

## 中国中生代早期甲虫化石修订\*

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**提要** 本文重新描述华南和新疆上三叠统和下侏罗统 20 枚甲虫模式标本, 共识别出 Cupedidae 科 3 属 5 种, Elateridae 科 4 属 4 种, Permosynidae 科 4 属 5 种, Schizocoleidae 科 2 属 3 种, 未定科 3 属 3 种。将 *Notocupoides fasciatus* Ponomarenko, 1966 归入 *Notocupes*, 建立一新种 *Notocupes lini* sp. nov.; 基于 *Ademosynoides chinaticus* Lin, 1992 建立一新属 *Toksunius* gen. nov., 形成一新组合 *Toksunius chinaticus* (Lin, 1922) comb. nov.。

**关键词** 鞘翅目 中生代 新疆 华南

## REVISION OF SOME EARLY MESOZOIC BEETLES FROM CHINA

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**Abstract** Twenty type specimens of beetles from the Upper Triassic and Lower Jurassic of southern China and Xinjiang are re-examined in detail: five species within three genera are assigned to Cupedidae; four species in four genera assigned to Elateridae; five species in four genera are assigned to Permosynidae, three species in two genera are assigned to Schizocoleidae; three species in three genera are incertae familiae. A new species, *Notocupes lini* sp. nov. is proposed for *Notocupoides fasciatus* Ponomarenko, 1966. A new genus, *Toksunius* gen. nov., is proposed for *Ademosynoides chinaticus* Lin, 1992, resulting in *Toksunius chinaticus* (Lin, 1922) comb. nov..

**Key words** Coleoptera, Mesozoic, Xinjiang, southern China

### 1 INTRODUCTION

Fossil beetles are amongst the commonest fossil insects (Ponomarenko, 2002). Although thousands of Coleopteran taxa have been described, most of them need to be revised. Some

fossil beetles were described from the Mesozoic of Xinjiang and southern China during the past thirty years (Huang *et al.*, 1991; Lin, 1986; Lin and Mou, 1989; Lin, 1992; Dong *et al.*, 2011). These specimens were re-examined in detail in 2008. Here we re-describe these specimens, some of which may provide new evidence for studying the

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evolution and palaeogeographical distribution of early beetles.

## 2 MATERIAL AND METHODS

The specimens were examined using a Nikon SMZ1000 stereomicroscope and drawings were made with the aid of a camera lucida. Photographs were prepared using a digital camera (DXM1200) connected to the same stereomicroscope, and line drawings were readjusted on photographs using image-editing software (CorelDRAW X4 and Adobe Photoshop CS). All specimens are deposited in the Nanjing Institute of Geology and Palaeontology (NIGP), Chinese Academy of Sciences.

Some fossils are just fragments of beetles, so they can only be placed in form taxa (also called as "morphotaxa"). A form taxon is created for the material with a particular type of taxonomic deficiency: they are not normal taxa, but may be treated as normal taxa when compared with other taxa of the same kind (Rasnitsyn, 2002). We do not know the natural systematic position of these form taxa, but can apply their taxonomical assemblages to show the general evolutionary trend of beetles.

## 3 SYSTEMATIC PALAEOLOGY

### Family Cupedidae Laporte, 1836

#### Subfamily Ommatinae Sharp and Muir, 1912

#### Tribe Ommatinae Sharp and Muir, 1912

#### Genus *Tetraphalerus* Waterhouse, 1901

**Diagnosis** Medium-sized, flat beetles. Head long, distance between base of head and eyes not shorter than half of diameter of eyes. Procoxae contiguous. Elytron usually with rows of small cells; disc of elytron smooth; cells possibly visible on outer surface of elytra. Abdomen with 5 flat ventrites. Middle and hind femora not extending laterally to the body margins.

#### *Tetraphalerus largicoxa* Lin, 1986

(Text-fig. 1A; Pl. I, fig. A)

1986 *Tetraphalerus largicoxa* Lin, p. 77, Pl. XVII, fig. 4, text-fig. 74.

**Examined material** Holotype, NIGP70069; a whole, poorly preserved body without antennae and legs; Lower Jurassic Guanyintan Formation; Guanyintan Town, Qiyang County, Hunan Province. Body length 14 mm, width 5.0 mm; elytral length 9.0 mm, width ca. 2.5 mm.

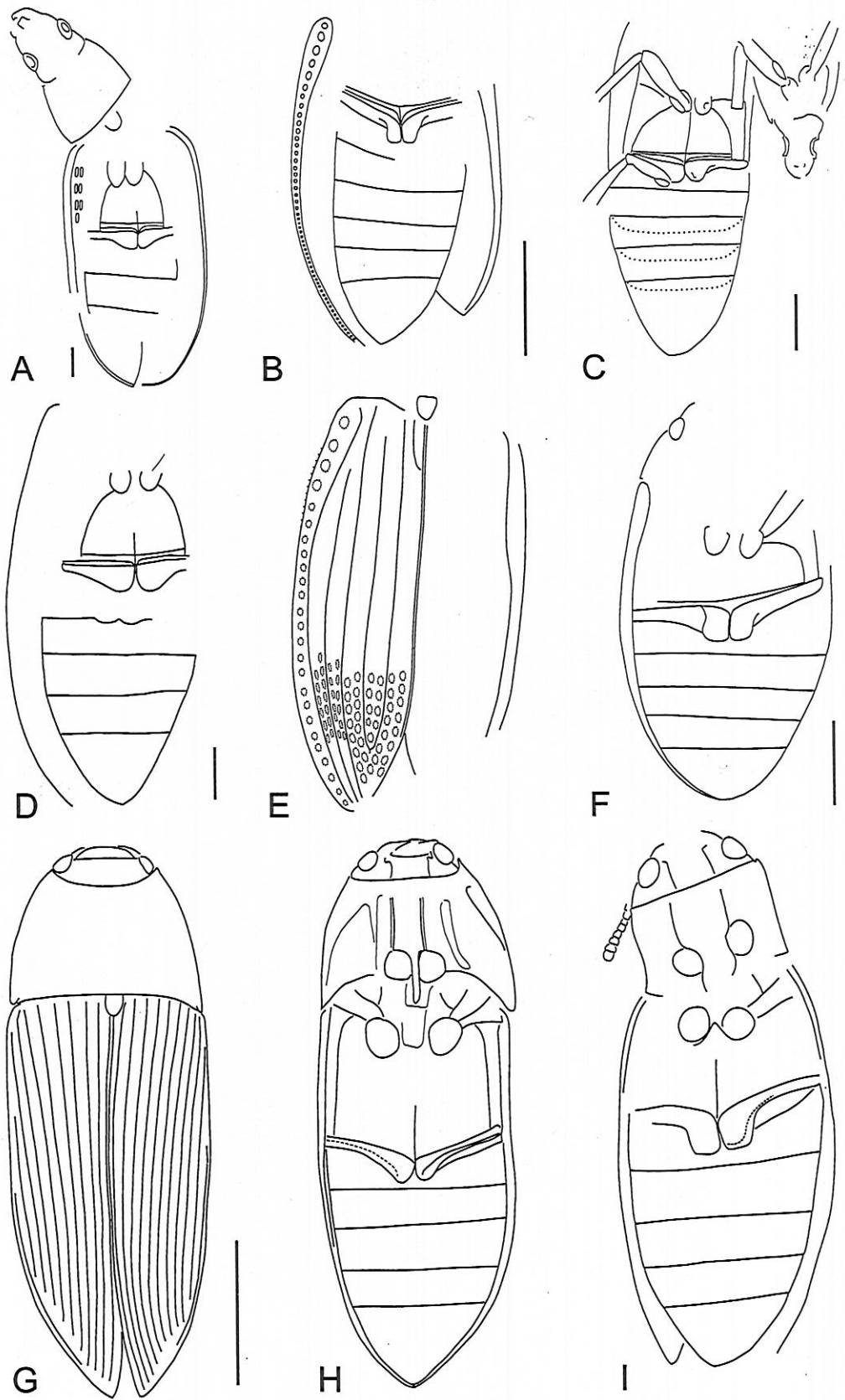
**Description** Medium-sized, flat beetles. Head large, slightly longer than wide. Eyes large, diameter somewhat longer than genae or temples. Supraocular ridges weak. Prothorax twice as wide as long, slightly narrowed anteriorly. Metaventricle transverse. Ventrites flat; last one ca. 1.5 times longer than previous. Elytra long, 4 times as long as wide. Disc of elytra probably smooth. Epipleura wide.

