DOI:10.19800/j.cnki.aps.1996.04.004
第35卷第4期 古生物学报 Vol.35,No.4
1996年7月 ACTA PALAEONTOLOGICA SINICA July, 1996

新疆准噶尔盆地中生代直脉科（昆虫纲，长翅目）昆虫化石*

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内 容 提 要

描述了采自新疆准噶尔盆地克拉玛依吐孜沟下侏罗统八道湾组和乌苏县四棵树煤矿之南哈尔沙拉上三叠统小泉沟群直脉科昆虫化石10种。它们被归入3属，其中5种为新种，即：*Orthophlebia exculpta* sp. nov.，*O. colorata* sp. nov.，*Mesopanorpa densa* sp. nov.，*M. monstrosa* sp. nov.和*Protorthophlebia strigata* sp. nov.。对中国的直脉科昆虫进行了详细的讨论。

关键词 昆虫纲 直脉科 上三叠统—下侏罗统 准噶尔盆地 新疆

MESOZOIC INSECTS OF ORTHOPHLEBIIDAE (INSECTA, MECOPTERA) FROM JUNGGAR BASIN, XINJIANG, CHINA

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ABSTRACT

Ten species of the family Orthophlebiidae are described from the Lower Jurassic Badaowan Formation in Tuzigou of Karamay and the Upper Triassic Xiaoquangou Group in Harsala to the south of the Four Trees Coal Mine, Wusu County in the Junggar Basin, Xinjiang. They are referred to three genera, with 5 species recognized as new, including *Orthophlebia exculpta* sp. nov., *O. colorata* sp. nov., *Mesopanorpa densa* sp. nov., *M. monstrosa* sp. nov. and *Protorthophlebia strigata* sp. nov. Some genera and species of the family were reported in China over the past ten years, but mostly with some problems in classification. This paper gives a detailed discussion on the Orthophlebiidae in China.

Key words: Insecta, Orthophlebiidae, Upper Triassic—Lower Jurassic, Junggar Basin, Xinjiang, China

* 国家自然科学基金（49172069）和中国科学院古生物与古人类学科基础研究特别支持费（No.9409）资助。

1 INTRODUCTION

The Orthophlebiidae belong to an extinct family of the order Mecoptera under the class Insecta. Insects of this family are extensively distributed in the Late Triassic-Early Cretaceous continental strata in the Northern Hemisphere except for a few species of *Protorthophlebia* distributed in Australia (Handlirsch, 1906, 1939; Martynov, 1927, 1937; Tillyard, 1933; Martynova, 1948, 1962; Bode, 1953; Riek, 1950, 1955; Sukatsheva, 1985, 1990; Willmann, 1978; Ueda, 1991; Lin, 1982, 1986, 1992; Hong, 1983, 1986; Huang *et al.*, 1991; Ren, 1995).

