与下眶孔(suborbital fenestra)大小相若。耳枕凹(otico-occipital depression)寬短而深,外形大体与 *Remigolepis* 的很相似,其

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1) 种名贈与昆明工学院温杰史教授。

前侧角仅稍超过下眶孔的后缘。该凹侧缘折曲,横过其后缘稍前处最宽,而横过其后缘和近前缘处最窄(图版 I, 图 1)。在各头甲的内模上,均没有保存喷水嵴 (spiracular crista) 的印痕(图版 I, 图 1)。

躯甲宽短,背壁低平,长大于宽,背壁前缘内凹,两侧关节突 (processus obstans) 十分发育。后缘外突,不具后角。中背脊甚发育。腹壁宽度约与背壁宽度相等,横过其中部最宽。前内横嵴 (crista transversalis interna anterior) 和后内横嵴 (crista transversalis interna posterior) 均发育。前腹突 (anterior ventral process) 和前腹坑 (anterior ventral pit) 的部位保存不好,了解不详。后腹坑 (posterior ventral pit) 的孔口横扁,呈前腹向。腹中脊 (ventral median ridge) 和腹中沟 (ventral median groove) 均不发育。

前中背片长大于宽,前缘稍凸,宽于后缘,后突很发育。

后中背片较前中背片明显为窄。

后背侧片和后侧片紧密愈合,形成混合侧片 (mixilateral plate, 图版 I, 图 3)。该片横过其背角的宽度最大。其侧叶后腹突 (postero-ventral process) 异常发育,致使该片后缘的宽度几与横过背角的宽度相等。

胸鳍分节,较粗壮。近节 (proximal segment) 长约为宽的 $4\frac{1}{2}$ 倍;远节 (distal segment) 呈矛状,长约为宽的 4 倍。

感觉沟系统头部后斜凹线沟 (posterior oblique cephalic pit-line groove) 和躯甲后腹斜凹线沟 (posterior oblique abdominal pit-line groove) 均存在(图版 I, 图 2、4)。

纹饰除头甲的背壁和躯甲的背壁和侧壁排列有左右对称、图案状的稜嵴外,在各骨片均有平均分布的微粒状小突起,惟躯甲在其背、腹壁的近后缘处,各有一排密集的短脊(图版 I, 图 4)。

比较: *Wudinolepis* 的胸鳍分节,后背侧片和后侧片愈合成混合侧片等特征,显然属星鳞鱼目 (Asterolepiformes)。头甲六边形,前中片长大,眶孔中位,侧缘上喷水突和上喷水缺等均发育;头甲、躯甲和胸鳍三者长度的比例以及头部后斜凹线沟和躯甲后斜腹凹线沟的存在等均与 Bothriolepidae 相一致,而与该目中的 Asterolepidae, Pterichthyidae, Ceraspidae 和 Sinolepidae 等各科相差甚远。

在个体大小,头甲的后侧角十分靠前以及头甲后缘向后突伸等方面,虽与 *Microbrachius* 有些类似,但后者的胸鳍十分短小,躯甲的腹壁较背壁明显为窄,二者差别极大。

Wudinolepis 不具眶前凹,耳枕凹十分宽短,躯甲腹壁的最宽处位于中部等特点,与已知各属显著不同,明显地超出了沟鳞鱼科 (Bothriolepidae) 的范围,据此,笔者建立一新科——*Wudinolepidae* 其系统位置可能与 Bothriolepidae 较近。

沟鳞鱼科 Bothriolepidae

滇鱼属 *Dianolepis* (gen. nov.)

刘氏滇鱼 *Dianolepis liui*¹⁾ (sp. nov.)