**Remarks** The preservation of the single specimen so far known is not good enough for deciding its systematic position. Elytral cells and small tubercles are not very clear. This species is more similar to *Tetraphalerus incertus* Ponomarenko, 1969 from the Lower Jurassic of Central Asia based on the short head with large eyes, but can be distinguished from the latter in its wider prothorax and the longer and narrower last abdominal ventrite.

The ventral abdomen of cupedid beetles may be flat or convex (semi-cylindrical). In flat ones, the ventrites margins are connected directly, without overlapping each other (as in *Omma*, *Tetraphalerus*, *Mesocupes*). In convex ones, the posterior ventrite slightly overlaps the anterior one (as in *Notocupes*, *Amblomma*, *Cupes*). Ratio of ventrites lengths could be estimated by measuring the distance to the elytral apex (equal to abdominal apex) and the length of the third visible ventrite. The third abdominal ventrite is almost always the same as the fourth one in length, and the last abdominal ventrite of *Tetraphalerus largicoxa* is 1.5 times longer than the previous ventrite.

#### Tribe Notocupedini Ponomarenko, 1964

#### Genus *Notocupes* Ponomarenko, 1964



Text-figure 1 Line drawings of examined specimens.

A. *Tetraphalerus largicoxa* Lin, 1986, NIGP70069; B. *Notocupes lini* sp. nov. NIGP70070; C. *Notocupes homorus* (Lin, 1986), NIGP70058; D-E. *Notocupes* sp., NIGP109266; F. *Memptus handlirschi* Ponomarenko, 1985, NIGP70068; G-H. *Archaeolus funestus* Lin, 1986, NIGP70071, part and counterpart; I. *Artinama qinghuoensis* Lin, 1986, NIGP70064. Scale bars=1 mm.

**Diagnosis** Medium-sized, flat beetles. Head long, with ridges under eyes. Procoxae contiguous, covered by short prosternal process. Elytron with rows of large cells, two veins nearest to sutural margin fused before reaching elytral apex. Abdomen with 5 convex ventrites; anterior margin of ventrites overlapped by hind part of previous one.

**Remarks** *Notocupes* is the most abundant and diverse genus of all Mesozoic beetles. Some representatives of the genus have been placed in different genera. The isolated elytra with similar structure were described before whole-bodied beetles were discovered (Westwood, 1854; Handlirsch, 1906). *Notocupes* was regarded to be a junior synonym of *Zygadenia* Handlirsch, 1906 (Ponomarenko, 2000). This opinion is probably incorrect, however, because several different genera sometimes possess similar elytral structures. Therefore, it is better to use the name *Zygadenia* only to refer to a form taxon for isolated elytra.

***Notocupes lini* sp. nov.**

(Text-fig. 1B; Pl. I, fig. B)

1986 *Notocupoides fasciatus* Ponomarenko, Lin, p. 78, Pl. XVII, figs. 1, 5, text-fig. 75.

**Etymology** Specific epithet is after the Chinese palaeontologist, Prof. Lin Qibin.

**Holotype** NIGP70070, a poorly-preserved body without prothorax, head and legs. Lower Jurassic Guanyintan Formation; Guanyintan Town, Qiyang County, Hunan Province. Body length as preserved ca. 2.9 mm; elytra length 2.9 mm, width 1.7 mm.

**Description** Small flat beetles. Metaventrite transverse. Abdominal ventrites convex, last one almost 3 times longer than previous. Elytra wide, 2.5 times as long as wide, widening at the midlength. Elytral cells large, oval; ca. 25 cells in row. Epipleura wide, with rows of cells in basal 1/3.

**Remarks** *Notocupes lini* is one of the smallest species of the genus. Owing to the large

elytral cells and long last abdominal ventrite, this species cannot be attributed to the genus *Notocupoides* and should be transferred to *Notocupes*. It is most similar to *Notocupes issykiensis* Ponomarenko, 1969 from the Lower Jurassic of Central Asia in the small size and long last abdominal ventrite, but differs in its longer and wider body.

***Notocupes homorus* (Lin, 1986)**

(Text-fig. 1C; Pl. I, fig. C)

1986 *Conexicoxa homora* Lin, p. 76, Pl. XVII, fig. 3, text-fig. 73.

**Examined material** Holotype, NIGP70058, a poorly-preserved body without elytra and lacking most portions of its legs; Lower Jurassic Guanyintan Formation; Lanshan County, Yongzhou City, Hunan Province. Body length ca. 8 mm, width 2.6 mm, elytra length 5.5 mm.

**Description** Medium-sized beetles. Metaventrite twice as wide as long. First abdominal ventrite not longer than the next; last one 2.5 times longer than the previous.