The Orthophlebiidae were set up hy Handlirsch in 1906 (then written as Orthophlebidae and revised to Orthophlebiidae by Handlirsch in 1920), composed of 7 genera, namely *Neorthophlebia*, *Orthophlebia*, *Orthoplebioides*, *Pseudopolycentropus*, *Mesopanorpa*, *Callopanorpa*, *Stenopanorpa* (Handlirsch, 1906, pp. 479—481, 615—616). Soon after that, he removed *Neorthophlebia* to a new family, Neorthophlebiidae, and *Pseudopolycentropus* to another, Pseudopolycentropidae (Handlirsch, 1920). In 1924 Cockrell established a new genus *Dinopanorpa* in the family (Cockrell, 1924). As Tillyard thought, the wings of the genus *Orthophlebioides* type were only hindwings of the genus *Orthophlebia*, indicating that *Orthophlebioides* was a synonym of *Orthophlebia* (Tillyard, 1933). Meanwhile, he erected a new genus *Protorthophlebia* in Orthophlebiidae (Tillyard, 1933). Later, Handlirsch set up two new genera, namely *Orthophlebiites*, *Synorthophlebia* and placed them in the family (Handlirsch, 1939). Martynova considered *Orthophlebiites* as a synonym of *Orthophlebia* and placed some species of *Synorthophlebia* in *Orthophlebia* and others in *Mesopanorpa* (Martynova, 1948). Riek set up a new genus *Choristopanorpa* in 1950 and another one *Neoparachorista* in 1955, and considered both genera as belonging to Orthophlebiidae (Riek, 1950, 1955). Martynova thought *Choristopanorpa* and *Dinopanorpa* respectively to be synonyms of *Protorthophlebia* and *Orthophlebia* (Martynova, 1962). At the same time, she separately placed part of *Neoparachorista* into *Orthophlebia*, *Protorthophlebia* and *Mesopanorpa*, and thought that the family Orthophlebiidae only included these three genera (Martynova, 1962). Carpenter placed *Dinopanorpa* in the new family Dinopanorpidae Carpenter (Carpenter, 1972). Lin (1976) established a new genus *Parachorista* (this generic name had been used for an extinct genus in Permochoristidae by Tillyard in 1926; consequently, *Parachorista* Lin, 1976 falls as a junior homonym of *Parachorista* Tillyard, 1926, and should be replaced by a new name) in Orthophlebiidae based on a forewing from the Upper Jurassic Yixian Formation in Beipiao of western Liaoning, China. The genus, however, has a forewing with Rs 4-branched and M 5-branched and obviously should be assigned to Permochoristidae. Willmann thought Orthophlebiidae to be composed of 6 genera which are *Choristopanorpa*, *Mesopanorpa*, *Orthophlebia*, *Parorthophlebia*, *Protorthophlebia* and *Stenopanorpa* (Willmann, 1978). Based upon forewing features of a fossil insect from the Middle Jurassic Jiulongshan Formation at

Xiaofanzhangzi, Hebei, Hong erected a new genus *Jibeiorthophlebia* in Orthophlebiidae which included 2 species, namely *J. xiafanzhangziensis* and *J. internata* (Hong, 1983), but the type species, *Jibeiorthophlebia xiafanzhangziensis*, has forewings with stem Rs1+2 twice as long as stem Rs3+4 and Rs1 4-branched, and should be assigned to *Mesopanorpa*, indicating that *Jibeiorthophlebia* is a synonym of *Mesopanorpa*. On the other hand, the so-called *Jibeiorthophlebia internata* has forewings with Rs1+2 and Rs3+4 branching at about the same level, and Rs1 having 4 hranches, indicating that the species is a component of *Orthophlebia*. Shortly afterwards, Sukatsheva lowered the Orthophlebiidae to a subfamily in the family Panorpidae Latreille (Sukatsheva, 1985, 1990). Carpenter thought that the Orthophlebiidae only consisted of three genera, *Orthophlebia*, *Mesopanorpa* and *Protorthophlebia* (Carpenter, 1992), while Ren thought that only 4 genera, namely *Orthophlebia*, *Protorthophlebia*, *Mesopanorpa*, *Jibeiorthophlebia*, were included in the Orthophlebiidae (Ren, 1995).

Based on the above analysis, it is rather believable that up to now the family Orthophlebiidae only include three genera, namely *Orthophlebia*, *Mesopanorpa*, and *Protorthophlebia*.

2 DISTRIBUTION OF ORTHOPHLEBIIDS IN CHINA AND SOME PROBLEMS IN THEIR CLASSIFICATION

Insects of the Orthophlebiidae are broadly distributed in China and were reported in succession over the past ten years.