(图版 II, 图 1、2)

材料: 除三个头甲和一些自然连结的躯甲腹壁和胸鳍之外,均系单块的分离骨片。

1) 种名赠与我的导师刘宪亭先生。

正型标本: 一近于完整的头甲的背面, 右侧保存不全。登记号: V. 2966. 1。

副型标本: 一头甲的腹面, 眶孔以后保存不全, 登记号: V. 2966. 3。

产地和时代: 云南武定赵家庄后山, 中泥盆世。

特征: 头甲六边形, 眶孔大, 关节缘短, 后侧角位于眶孔后缘的延线之后, 后松果片 (postpineal plate) 特别宽大, 单独构成眶孔的后缘, 其两侧与侧片的后眶角 (postorbital corner) 相接触 (图版 II, 图 1、2)。中颞片的前侧角不达眶孔后缘, 其前缘完全为后松果缺 (postpineal notch) 所占据。中枕脊 (median occipital crista) 不发育。

躯甲的背壁较高, 中背脊十分发育, 突起呈冠状。各骨片的覆压关系与 *Bothriolepis* 的正常类型同。举穴 (levator fossa) 窄长, 腹中沟很发育; 在成体, 腹中脊仅在举穴内有一短脊。前中背片窄长, 其前、后缘宽度约相等。后中背片的后缘区 (posterior marginal area) 很宽, 后内横脊中背部的前缘明显凸出后中背片的腹面之上。前腹侧片的腋孔 (foramen axillare) 很小。

胸鳍粗壮宽大, 鳍刺不发育, 呈疣突状。

纹饰在成体和幼体均为平均分布的圆粒状突起, 无生长阶段性变化。

比较: 从上述标本的一般形态结构, 显然为 *Bothriolepidae* 类型。就前中背片的外形和与相邻骨片的覆压关系, 与该科 *Grossilepis* 明显不同, 而与 *Bothriolepis* 则基本一致。但是与后者也存在以下一些重要区别:

比 较 部 位	种 类	<i>Dianolepis</i>	<i>Bothriolepis</i>
后 松 果 片		特别宽大, 侧缘与侧片相交, 占据整个眶孔的后缘	窄小, 其两侧为中颞片所限定不与侧片相交
中 颞 片		宽短, 后松果缺占据整个前缘, 前侧角向前不达眶孔后缘, 不具眶面	较窄长, 前侧角向前伸达眶孔后缘, 构成眶孔后缘的一部分, 有眶面
中 枕 脊		不 发 育	发 育
中腹沟和中腹脊		中腹沟十分发育, 而中腹脊在成体仅稍发育	中腹沟在成体较发育, 而中腹脊在成体则很发育
腋 孔		小	大
纹 饰		圆粒状的突起, 生长过程没有变化	网脊状或短脊状, 有生长阶段性变化

这里必须着重指出的是, *Dianolepis liui* 的后松果片和中颞片的形状与澳大利亚晚泥盆世产的 *B. gippslandiensis* 的十分近似。依 Hills 氏当时的见解: 就 *B. gippslandiensis* 的后松果片和中颞片的形状和比例, 与已知 *Bothriolepis* 各种显著不同, 而与 *Pterichthyodes*, *Gerdalepis*, *Asterolepis* *Remigolepis* 等更为接近; 但其他一些已知特征, 则与 *Bothriolepis* 相一致, 因而将其放入 *Bothriolepis*。 *B. gippslandiensis* 的躯甲短而高, 背壁的“背冠”尤为发育, 前中背片宽大于长以及在生长过程中, 其纹饰具有明显的阶段性变化等, 与 *Dianolepis liui* 的区别很大。

沟鳞鱼属 *Bothriolepis*东生沟鳞鱼 *Bothriolepis tungsensis*¹⁾ (sp. nov.)

(图版 III, 图 1、2、3、4)

材料: 材料至少包括一百以上的个体,除少部分保存有骨片外,大多系内、外印模,有不少印模保存相当完好。

正型标本: 一条较完整的鱼体内模,附胸鳍的近节部分。躯干背壁稍受挤压,头部的前端亦保存不全。登记号: V. 2964. 1.