**Remarks** The poor preservation of this specimen prevented exact determination of its systematic position. The genus *Conexicoxa* was originally attributed to Trachypachidae, but it has no specific features of that family. Judging from the convex abdominal ventrites superimposing each other and characteristic tuberculation, the species belongs to the cupedid genus *Notocupes*. It is mostly similar to *Notocupes sogutensis* Ponomarenko, 1969 from the Lower Jurassic of Central Asia in the body size and long last abdominal ventrite but differs in having the short first abdominal ventrite and wider metaventrite.

***Notocupes* sp.**

(Text-figs. 1D-E; Pl. I, fig. D)

1991 *Notocupes* sp., Huang *et al.*, p. 651, Pl. I, fig. 2, text-fig. 6.

**Examined material** Holotype, NIGP109266, a poorly preserved body without prothorax, head and legs; Lower Jurassic Menkoushan Formation; Qigong Town, Yiyang County, Shangrao City, Jiangxi Province.

**Description** Body length ca. 8 mm, width

ca. 4.8 mm; elytral length 8 mm, width 2.4 mm. Medium-sized flattened beetles. Metaventricle transverse. Abdominal ventrites flat; last one nearly twice as long as previous. Elytra elongated, 3 times longer than wide, widening after the middle, and narrowing in apical 1/3. Elytral cells large, oval, ca. 25 in a row. Epipleura wide, wider in basal 1/3, with rows of cells up to end.

**Remarks** The preservation of the specimen is not good enough to decide its systematic position precisely. It is most similar to *Notocupes oxy-pygus* Ponomarenko, 1969 from the Upper Triassic of East Kazakhstan in its size, long rows of cells on epipleura, length and form of the last ventrite, but differs in its wider body. However, this difference is probably a result of post-mortem distortion, because the left elytron is 1.3 times wider than the right one.

#### Genus *Memptus* Handlirsch, 1906

**Diagnosis** Elytron small, smooth; base and sutural margin straight; apex pointed; outer margin straight in basal 2/3, narrowed apically after it; an internal ridge in apical 1/3 merging with outer margin. Second abdominal ventrite external. Hind coxae slightly oblique.

**Remarks** Possibly belongs to Hydradephaga.

#### *Memptus handlirschi* Ponomarenko, 1985

(Text-fig. 1F; Pl. I, fig. E)

1986 *Necronectulus avus* Ponomarenko, Lin, p. 75, Pl. XVII, fig. 7, text-fig. 72.

**Examined material** Holotype, NIGP70068, a pair of elytra and some obscure sternal details. Lower Jurassic Guanyintan Formation; Guanyintan Town, Qiyang County, Hunan Province. Elytra length 3.4 mm, width ca. 2.0 mm.

**Remarks** The specimen was originally described as *Necronectulus* in the family Trachypachidae, but it does not have any specific features of *Necronectulus* except for the outline of body. Furthermore, *Necronectulus* cannot be placed in Trachypachidae, because it had swimming hairs on the hind legs. The shape, size and some sternal

features attribute this specimen to *Memptus handlirschi* from the Lower Jurassic of Central and East Siberia.

#### Family Elateridae Leach, 1915

##### Subfamily Protagyrypninae Dolin, 1973

##### Tribe Protagyrypnini Dolin, 1973

##### Genus *Archaeolus* Lin, 1986

1986 *Archaeolus* Lin, p. 78.

**Diagnosis** Beetle small, oval. Head very short. Eyes large. Prothorax trapezoidal, its anterior margin just half as long as hind one; lateral sides convex; anterior angles rectangular, hind ones pointed; medial longitudinal plate wide, prosternal sutures open from the base of prothorax, prosternal process wide. Middle coxae rounded, large, separated; mesoventrite small. Mesepimeron extending to middle coxal cavities. Metepisterns very narrow. Metacoxae slightly oblique, coxal plates mesally longer than coxae, shortened before middle of coxae.

**Remarks** The genus *Archaeolus* belongs to Protagyrypnini because it possesses a prosternum with medial longitudinal plate, open prosternal sutures, and mesoventrite with transverse suture. According to the key (Dolin, 1980), *Archaeolus* is closely related to *Lithomerus* Dolin, 1980 and *Paragyrypnites* Dolin, 1980, but differs from them in having a wider body, trapezoidal prothorax without constriction behind its middle part, and the large and middle coxae widely separated.

##### *Archaeolus funestus* Lin, 1986

(Text-figs. 1G-H; Pl. I, figs. F-G)

1986 *Archaeolus funestus* Lin, p. 78, Pl. XV, fig. 7, text-fig. 76.

**Examined material** Holotype, NIGP70071, a poorly preserved body without antennae and most portions of the legs; Lower Jurassic Shiti Formation; Zhongshan County, Guangxi Province. Body length 3.8 mm, width 1.4 mm, elytral length 2.8 mm, width ca. 0.7 mm.

**Description** Body 3 times as long as wide. Head also 3 times as wide as long. Distance between eyes three times more than diameter of

eyes. Prothorax 1.8 times as wide as long; width of medial longitudinal plate twice as wide as distance between it and prosternal sutures; procoxae ten times wider than prosternal process. Middle coxae larger than procoxae, distance between coxae almost equal to its diameter. Scutellum longitudinal, semi-oval. Metepistern ten times as long as wide. Metacoxae mesally twice longer than middle region; coxal plates triangular. Abdomen narrowed from the base of second ventrite, base of fifth ventrite of 1.2 times shorter than base of abdomen, last ventrite twice as long as previous one, abdominal apex rounded. Elytron extended, narrowed in apical third; base straight; outer and sutural margins straight up to the apical third, tip asymmetrically truncated to the sutural margin. Elytral striae thin, slightly oblique in basal part; interstices with longitudinal rows of large punctation.

#### Genus *Artinama* Lin, 1986

1986 *Artinama* Lin, p. 72—73.

**Diagnosis** Beetle small, oval. Head very short. Prothorax transverse; its anterior and posterior margins nearly equal in width; lateral sides rounded in anterior half, constricted before base, anterior angles obtuse, hind angles rectangular; prosternal process wide, widened after procoxae; prosternal plate wide. Middle coxae rounded, large, separated. Metacoxae almost transverse, coxal plates mesally long, laterally shortened before middle of coxae. Elytron with striae.

**Remarks** *Artinama* does not belong to Acanthocnemidae according to the structures of its pro- and mesosternum, and should be regarded as a member of Elateroidea. Furthermore, it belongs either to Protagrypnini because its prosternum has a medial longitudinal plate, and open prosternal sutures, or to Praelateridae based on the very wide prosternal process (but its tip is not visible in the holotype). It is similar to *Mercata* Lin, 1986 and *Gripecolous* Lin, 1986 in the oval small body, shape of prothorax, and widely separated procoxae.

#### *Artinama qinghuoensis* Lin, 1986

(Text-fig. 11; Pl. I, fig. H)

1986 *Artinama qinghuoensis* Lin, p. 73, Pl. XV, fig. 7, Pl. XVI, figs. 1, 3, text-fig. 68.