Mesopanorpa yaojiashanensis Lin and *M.* (?) *gambra* Lin occur in the Late Jurassic Laocun Formation in Shouchang, Zhejiang (Lin, 1980); *Orthophlebia quadrimacula* Lin is present in the Middle Jurassic Zhiluo Formation in Jianhe of Changqing, Shaanxi (Lin, 1982); *Protorthophlebia latipennis* Till., *Protorthophlebia deformis* Lin and *Mesopanorpa enormis* Lin are distributed in the Lower Jurassic Shiti Formation at the Xiwan Coal Mine of Zhongshan, Guangxi (Lin, 1986); *Protorthophlebia latipennis* Till. also occurs in the Lower Jurassic Menkoushan Formation in Yiyang, Jiangxi (Huang *et al.*, 1991); *Protorthophlebia macula* Lin exists in the Huangshanjie Formation of the Upper Triassic Xiaoquangou Group in Toksun, Xinjiang (Lin, 1992); *Protorthophlebia yaogouensis* Hong and *Mesopanorpa luanpingensis* Hong are distributed in the Middle Jurassic Jiulongshan Formation at Zhouyingzi, Hebei (Hong, 1983); *Jibeiorthophlebia xiafanzhangziensis* Hong and *J. internata* Hong occur in the Middle Jurassic Jiulongshan Formation at Xiaofanzhangzi, Hebei; *Protorthophlebia yangjuanxiangensis* Hong exists in the Middle Jurassic Xiahuayuan Formation at Yangjuanxiang of Yuxian County, Hebei (Hong, 1986), while *Orthophlebia fanshanensis* Ren is present in the Lower Cretaceous Lushangfen Formation at Xishan, Beijing (Ren, 1995).

It is worth pointing out that there exist some problems in classification of most of the

above-mentioned genera and species. *Protorthophlebia yaogouensis* and *P. yangjuanxiangensis* have a forewing with three-branched vein Rs1 which is the character of the genus *Orthophlebia* and they should be assigned to the genus *Orthophlebia*. Ueda (1991) made a correction of the latter species, but he mistook it for *P. yaogouensis*. In addition, *P. deformis* also has three-branched Rs1 and should be assigned to *Orthophlebia*. *Mesopanorpa* (miswritten as *Mesopanra* by Hong) *luanpingensis* was represented by a forewing as Hong described in his book (Hong, 1983). But by the photo and text-figure 90, the wing has a little shorter Sc and 4-branched M and may be a hindwing. Moreover, the species has the hindwing with 3-branched Rs1 and stem of Rs1+2 a little longer than that of Rs3+4 and should be assigned to *Orthophlebia*. *Jibeiorthophlebia xiaofanzhangziensis* (misspelled as *xiafanzhangziensis* by Hong in his description in Chinese) should be assigned to *Mesopanorpa* and *J. internata* to *Orthophlebia* (as revised above by the author). *Orthophlebia fanshanensis* Ren has a forewing with stem Rs1+2 twice as long as stem Rs3+4 and should be assigned to *Mesopanorpa*.

Table I　Distribution of orthophlebiids in China

Genera and species	Horizon	Locality
Protorthophlebia		
macula Lin	Upper Triassic Huangshanjie Formation	Toksun, Xinjiang
latipennis Tillyard	Lower Jurassic Shiti Formation	Zhongshan, Guangxi
	Lower Jurassic Badaowan Formation	Karamay, Xinjiang
	Lower Jurassic Menkoushan Formation	Yiyang, Jiangxi
strigata sp. nov.	Upper Triassic Xiaoquangou Group	Wusu, Xinjiang
Orthophlebia		
quadrimacula Lin	Middle Jurassic Zhiluo Formation	Changqing, Shaanxi
deformis (Lin, 1986)	Lower Jurassic Shiti Formation	Zhongshan, Guangxi
yaogouensis(Hong, 1983)	Middle Jurassic Jiulongshan Formation	Zhouyingzi, Hebei
luanpingensis(Hong, 1983)	Middle Jurassic Jiulongshan Formation	Zhouyingzi, Hebei
yangjuanxiangensis(Hong, 1986)	Middle Jurassic Xiahuayuan Formation	Yuxian, Hebei
internata(Hong, 1983)	Middle Jurassic Jiulongshan Formation	Xiaofanzhangzi, Hebei
latebrosa Sukatsheva	Lower Jurassic Badaowan Formation	Karamay, Xinjiang
exculpta sp. nov.	Upper Triassic Xiaoquangou Group	Wusu, Xinjiang
colorata sp. nov.	Lower Jurassic Badaowan Formation	Karamay, Xinjiang
Mesopanorpa		
brodiei (Tillyard)	Lower Jurassic Badaowan Formation	Karamay, Xinjiang
enormis Lin	Lower Jurassic Shiti Formation	Zhongshan, Guangxi
fanshanensis (Ren, 1995)	Lower Cretaceous Lushangfen Formation	Xishan, Beijing
kuliki Martynova	Lower Jurassic Badaowan Formation	Karamay, Xinjiang
obscura Martynova	Lower Jurassic Badaowan Formation	Karamay, Xinjiang
xiaofanzhangziensis(Hong,1983)	Middle Jurassic Jiulongshan Formation	Xiaofanzhangzi, Hebei
yaojiashanensis Lin	Upper Jurassic Laocun Formation	Shouchang, Zhejiang
? *gambra* Lin	Upper Jurassic Laocun Formation	Shouchang, Zhejiang
densa sp. nov.	Lower Jurassic Badaowan Formation	Karamay, Xinjiang
monstrosa sp. nov.	Lower Jurassic Badaowan Formation	Karamay, Xinjiang