副型标本: 一完整的头甲内、外印模,登记号: V. 2964. 20; 一胸鳍远节的外模,登记号: V. 2977. 1。

产地和时代: 云南武定龙潭村,赵家庄后山。中泥盆世。

特征: 个体较小的沟鳞鱼。全背长(头长+躯甲背长)约 11—12 厘米。头长约为全长的三分之一,其宽、长之比仅为 1.05—1.15 倍,较一般沟鳞鱼的头甲都窄。眶前部高度拱起,不低于眶后部。

头甲(图版 III, 图 2、3)吻缘向前突伸,较后缘短,不具吻角。侧缘较长,由后向前逐渐向中靠拢。关节缘长度中等,后侧角一般位于眶孔后缘的延续。后缘中突不很发育。

眶孔较大,在中等以上的个体,其横径一般约为头宽的 40% 以上。下眶孔较眶孔明显窄小。前中斜脊(oblique premedian ridge)和中突(median elevation)均发育。眶前凹的中部,其前缘稍突或明显前突,其长度约为前中片长度的五分之二,侧部很短,外缘呈弧形。喷水沟的前、后喷水嵴均发育。

耳枕凹为该属一般类型。横颈脊(transverse nuchal crista)发育,中部略向前突。中枕脊仅稍发育。

躯甲低平,宽、长之比约为 72—92% 之间,侧壁与背壁相交几成直角,腹壁宽度较背壁稍小。前内横脊腹壁单支,后内横脊的中背部分高而明显。

头甲前中片后背缘平直,无鼻突(nasal process)和鼻缺(nasal notch)。腹侧缺(ventral lateral notch)发育,位腹侧缘的前部。后松果片的前缘向前高度突伸。

躯甲前中背片长大于宽,宽、长之比为 78—90%。后中背片前缘前突,后缘后角(posterior angle)十分发育,该片宽、长之比约为 79—83%。前背侧片背叶长约为宽的 2.2 倍;侧叶长约为高的 2.6 倍。混合侧片背叶长为宽的 1.7—1.8 倍;侧叶长约为高的 2.5—2.7 倍。前腹侧片的侧叶长约为高的 2.5—2.6 倍;腹叶长约为宽的 2.1—2.5 倍。后腹侧片的背角(dorsal corner)明显,侧叶长约为高的 2.4 倍;腹叶长约为宽的 2.2—2.8 倍。中腹片较小。

胸鳍较细长,近节长约为宽的 4.3—4.7 倍,最宽处位于其中间稍后处;远节较近节短,呈矛状。

纹饰除躯甲腹壁外,几全为连续的网脊状,在头甲眶前部和躯甲背壁的近边缘部分则为平行的脊,无间断,各脊间彼此亦很少相交。后中背片上的纹饰具明显的同心状排列。

1) 种名赠与刘东生先生。

胸鳍远节的纹饰为纵长平行的脊纹(图版 III, 图 4)。

比较: 在我国已发现的沟鳞鱼有五个种。*B. kwangtungensis* 的前中背片窄长, 宽仅为长的 50%; *B. lochangensis* 的前中背片宽短, 宽度大于长度; *B. shaokuanensis* 的耳枕凹侧部突伸成角状等与武定 *B. tungseni* 显然有所不同; *B. sinensis* 和 *B. yunnanensis* 的材料较少, 前中背片的外形轮廓与 *B. tungseni* 较为近似, 但从前二者骨片外模所显示的纹饰, 与 *B. tungseni* 平行连贯的纹饰很有区别。

B. tungseni 在其一般外形和比例, 头甲拱起的程度等方面, 与 *B. canadensis* 的情形相近似, 但 *B. tungseni* 的头甲较 *B. canadensis* 的头甲明显为长, 在后者头宽一般均为头长的 1.3—1.52 倍之间, 而我们的标本, 头甲宽度最多不超过头长的 1.15 倍; 在眶前凹方面, *B. tungseni* 较 *B. canadensis* 更为发育, 前者眶前凹中部的前缘前突或明显前突, 其长度约为前中片长度的五分之二; 而后者眶前凹中部的前缘平直, 其长度约为前中片长度的三分之一; *B. tungseni* 的下眶孔较眶孔明显窄小, 而 *B. canadensis* 的下眶孔反较眶孔宽大; *B. tungseni* 在头甲的前部和躯甲背壁的边缘, 特别是胸鳍远节上的纹饰均呈连续的脊纹等特点, 与 *B. canadensis* 显著不同。