**Examined material** Holotype, NIGP70064, a poorly preserved body; Lower Jurassic Zaoshang Formation; Wenjiashi Town, Liuyang City, Hunan Province. Body length 3.2 mm, width 1.3 mm.

**Description** Body 2.4 times as long as wide. Head 2.5 times as wide as long. Distance between eyes 2.5 times more than diameter of eyes. Prothorax 1.5 times as wide as long, prosternal process and procoxae almost equal in length. Middle coxae much larger than procoxae, distance between middle coxae shorter than its diameter. Metepistern ten times as long as wide. Metacoxae mesally twice as long as middle part; coxal plates mesally subquadrate. Abdomen narrowed from the base of second ventrite; base of fifth ventrite of 1.5 times narrower than base of abdomen; last ventrite 1.5 times as long as previous one; tip of abdomen rounded. Elytron extended, narrowed in apical third, 3.7 times as long as wide; base straight; outer and sutural margins straight up to apical third; tip asymmetrically truncated to the sutural margin.

#### Genus *Mercata* Lin, 1986

1986 *Mercata* Lin, p. 79.

**Diagnosis** Beetle small, with parallel-sided body; anterior and posterior margin rounded. Head short. Prothorax bell-shaped, anterior margin nearly half as long as posterior one, gradually narrowing before middle part, angles rectangular; medial longitudinal plate wide, prosternal sutures open, prosternal longitudinal plate and prosternal process wide. Middle coxae rounded, large, separated. Mesepimeron extending to middle coxal cavities. Metacoxae almost transverse, coxal plates mesally long, laterally shortened before middle of coxae. Elytra with striae.

**Remarks** *Mercata* does not belong to Silphidae based on the structures of pro- and mesoster-

num with click-mechanism, and should be regarded rather as a member of Elateridae. Furthermore, it belongs to Protagrypninae because the prosternum has a median longitudinal plate. Prosternal sutures are not visible in the holotype. It is similar to some groups of Desmatini in having long metacoxal plates, but differs in its laterally shortened metacoxal plates. It is better to consider *Mercata* as Protagrypninae incertae triba.

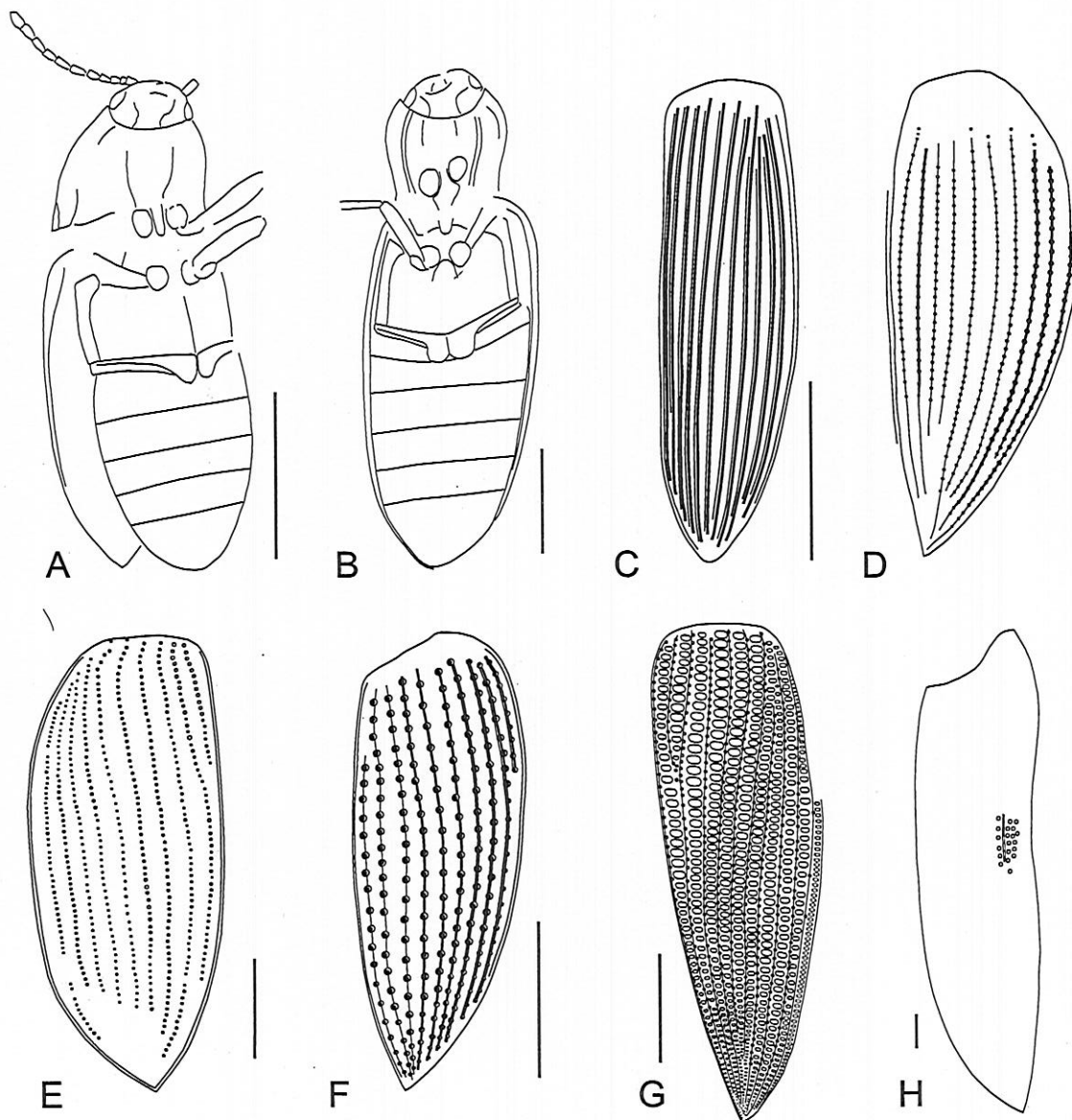
***Mercata festira* Lin, 1986**

(Text-fig. 2A; Pl. I, fig. 1)

1986 *Mercata festira* Lin, p. 79—80, 105 (English description), Pl. XV, fig. 4, text-fig. 77.

**Examined material** Holotype, NIGP70072 (part and counterpart), a poorly preserved body; Lower Jurassic Shiti Formation; Zhongshan County, Guangxi Province. Length ca. 3.0 mm, width ca. 1.3 mm.