Recently the author found some insect fossils of the family when arranging specimens collected from Tuzigou of Karamay and Harsala to the south of the Four Trees Coal Mine of Wusu County in the Junggar Basin, Xinjiang. The sections bearing insects are recognized as follows:

Harsala section

Lower Jurassic Badaowan Formation

Greyish yellow conglomerate, sandy conglomerate and sandstone intercalated with thin grey mudstone; sandy conglomerate, mainly consisting of quartzite and variegated sandstone with large cross beddings, bearing coal beds in unequal thickness; top unseen. 308.87m

--------paraunconformity--------

Upper Triassic Xiaoquangou Group

Yellowish green, grey mudstone, silty mudstone and siltstone, yielding the insects *Orthophlebia exculpta* sp. nov., *Protorthophlebia strigata* sp. nov., and Kazacharthra; bottom unseen. 40m

Tuzigou section

Middle Jurassic Xishanyao Formation

Grey, greyish green and greyish white mudstone, silty mudstone and muddy siltstone; with bottom consisting of variegated conglomerate. 136.15m

--------paraunconformity--------

Lower Jurassic Badaowan Formation

Grey, greyish green sandstone, siltstone and mudstone intercalated with thin conglomerate, yielding plants and the fossil insects *Protorthophlebia latipennis*, *Orthophlebia latebrata*, *O. colorata* sp. nov., *Mesopanorpa brodiei*, *M. obscura*, *M. kuliki*, *M. densa* sp. nov., *M. monstrosa* sp. nov. 182.75m

The insects referred to the family Orthophlebiidae which had been reported in China are listed in Table Ⅰ.

3 SYSTEMATIC PALAEONTOLOGY

Order Mecoptera Packard, 1886

Family Orthophlebiidae Handlirsch, 1906

Insects of this family mostly represented by forewings or hindwings. Forewing slightly broader than in Panorpidae; vein Sc long with only 1 short branch to costal margin; R not forked; Rs with 5 to 9 branches; M with 5 branches; CuA not fused with M basally, but connected to it by a short cross vein. Hindwing similar to forewing but slightly smaller and Sc a little shorter; CuA coalesced with M basally for a short distance; free piece of CuA resembling cross vein.

Genus *Orthophlebia* Westwood, 1845

Type species: *Orthophlebia liassica* (Mantell) Tillyard, 1933

Generic characters: Forewing with Rs1+2 and Rs3+4 forking at about the same level; Rs_1 with at least 3 branches.

In different descriptions, number of Rs1 branches varying from not less than 3 (Martynov, 1927, 1937; Martynova, 1948); 3 or 4 (Tillyard, 1933); more than 3 (Martynova, 1962) and at least 4 indicated by Rs1 forking at least 3 times (Carpenter, 1992). Based on present materials, it seems appropriate that Rs1 has at least 3 branches.

Geologic and geographic distribution: Upper Triassic—Middle Jurassic; Northern Hemisphere.

Orthophlebia latebrosa Sukatsheva, 1985

(Pl. I, fig. 3)

1985 *Orthophlebia latebrosa* Sukatsheva, p. 101, pl. 15, fig. 5.

Material: A well-preserved forewing; total length 14mm, width 4mm. 58SK44/K1.

Description: Specimen slightly different from the type species in the forewing with somewhat convex veins C and Sc, narrower costal area than subcostal one and the absence of cross veins sc-r, r-rs_{1+2}.