就纹饰方面来看, *B. tungseni* 与北美 *B. nitida* 十分一致, 遗憾的是后者的材料较少, 了解不全, 仅从前腹侧片腹叶的长、宽比例来说, *B. nitida* 明显为宽, 其长仅为宽的 1.3 倍左右; *B. tungseni* 则明显较长, 其腹叶长度超过宽度的 2 倍以上。

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NEW ANTIARCHS FROM THE MIDDLE DEVONIAN OF YUNNAN

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Among the antiarchian fishes collected from Middle Devonian of Wuding, Yunnan, some specimens are very well preserved and represent a new family and two new genus, which are preliminarily described in the present notes.

Order Asterolepiformes

Family Wudinolepidae (fam. nov.)

Genus *Wudinolepis* (gen. nov.)

Genotype *Wudinolepis weni** (sp. nov.)

(Pl. I, figs. 1, 2, 3, 4)

Material: Internal and external mould of four complete head-shields and some trunk-armours, a few pectoral fins, representing in total about ten individuals.

Type: Internal and external mould of a camplated head-shield, V.2963. 1.

Horizon and Locality: Middle Devonian; Xiang-shui-zhuang, Wuding, Yunnan.

Diagnosis: Size very small, total dorsal length of armour (length of head-shield plus dorsal length of trunk-armour) less than 20 mm. Dorsal and lateral wall of armour symmetrical and regular ridges (Pl. I, figs. 2, 3, 4), similar to *Bothriolepis* in length proportion of head-shield, trunk-armour and pectoral fin.

Head-shield (Pl. I, fig. 1) hexagonal, broader than long. Orbital fenestra at the center of head-shield and moderate in size. Preorbital division very low, flat and with a special "circum-orbital ridge". Ornament of head-shield reach to the anterior end (Pl. I, fig. 2).

Rostral margin of head-shield slightly longer than posterior margin, and strongly convex from antero-lateral corner, but comparatively straight in the middle part. Lateral margin strikingly shorter and converging more or less forward. Obstantic margin very long and almost equal to the length of lateral margin. The postero-lateral corner of head-shield just at the axis of orbital fenestra. Obteched nuchal area triangular in shape with the apex protruding backward.

Preorbital recess absent, so the suborbital fenestra and the orbital fenestra become similar in size. Otico-occipital depression considerably broader and shorter in relation with the breadth of the head-shield than that in *Bothriolepidae*, its antero-lateral corner shorter, slightly exceeds the transverse plane through the posterior margin of the orbital fenestra. The depression is broadest just in front of its posterior end and narrowest across the posterior margin and near anterior ends of its antero-lateral corner as in *Remigolepidae*. No trace of spiracular crista has been found (Pl. I, fig. 1).

Trunk-armour broad, short, with a low and flat dorsal wall, its length somewhat

* In honour of Prof. J. S. Wen, Kunming Engineering college.

larger than its breadth, as a whole its anterior margin of dorsal wall is concave and posterior margin fairly convex backwards, without posterior corner or angle. Dorsal median ridge well developed. Breadth of ventral wall of trunk-armour and that of dorsal wall are approximately equal. Crista transversalis interna anterior and crista transversalis interna posterior clearly developed. Ventral median ridge and ventral median groove absent.