**Description** Body 2.6 times as long as wide. Head twice as wide as long. Distance between eyes more than twice diameter of eyes. Antenna extending to base of prothorax, weakly clubbed. Prothorax 1.2 times as wide as long; width of medial



Text-figure 2 Line drawings of examined specimens

A. *Mercata festira* Lin, 1986, NIGP70072; B. *Gripecolous enallus* Lin, 1986, NIGP70073; C. *Bistrisyne tenua* Lin, 1986, NIGP70067; D. *Dzeregia juxta* (Lin, 1986), NIGP70065; E. *Alveolicupes primus* Lin, 1986, NIGP70059; F. *Alveolicupes secundus* Lin, 1986, NIGP70060; G. *Diarcuipenna heterosa* Lin, 1986, NIGP70061; H. *Metrorynchites diluies* (Lin, 1986), NIGP70062. Scale bars=1 mm.

longitudinal plate twice wider than distance between it and prosternal sutures; procoxa 1.5 times wider than prosternal process. Metacoxae mesally twice longer than middle region, coxal plates mesally sub-quadrate. Abdomen narrowed from the base of third ventrite; base of fifth ventrite half as wide as basal width of abdomen; last ventrite 1.5 times longer than previous one; tip of abdomen rounded. Elytra extended, narrowed in apical third, three times as long as wide; base straight; outer and sutural margins straight up to apical third, tip asymmetrically neared to sutural margin. Elytral striae wide.

**Remarks** This specimen was re-described and re-drawn by Dong *et al.* (2011). Here we give an additional description.

#### Genus *Gripecolous* Lin, 1986

1986 *Gripecolous* Lin, p. 80.

**Diagnosis** Beetle small, long, oval, with hard constriction on the base of prothorax. Head short, antenna with weak club. Prothorax rounded, its fore and hind margins nearly equal; lateral sides rounded in anterior half, constricted before base, angles obtuse; prosternal sutures open, prosternal process wide. Middle coxae rounded, large, separated. Metacoxae almost transverse; coxal plates mesally long, laterally narrowed before middle of coxae. Elytron with striae.

**Remarks** Based on the structures of its pro- and mesosternum *Gripecolous* does not belong to Silphidae and should be regarded rather as a member Elateroidea belonging to Praelateridae or Elateridae-Protagrypninae. It is similar to *Praelaterium* Dolin, 1973 in the outline of its body, widely separated procoxae and absence of a clear click-mechanism with a long narrow procoxal process and mesosternal cavity, prosternal medial longitudinal plate. The antennae with weak clubs and open prosternal sutures show that it is closely related to some Hipnomorphini. It is similar to Desmatini in having long metacoxal plates but differs from them in having laterally shortened metacoxal plates. The details of the procoxal process are not visible in

this specimen.

#### *Gripecolous enallus* Lin, 1986

(Text-fig. 2B; Pl. I, fig. J)

1986 *Mercata festiva* Lin, p. 80, Pl. XV, figs. 1, 2, text-fig. 78.

**Examined material** Holotype, NIGP70073, a poorly preserved body; Lower Jurassic Shiti Formation; Zhongshan County, Guangxi Province. Length ca. 4.8 mm, width ca. 1.7 mm.

**Description** Body 2.6 times longer than wide. Head twice as wide as long. Distance between eyes more than twice diameter of eyes. Prothorax 1.2 times as wide as long; width of medial longitudinal plate twice as wide as distance between it and prosternal sutures; procoxae 1.5 times wider than prosternal process. Metacoxae mesally twice as long as middle region, coxal plates mesally subquadrate. Abdomen narrowed from the base of third ventrite; base of fifth ventrite 1/4 longer than the base of abdomen; last ventrite 1.8 times longer than previous one; tip of abdomen rounded.

#### Coleoptera incertae sedis

#### Form Family Permosynidae Tillyard, 1924

The family is considered as a form taxon for isolated beetle elytra with punctuated and unpunctuated striae. Most of these beetles belong to Polyphaga in the natural system, and a few specimens probably fall into Archostemata-Ademosynidae or Adephaga.

#### Genus *Bistrisyne* Lin, 1986

**Diagnosis** Elytron small, elongated (3 times longer than wide); base straight; apex not pointed; widened in basal 1/10, narrowed in apical 1/3. Ten unpunctuated, short striae in basal sutural part. All striae parallel, extending to the apical region of elytron; striae on disc doubled on sutural side.

**Remarks** *Bistrisyne* is most similar to *Agri- lium* Westwood, 1854 in the form and size of its striae. It differs from other elytra in having doubled striae. It most probably belongs to Elater-



oidea, because all the intact beetles with the same proportions from the locality are attributed to this superfamily. On the Pl I, figure K is flipped vertically.

#### ***Bistrisyne tenua* Lin, 1986**

(Text-fig. 2C; Pl. I, fig. K)

1986 *Bistrisyne tenua* Lin, p. 75, Pl. XVII, fig. 2, text-fig. 71.

**Holotype** NIGP70067, right elytron. Upper Triassic Sanqiutian Formation; Chengtanjiang Town, Liuyang City, Hunan Province. Elytron length 2.7 mm, width ca. 1.0 mm.

#### **Genus *Dzeregia* Ponomarenko, 1985**

**Diagnosis** Elytron small, wide, convex, striato-punctate, widest in basal 1/3, symmetrically narrowed in apical 1/3; base straight or rounded; apex pointed. 10 punctuated striae. Striae in sutural part curved along margin. Second stria from sutural margin terminating near middle of elytra; next two merging to margin before apex. Scutellary stria absent. Punctuation of striae large. Interstices often with transverse rugulae.

**Remarks** This type of elytra is known amongst fossil and recent Byrrhidae.

#### ***Dzeregia juxta* (Lin, 1986)**

(Text-fig. 2D; Pl. II, fig. A)

1986 *Ademosynoides juxta* Lin, p. 73, Pl. XVI, fig. 2, text-fig. 69.

**Examined material** Holotype, NIGP70065, right elytron. Upper Triassic Anyuan Formation; Chengtanjiang Town, Liuyang City, Hunan Province. Elytra length 3.9 mm, width ca. 1.7 mm.

**Description** Elytron small, wide (2.2 times longer than wide), convex, base rounded, apex pointed, widest in basal third, symmetrically narrowed in apical third, 10 punctuated striae. Striae in the sutural part curving along margin. Second stria from the sutural margin terminating near the middle of elytron; next two merging to margin just before apex. Scutellary stria absent. Punctuation of striae large and sparse.

**Remarks** This specimen does not belong to the genus *Ademosynoides* Dunstan, 1923 of

*Ademosynidae*, partly because *Ademosynoides* has unpunctuated striae, partly because *Ademosynidae* is a family of the natural system and not for the isolated elytra. The specimen should be attributed to the form genus *Dzeregia* of the form family *Permosynidae* based on the shortened second stria from the sutural margin.