Locality and Horizon: Tuzigou of Karamay, Xinjiang; Lower Jurassic Badaowan Formation.

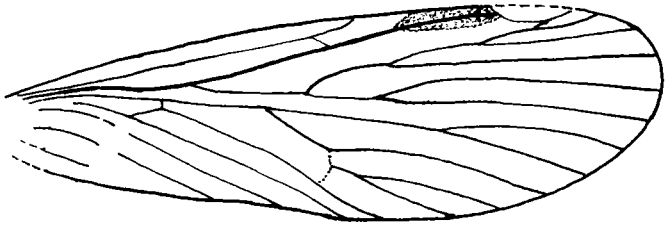
Orthophlebia exculpta sp. nov.

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

Etymology: "exculptus", Latin, carving.

Material: A right forewing with slightly damaged base; total length 11mm, maximum width 5mm. 93-HE-1/K1, holotype.

Description Vein Sc short and straight, close to and ending in anterior margin slightly behind the middle of the wing. Vein R, with stem thick, straight before middle and arched down behind middle, branching into two slightly before one-third of wing length; R1 parallel to Sc, concave a little behind ending of Sc and ending in anterior margin. A cross vein between Sc and R1 just before ending of Sc. Pterostigma well developed; its posterior boundary demarcated by a sharp line running



Text-fig. 1 *Orthophlebia exculpta* sp nov. forewing, X8, holotype

well below the curved distal portion of R1. Rs forking a little before the middle of the wing; stem of Rs1+2 slightly shorter than that of Rs but as long as that of Rs1 with 3 branches; Rs3+4 2-branched with stem a little shorter than that of Rs1+2. Vein M 5-branched, forking just before first branching of Rs; stem of M1+2 3 times as long as that of M3+4 and equal to branches of M1+2 in length; M4 with 2 branches. CuA, CuP long, ending in posterior margin; CuA connected to M by a short cross vein near base. Vein A with 3 branches straight and parallel to each other.

Comparison: The new species is similar to *O. liassica* (Mantell) Tillyard in the forewing, but differs in the smaller forewing with shorter Sc.

Locality and Horizon: Harsala of Wusu County, Xinjiang; Upper Triassic Xiaoquangou Group.

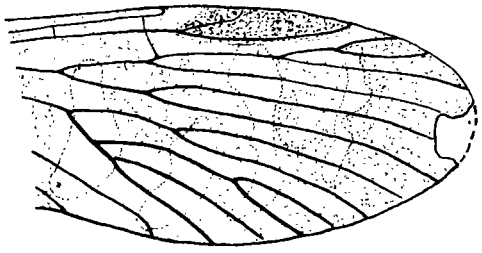
Orthophlebia colorata sp. nov.

(Pl. I, fig. 6; Text-fig. 2)

Etymology: "coloratus", Latin, of colour.

Material: A forewing in brown colour with base missing; preserved length 12.6 mm, width 6.4mm. 93-T-10/K2, holotype.

Description: Vein Sc not long but straight, close to and ending in anterior margin. Vein R1 parallel to Sc before the ending level of Sc and then becoming concave, ending in anterior margin. Pterostigma not very obvious. Rs1+2 branching a little before ending point of Sc; Rs1 3-branched; Rs2 simple; stem of Rs1 about 1.5 times and Rs2 about 4 times as long as that of Rs1+2; stem of Rs1+2 as long as that of Rs3+4. Vein M forking slightly behind first branching of Sc with 5 branches; stem of M1+2 2.5 times as long as that of M3+4, while M1 twice that of M1+2; M3 branching into two near the end. CuA straight. Cross veins between Sc and R1, R1 and Rs1. Surface decorated with white stripes.



Text-fig. 2 *Orthophlebia colorata* sp. nov. forewing with base missing, X5, holotype

Comparison: The new species is similar to *O. varia* Martynova, but differs in its shorter Sc, longer stem of Rs1+2 and 2-branched M3.

Locality and Horizon: Tuzigou of Karamay, Xinjiang; Lower Jurassic Badaowan Formation.