Anterior median dorsal plate longer than broad, anterior margin of this plate convex, and posterior process of posterior margin strongly developed. Posterior median dorsal plate narrower than anterior median dorsal plate. Posterior dorso-lateral plate coalesced into a mixilateral plate with posterior lateral plate, its postero-ventral process (pr. tv) very long, therefore, the distance between it and medial dorsal process (pr. dm) equivalent to the breadth of the mixilateral plate at the level of its dorsal corner, dorsal lamina of this plate clearly broader than exposed area of the dorsal lamina of the anterior dorsal lateral plate.

Pectoral fin subdivided into two segments.

Posterior oblique cephalic pit-line groove and posterior abdominal pit-line groove weakly developed.

Ornaments on the armour include very small pointed tubercles irregularly distributed and coarse parallel ridges, the latter are limited only to the posterior margin of dorsal and ventral wall.

Remarks: This new form with its pectoral fin subdivided into proximal and distal segments and with a coalesced mixilateral plate, is certainly an *Asterolepigorme*. It is nearest to the *Bothriolepidae* in the general shape of head-shield, length proportion of head-shield, trunk-armour and pectoral fin and the presence of the sensory canal of head-shield and trunk-armour. It also resembles *Microbranchus* in size and in position of postero-lateral corner of head-shield, but differs from the latter in having a very long and comparatively big pectoral fin and symmetrically arranged ridges on the armour. However, *Wudinolepis weni* differs markedly from the other better known genera of *Bothriolepidae* in the absence of preorbital recess and with otico-occipital depression like that in *Remigolepidae*.

Family Bothriolepidae

Genus *Dianolepis* (gen. nov.)

Genotype *Dianolepis liui** (sp. nov.)

(Pl. II, figs. 1, 2)

Material: Three head-shields, some detached bone-plates, a few imperfect trunk-armours and proximal and distal segments of pectoral fins.

Type: A nearly complete head-shield, No. V.2966.1.

Paratype: An incomplete head-shield preserved ventrally, V.2966.3.

Horizon and Locality: Middle Devonian; Zhao-jia-zhuang, Wuding, Yunnan.

Diagnosis: Size moderate. Obstantic margin of head-shield short, orbital fenestra large. Posterior lateral corner of head-shield far behind the transverse plane through the

* The specific name is in honor of my teacher Liu Hsien-t'ing.

posterior boundary of the orbital fenestra. Postpineal plate very short and broader excluding the centro-nuchal plate from the orbital fenestra, and suturates with lateral plate in front of the centro-nuchal plate (Pl. II, figs. 1, 2). Anterior division of lateral margin of centro-nuchal plate very short, anterior margin occupied throughout by postpineal notch. Median crista absent.

Dorsal wall of trunk-armour rather high, dorsal median ridge elevated into a high crest. Sutural connections of anterior median dorsal plate with anterior dorso-lateral plate and mixilateral plate resemble those in *Bothriolepis*. Posterior marginal area of posterior median dorsal plate strikingly broad, and the median dorsal division of crista transversalis interna posterior clearly convex. Foramen axillare of anterior ventro-lateral plate very small.

Pectoral fins fairly robust, lateral and medial spines absent.

Ornament, in adult and young individuals, retaining cycloidal tubercles.

Remarks: This new genus is similar to *Bothriolepis* in shape and in the way of connection of anterior median dorsal plate, but differs strikingly from the latter in shape and connection of postpineal and centro-nuchal plate, in the small size of the foramen axillare, in possessing tuberculous ornament, in the absence of median occipital crista, etc.

It is worthy to notice that our specimens resemble *B. gippslandiensis* in shape of postpineal and centro-nuchal plate. As pointed by Hills (1931) *B. gippslandiensis* differs considerably from other *Bothriolepis* species known as to the shape and relations of the postpineal and centro-nuchal plate, which are nearest as in *Pterichthyodes*, *Gerdalepis*, *Asterolepis* and *Remigolepis*. But our specimens are of larger size than the Australian form, and in which the dorsal median ridge on the dorsal wall of trunk-armour is higher. There are also differences in ornamentation.