#### **Genus *Alveolicupes* Lin, 1986**

**Diagnosis** Elytron small, wide (2.2 times longer than wide), base straight, apex rounded, widest in basal third, symmetrically narrowed in apical third. Humeral area oblique. 10 (including long scutellary) punctuated striae. All striae subparallel, extending to the apical part of elytron, convex in humeral area. Punctuation of striae large and sparse. 3-4 punctures on width of interstices. Interstices with transversal rugulae.

**Remarks** This genus cannot be attributed to *Taldycupedidae*, because it does not have cellulitic but has striato-punctate elytra. It should be regarded as a member of the form family *Permosynidae*. Detailed comparison between the type specimen and *Clathropenna* Fudjiyama, 1973 is impossible, because the latter was described based on an elytron with a destroyed upper surface with only the inside structures visible. This genus is different from other beetles from the Early Mesozoic in having its particular pattern of elytral punctuation.

#### ***Alveolicupes primus* Lin, 1986**

(Text-fig. 2E; Pl. II, fig. B)

1986 *Alveolicupes primus* Lin, p. 70, Pl. XX, fig. 6, text-fig. 63.

**Examined material** Holotype, NIGP70059, left elytron. Upper Triassic Sanqiutian Formation; Chengtanjiang Town, Liuyang City, Hunan Province. Elytra length 4.2 mm, width 2.0 mm.

**Description** Same as the original description.

#### ***Alveolicupes secundes* Lin, 1986**

(Text-fig. 2F; Pl. II, fig. C)

1986 *Alveolicupes secundes* Lin, p. 70, Pl. XX, fig. 5, text-fig. 64.

**Examined material** Holotype, NIGP70060, right elytron. Upper Triassic Sanqiutian Forma-

tion; Chengtanjiang Town, Liuyang City, Hunan Province. Elytron length 3.0 mm, width 1.1 mm.

**Description** Elytron small, wide (2.1 times longer than wide), widest in middle region; base straight; apex pointed, asymmetrical, truncated to the outer margin. Sutural margin more convex than outer. Humeral area oblique. 10 (including long scutellary) punctuated striae. Striae in outer region of elytra sub-parallel; four striae in sutural region sub-parallel to sutural margin, and merged with it in apical third of elytra. Punctuation of striae large. Interstices smooth.

**Remarks** The species possibly belongs to another form genus, because the outline and striation of the elytra of this species is different from those of the type species.

#### Genus *Diarcuipenna* Lin, 1986

**Diagnosis** Elytron small, wide (4 times longer than wide); base straight; apex pointed; widest in middle region, symmetrically narrowed in apical third. Humeral area oblique. 10 (including long scutellary) rows of rounded cells and thin interstices (costae). Cell two-three times as wide as costae. All rows parallel, and extending to apical area of elytron, the one nearest to sutural margin running along it, the three previous merged with praesutural in apical third of elytron.

**Remarks** This genus does not belong to Taldycupedidae, because it does not have short rows of cells in the middle of the basal region of the elytra. This elytron seems to be close to the elytra of Taldycupedidae. However, if we place this genus into Taldycupedidae, we must change the family diagnosis. It should, in our view, be a member of the form family Permosynidae. Several similar elytra were described (e. g. *Simmondsia* Dunstan, 1923 in Tillyard and Dunstan, 1923; *Clathropenna* Fujiyama, 1973; *Argentinocupes* Martins-Neto and Galliego, 2006 in Martins-Neto *et al.*, 2006), and further interpretation was presented by Fujiyama based on a special preservational form of the elytra, which makes it possible to see the inside structures (Fujiyama, 1973). At pre-

sent, it is better to regard these forms as an aberrant member of the form family Permosynidae.

#### *Diarcuipenna heterosa* Lin, 1986

(Text-fig. 2G; Pl. II, fig. D)

1986 *Diarcuipenna heterosa* Lin, p. 71, Pl. XVI, fig. 5, text-fig. 65.

**Examined material** Holotype, NIGP70061, right elytron. Upper Triassic Anyuan Formation; Chengtanjiang Town, Liuyang City, Hunan Province. Elytron length 4.6 mm, width 1.4 mm.

**Description** Same as the original description.

**Remarks** There are two specimens (collection number 70061) in the box with the name *Diarcuipenna heterosa* Lin, 1986. The specimen shown on Pl. XVI, fig. 5 and text-fig. 65 was designated here as the holotype. The second specimen is a fragment of punctato-striate elytron and must be excluded. It belongs to *Alveolicupes secundus* Lin, 1986.

#### Form Family Schizocoleidae Rohdendorf, 1961

The family is considered as a form taxon for isolated elytra with irregular punctuation (end of columellae) and "schiza"—a short longitudinal ridge on the internal surface of the elytra in the middle outer area. Most of these beetles belong to Archostemata-Schizophoridae in the natural system and a few to Adephaga. Sometimes "schiza" and columellae are not visible and the surface of elytra is smooth or tuberculate.

#### Genus *Metrorynchites* Tillyard, 1916

**Diagnosis** Elytra large or medium-sized, elongated (4 times longer than wide), widest proximally, middle region, symmetrically narrowed in apical fifth region. Apex pointed, humeral area oblique, outer margin in middle region cutting out. Disc of elytra with numerous large ring-form punctations.

**Remarks** The genus does not belong to Rhombocoleidae and should be regarded as a member of the form family Schizocoleidae according to its elytral structure.

***Metrorynchites dilutes* (Lin, 1986)**

(Text-fig. 2H; Pl. II, fig. E)

1986 *Mancicipes dilutes* Lin, p. 71, Pl. XVII, fig. 6, text-fig. 66.

**Examined material** Holotype, NIGP70062, left elytron. Upper Triassic Anyuan Formation; Chengtanjiang Town, Liuyang City, Hunan Province. Elytron length ca. 14 mm, width 3.5 mm.

**Description** Elytron large (5 times longer than wide), widest behind middle region, outer margin straight, weakly cutting out before the middle region, sutural margin weakly convex. Disc of elytra with numerous large ring-form punctations. "Schiza" short, in basal region of elytron.