Genus *Bothriolepis*

*Bothriolepis tungseni** (sp. nov.)

(Pl. III, figs. 1, 2, 3, 4)

Material: Internal and external moulds and isolated bone-plates belonging to more than a hundred individuals.

Type: Rather complete internal mould of the whole armour, with head and proximal segments of pectoral fin. V.2964.1.

Paratype: A complete internal mould of head-shield, and external mould of the same, V.2964.20; An external mould of distal segment of pectoral fin, V.2977.1.

Horizon and Locality: Middle Devonian; Long-tan-zun and Zhao-jia-zhuang, Wuding, Yunnan.

Diagnosis: Size small, total dorsal length of armour maximally about 11–12 cm. Head-shield with a breadth: length ratio of 1.05–1.12, preorbital division strongly arched (Pl. III, fig. 2).

Rostral margin of head-shield fairly shorter than posterior margin and considerably convex. Lateral margin comparatively longer. Obstantic margin moderate, postero-lateral corner usually at a transverse plane through the posterior boundary of orbital

* In honor of Prof. Liu Tung-sen.

fenestra. Orbital fenestra large, suborbital fenestra strikingly smaller than orbital fenestra. Preorbital recess well-developed and with a shape of semilunar, as a whole its anterior boundary convex or strongly convex in dorsal and ventral aspect. Prespiracular crista and postspiracular crista of spiracular groove considerably developed.

Premedian plate devoid both of nasal notch and process, its ventral lateral notch situated in front of the middle of ventral lateral margin.

Postpineal plate with a much convex anterior margin.

Trunk-armour low, dorsal wall rather flat, dorsal wall meeting the lateral wall of each sides about in a right angle. Dorsal median ridge developed. Ventral division of crista transversalis interna anterior single. Median dorsal division of crista transversalis interna posterior clearly developed.

Anterior median dorsal plate longer than broad, its breadth: length ratio about 0.78—0.90. Posterior median dorsal plate comparatively long and with a breadth: length ratio of 0.79—0.83, its posterior median corner very developed. Dorsal lamina of anterior dorsal lateral plate about 2.2 times as long as broad; lateral lamina of this plate about 2.6 times as long as high. Dorsal lamina of mixilateral plate 1.7—1.8 times as long as broad; lateral lamina of this plate 2.5—2.7 times as long as high. Ventral lamina of anterior ventro-lateral plate about 2.1—2.5 times as long as broad; its lateral lamina about 2.5 times as long as high. Posterior ventro-lateral plate with a marked dorsal corner, its lateral lamina about 2.4 times as long as high; its ventral lamina about 2.2—2.8 times as long as broad. Median ventral plate moderate size.

The proximal segment of pectoral fin about 4.3—4.7 times as long as broad in mature individuals, its lateral and medial spine numerous, small, and fairly obtuse; distal segment of pectoral fin somewhat robust, spines absent.

Ornament in general comparatively coarse, especially in area of distal segment of pectoral fin and near the margins of dorsal wall of trunk-armour, where they form parallel ridges.

Remarks: The here described species differs markedly from *B. lochangensis* and *B. kwangtungensis* in shape and proportion of anterior median dorsal plate. In *B. lochangensis* this plate is very broad, and greater than its length. But in *B. kwangtungensis* it is very long (breadth: length ratio about 0.5). The new species differs from *B. shaokuanensis* in the shape of preorbital recess. As for the external shape and proportion of anterior median dorsal plate, our specimens, though quite similar to *B. sinensis* and *B. yunnanensis*, differ from them in ornament.

In some aspects such as the shape of trunk-armour, the arching degree of head-shield, the present specimen is similar to *B. canadensis*, but the size of ours is smaller, the head-shield longer, and the preorbital recess more developed. It is worthy to notice that the orbital fenestra of orbital chamber is larger than its suborbital fenestra, while it is reverse in *B. canadensis*, so that the orbital fenestra is smaller than fenestra suborbitalis. The range and development of ornament of new species differ considerably also from those in *B. canadensis*.

The present species is very similar to *B. nitida* in ornament, unfortunately, the latter one is not so complete that it is impossible to make a complete comparison with ours, but based on the ratio of length to breadth they are obviously different.

图 版 I

Wudinolepis weni, gen. et. sp. nov.

1. 正型标本, 头甲的内模。
(Holotype, internal mould of head-shield. V. 2963. 1.) $\times 8$.
2. 一近于完整的头甲外模。
(A nearly complete external mould of head-shield. V. 2963. 2.) $\times 8$.
3. 一完整的混合侧片的外模。
(A complete external mould of mixilateral plate. V. 2963. 10.) $\times 8$.
4. 一不完整的躯甲背壁的外模。
(An incomplete external mould of dorsal wall of trunk-armour. V. 2963. 6.) $\times 4$.

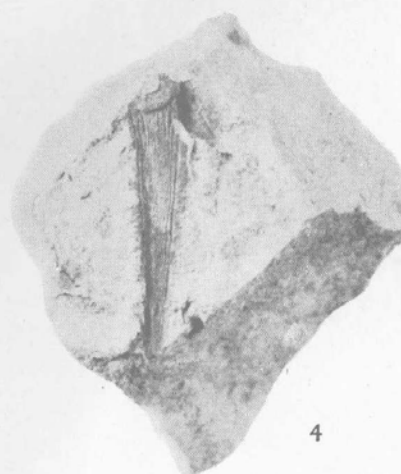
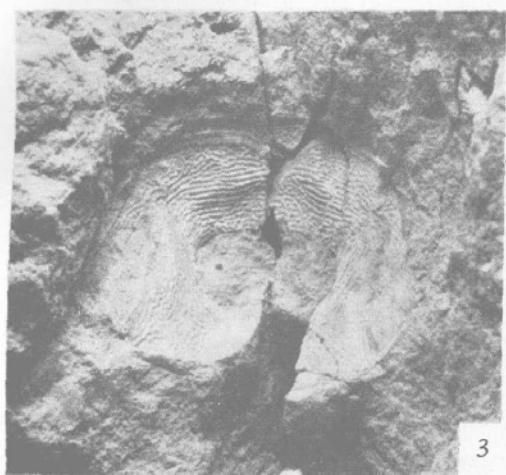
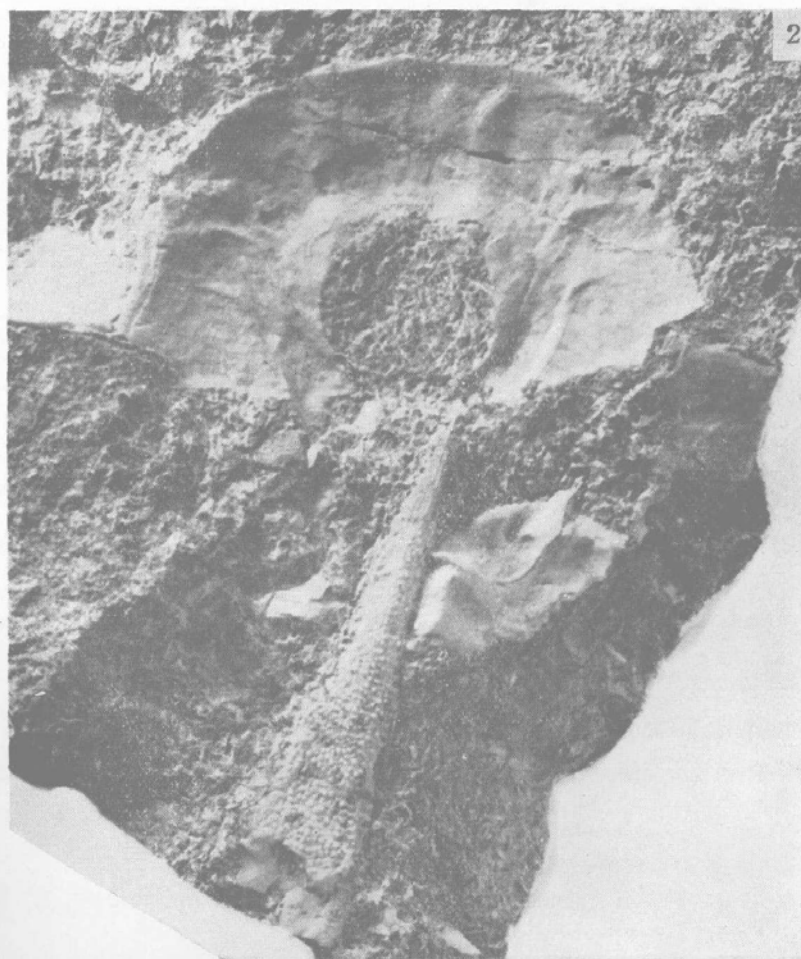
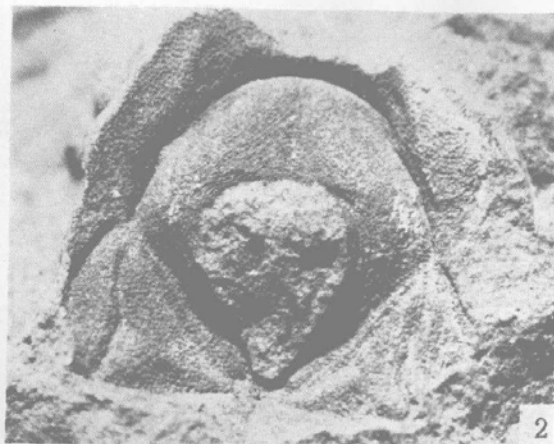