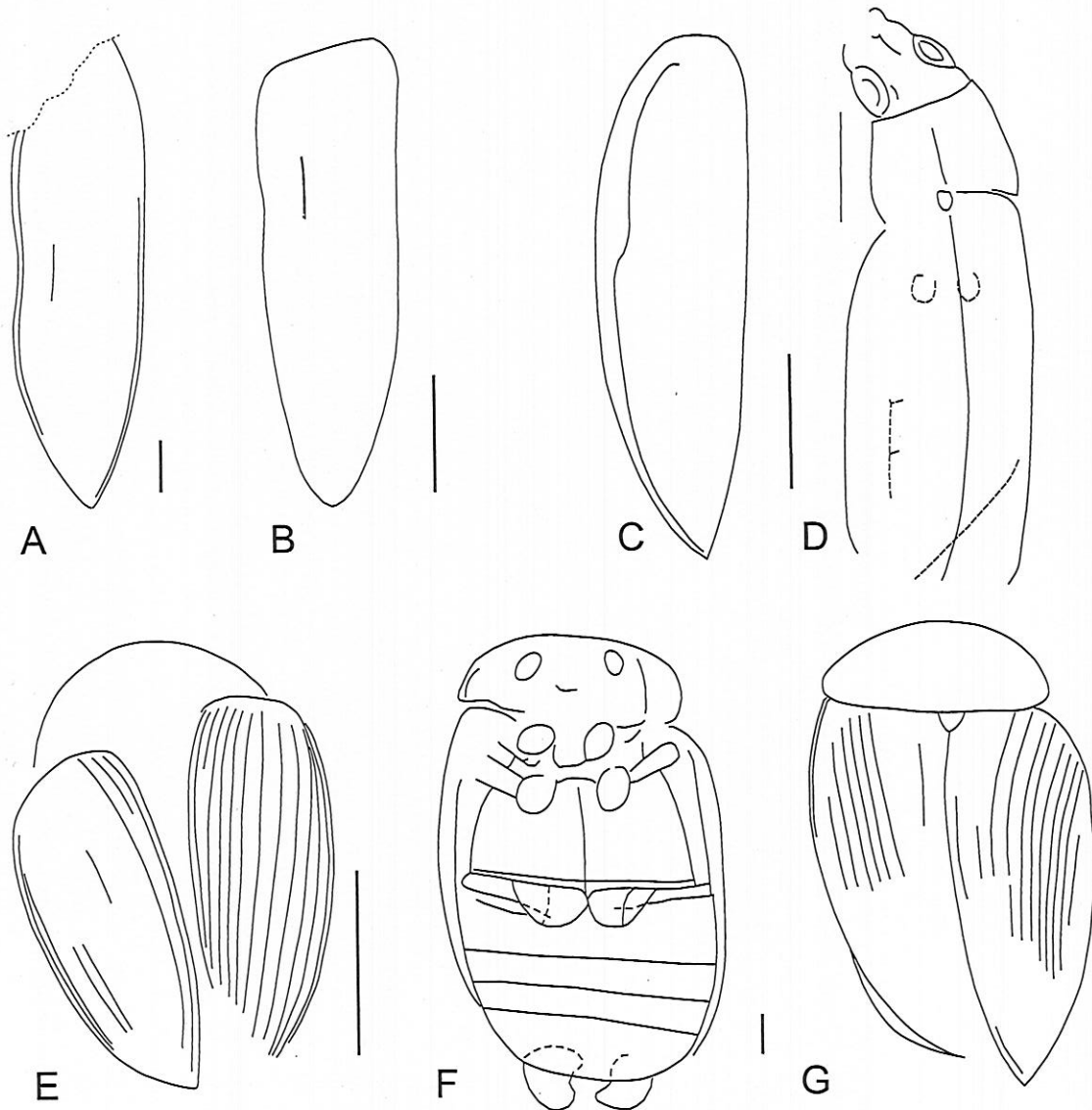
***Metrorynchites putativus* (Lin, 1986)**

(Text-fig. 3A; Pl. II, fig. F)

1986 *Aenigmocoleus putativus* Lin, p. 72, Pl. XVIII, fig. 5, text-fig. 67.

**Examined material** Holotype, NIGP70063, damaged left elytron. Lower Jurassic Zaoshang Formation; Chengtanjiang Town, Liuyang City, Hunan Province. Elytron length ca. 9 mm, width 2.3 mm.

**Description** Elytra medium-sized (just 5 times longer than wide), widest proximally middle region, apex symmetrically pointed, outer margin



Text-figure 3 Line drawings of examined specimens

A. *Metrorynchites putativus* (Lin, 1986), NIGP70063; B. *Lobites punctatoides* (Lin, 1986), NIGP70066; C-D. *Grammocoulos arcuatus* Lin, 1986, NIGP70074; E. *Ademosynoides minor* (Handlirsch, 1906), NIGP86094; F-G. *Toksunius chinaticus* (Lin, 1992), NIGP86093, part and counterpart. Scale bars=1 mm.

curved at the midlength, sutural margin weakly convex. Disc of elytron with numerous tubercles. "Schiza" and columellae not clearly visible.

**Remarks** The specimen belongs to Schizocoleidae, but not to the genus *Aenigmocoleus* Rohdendorf, 1961. *Aenigmocoleus* belongs to Rhombocoleidae, because it has rows of large separated punctures on the elytra. The specimen may however be regarded as a member of *Metrorynchites* Tillyard, 1916 in having an extended elytron without longitudinal rows of punctations. *Metrorynchites putativus* differs from *M. dilutes* in its smaller size and symmetrical apex.

#### Genus *Lobites* Dunstan, 1923

**Diagnosis** Elytra small or medium-sized (2.5-3.5 times longer than wide), widest in middle, symmetrically narrowing in apical quarter. Apex pointed, humeral area oblique, outer margin in the middle region cutting out. Disc of elytra with numerous large ring-shaped punctations.

**Remarks** This genus cannot be attributed to Buprestidae and should be regarded as a member of the form family Schizocoleidae according to its elytral structure.

#### *Lobites punctatoides* (Lin, 1986)

(Text-fig. 3B; Pl. II, fig. G)

1986 *Polysitum punctatoides* Lin, p. 74, Pl. XVI, fig. 4, text-fig. 70.

**Examined material** Holotype, NIGP70066, left elytron (without basal region). Upper Triassic Sanqutian Formation; Chengtanjiang Town, Liuyang City, Hunan Province. Elytra length 4.0 mm, width ca. 1.0 mm.

**Description** Elytron medium-sized (3.5 times longer than wide), widest proximally middle region, apex symmetrically pointed, outer margin almost straight, weakly cutting out at the midlength, sutural margin convex. Disc of elytra with numerous tubercles. "Schiza" and columellae not visible clearly.

**Remarks** The species does not belong to *Polysitum* because the later is wider and has no cutting

on the midlength. It is also different from *Metrorynchites* in having the different shape.

#### Coleoptera incertae familiae

#### *Grammocolous arcuatus* Lin, 1986

(Text-figs. 3C-D; Pl. II, figs. H-I)

1986 *Grammocolous arcuatus* Lin, p. 81, Pl. XIV, fig. 5; Pl. XV, fig. 3; text-fig. 79.