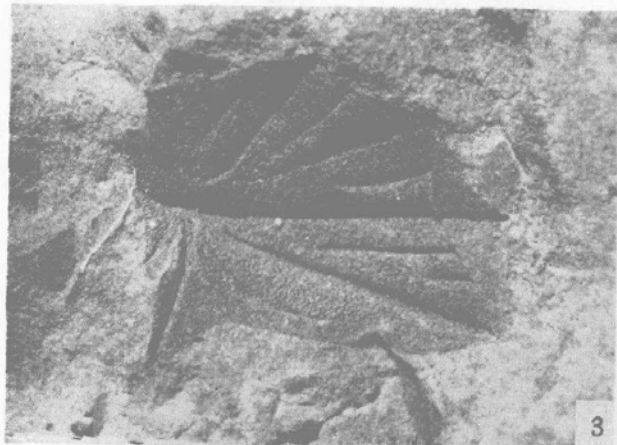


图 版 II

Dianolepis liui gen. et. sp. nov.

1. 正型标本,一近于完整的头甲,背视。
(Holotype, a nearly complete head-shield, dorsal aspect, V. 2966. 1.) $\times 1.5$
2. 副型标本,一不完整的头甲(上),腹视;一左胸鳍远节,背视。
(Paratype, an incomplete head-shield, ventral aspect, V. 2966. 3; a distal segment of a left pectoral fin, dorsal aspect, V. 2966. 4.) ca. $\times 1.2$





图版III说明 *Bothriolepis tungsensi* sp. nov.

1. 正型标本, 一较完整的头甲和躯甲的内模, 背视。
(Holotype, a comparatively complete internal mould of total armour, dorsal aspect. V. 2964. 1.) $\times 1$.
2. 副型标本, 一头甲的完整内模, 背视。
(Paratype, a complete internal mould of head-shield, dorsal aspect. V. 2964. 20a.) $\times 1$.
3. 同上, 外模。
(Ditto, external mould. V. 2964. 20b.) $\times 1$.
4. 副型标本, 一胸鳍远节的外模。
(Paratype, external mould of distal segment of pectoral fin. V. 2977. 1.) $\times 1$.