**Examined material** Holotype, NIGP70074, a poorly preserved body; Lower Jurassic Shiti Formation; Zhongshan County, Guangxi Province. Body length ca. 5 mm, width 1.4 mm; elytral length 3.9 mm, width 1.0 mm.

**Description** Small elongate beetle. Head free, not inserted into prothorax (possible a result of gas pressure during decay), short, nearly as long as wide. Prothorax transverse, rectangular, its anterior and hind margin nearly equal, sides straight, elytron smooth.

**Remarks** *Grammocolous arcuatus* does not belong to Silphidae, because it has no characteristics of that family. It probably belongs to Elateroidea if the position of its head was changed by post-mortem deformation. An isolated, smooth elytron was discovered from the same box NIGP70074 with the holotype of *G. arcuatus* and possibly belongs to the same species.

#### *Ademosynoides minor* (Handlirsch, 1906)

(Text-fig. 3E; Pl. II, fig. J)

1992 *Ademosynoides minor* Lin, p. 326, Pl. IV, fig. 5, text-fig. 15.

**Examined material** Holotype, NIGP86094, a poorly preserved body. Upper Triassic Huangshanjie Formation; Toksun, Xinjiang. Beetle length ca. 2.4 mm, width 1.8 mm, elytra length 1.8 mm.

**Description** Small oval beetle. Head ortho- or opisthognathous. Prothorax transverse, semi-oval, visible length of prothorax 2.7 times shorter than width. Elytron not very elongated, 2.5 times longer than wide, base straight, sides convex, apex pointed. 10 unpunctuated striae (including short scutellary), all merging into apex of elytron.

**Remarks** This specimen is similar to *Ademosynoides minor*, but differs from the other known species in having a shorter body and in having

scutellary striae. All other early Mesozoic genera with scutellary striae have more extended bodies.

#### *Toksunius* gen. nov.

**Type species** *Toksunius chinaticus* sp. nov.

**Diagnosis** Beetle large. Body flattened, wide, oval. Head ortho- or opisthognathous. Eyes small. Prothorax seemingly transverse, oval. Procoxae transverse, with large exposed trochanters. Middle coxae rounded, large, distant from each other; mesoventrite small. Mesocoxal cavities constructed by meso- and metaventrite and mesepimeron. Mesepisterna narrow, its anterior margin wider than posterior. Metacoxae transverse, with coxal plates. Coxal plates mesally longer than coxae, shortened before middle of coxae. Abdomen narrowed from the base of third ventrite, suture between first and second ventrite invisible, possibly connate, last ventrite wide and short. Elytra striate.

**Distribution and age** Upper Triassic Huangshanjie Formation; Toksun, Xinjiang.

**Remarks** *Ademosynoides* Dunstan, 1923 was described based on a beetle with unknown structures of the body, and therefore it should be considered as a form taxon in the family Permosyniidae. Many body structures are preserved in the beetle described here and therefore it can be considered within the framework of the natural system. The beetle is especially interesting because few Triassic beetles have preserved body structures, and large-sized beetles with striated elytra are very rare, with only four species longer than 1 cm described before.

#### *Toksunius chinaticus* (Lin, 1992)

(Text-figs. 3F-G; Pl. II, fig. K)

1992 *Ademosynoides chinaticus* Lin, p. 326, Pl. III, fig. 5, Pl. IV, fig. 4, text-fig. 14.

**Holotype** NIGP86093, body without antennae and legs. Beetle length 13.0 mm, width 8.0 mm, elytra length 10.0 mm.

**Description** Beetle 1.7 times longer than wide. Visible length of prothorax 2.3 times shorter

than wide; prosternal process as long as wide, equal to procoxae in length. Middle coxae larger than procoxae, distance between coxae almost the same as coxal diameter. Scutellum longitudinal, oval. Metepisterna 10 times as long as wide. Metaventrite twice wider than its length. Metacoxae mesally twice longer than in middle part, coxal plates mesally oval. Abdomen very weakly narrowed, base of fifth ventrite 1.4 times shorter than base of abdomen, last ventrite hardly longer than the penultimate one, tip of abdomen rounded. Elytra wide, narrowed in apical fifth, 2.8 times as long as wide, base straight, outer and sutural margins straight up to apical fifth, tip symmetrical. Elytral striae thin, oblique in basal humeral part, parallel to margin in sutural part.

**Remarks** This species is closely related to some small isolated elytra from the Carnian of Japan (*Menepihilites* in Fujiyama, 1973).

#### *Insecta incertae sedis*

##### *Hukouscytina duracina* Lin, 1986

(Pl. II, fig. L)

1986 *Hukouscytina duracina* Lin, pl. XIII, fig. 2; text-fig. 49b.

**Remarks** The specimen NIGP70044, *Hukouscytina duracina* Lin, 1986, from the Upper Triassic of Fujian was previously described as a cicada abdomen (Lin, 1986, Pl. XIII, fig. 2, text-fig. 49b). It also looks like an abdomen of a beetle (probably Polyphaga), but to determine its definite taxonomic system requires more fossils.

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### Explanation of Plates

Scale bar = 1 mm.

#### Plate I

- A. *Tetraphalerus largicoxa* Lin, 1986, NIGP70069.  
 B. *Notocupes lini* sp. nov., NIGP70070.  
 C. *Notocupes homorus* (Lin, 1986), NIGP70058.  
 D. *Notocupes* sp., NIGP109266.  
 E. *Memptus handlirschi* Ponomarenko, 1985, NIGP70068.  
 F-G. *Archaeolus funestus* Lin, 1986, NIGP70071, part and counterpart.  
 H. *Artinama qinghuoensis* Lin, 1986, NIGP70064.  
 I. *Mercata festira* Lin, 1986, NIGP70072.  
 J. *Gripecolous enallus* Lin, 1986, NIGP70073.  
 K. *Bistrisyne tenua* Lin, 1986, NIGP70067.

#### Plate II

- A. *Dzeregia juxta* (Lin, 1986), NIGP70065.  
 B. *Alveolicupes primus* Lin, 1986, NIGP70059.  
 C. *Alveolicupes secundes* Lin, 1986, NIGP70060.  
 D. *Diarcuipenna heterosa* Lin, 1986, NIGP70061.  
 E. *Metrorynchites dilutes* (Lin, 1986), NIGP70062.  
 F. *Metrorynchites putativus* (Lin, 1986), NIGP70063.  
 G. *Lobites punctatoides* (Lin, 1986), NIGP70066.  
 H-I. *Grammocolous arcuatus* Lin, 1986, NIGP70074.  
 J. *Ademosynoides minor* (Handlirsch, 1906), NIGP86094.  
 K. *Toksunius chinaticus* (Lin, 1992), NIGP86093.  
 L. *Hukouscytina duracina* Lin, 1986, NIGP70044.