Genus *Mesopanorpa* Handlirsch, 1906

Type species: *Mesopanorpa hartungi* (B. R. G., 1889) Handlirsch, 1906

Generic characters: Forewing with stem Rs1+2 about twice as long as stem Rs3+4; Rs1 with 2 branches or more.

Since the genus was erected in 1906, descriptions of *Mesopanorpa* have been quite different, especially in the number of Rs1 branches in the forewing, which varies from only 2 (Handlirsch, 1906; Carpenter, 1992), only 2 or at most 3 (Martynov, 1927), 2 or more (Martynova, 1948). Martynova (1962) ever described Rs as having three branches or more, in which Rs1+2 was probally miswritten as Rs. It seems that Martynova's opinion is sound after the author has made a careful study of current materials.

Geologic and geographic distribution: Late Triassic—Early Cretaceous; China, former USSR and Europe.

Mesopanorpa brodiei (Tillyard, 1933) Martynova, 1948

(Pl. Ⅰ, fig. 4)

1933 *Orthophlebia brodiei* Tillyard, p. 43, text-fig. 16.

1948 *Mesopantorpa brodiei*, Martynova, p. 57.

Material: A forewing with base slightly damaged; total length 9. 5mm (possibly 10. 5mm), width 3. 6mm. 58SK14/K1.

Description: Specimen bearing a forewing with the last fork of Rs1 shorter than that of the type species.

Locality and Horizon: Tuzigou of Karamay, Xinjiang; Lower Jurassic Badaowan Formation.

Mesopanorpa kuliki Martynova, 1948

(Pl. Ⅱ, fig. 1)

1948 *Mesopanorpa kuliki*, Martynova, p. 64, fig. 44.

Material: A forewing with base and part of anterior margin missing; preserved length 9. 9mm, width 4. 1mm. 58SK14/K3.

Description: The specimen is slightly different from the type species in the somewhat longer stem of M3+4, without cross veins near apex.

Locality and Horizon: Tuzigou of Karamay, Xinjiang; Lower Jurassic Badaowan Formation.

Mesopanorpa obscura (Martynov, 1925) Martynov, 1927

(Pl. Ⅱ, figs. 2—4)

1925 *Orthophlebioides obscurus* Martynov, p. 760.

1927 *Mesopanorpa obscura*, Martynov, pp. 655, 661.

1937 *Mesopanorpa obscura*, Martynov, p. 19.

1948 *Mesopanorpa obscura*, Martynova, p. 59, fig. 41.

1953 *Orthophlebioides obscurus*, Bode, p. 279.

1978 *Mesopanorpa obscura*, Willmann, p. 68.

Material: Three forewings. Forewing 92-T-22/K3 with a small part of base missing, preserved length 10mm, width 3mm; 58SK15/K3 with base and anal area partly missing, preserved length 8.8mm, width 3.2mm; 92-T-22/K1 complete, length 13mm, width 4.4mm.

Description: Forewing 92-T-22/K3 very similar to that from Sogyuty (Martynov, 1948) except for the unbranched Sc and the absence of cross vein rs_2-rs_3, 58SK15/K3 for the slightly shorter stem of Rs1+2 and the absence of cross vein rs_2-rs_3; 92-T-22/K1 very similar to that from Karatau except for the slightly curved costal margin.

Locality and Horizon: Tuzigou of Karamay, Xinjiang; Lower Jurassic Badaowan Formation.

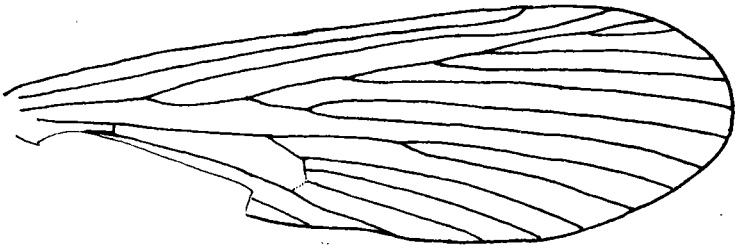
Mesopanorpa densa sp. nov.

(Pl. Ⅱ, fig. 6; Text-fig. 3)

Etymology: "densus", Latin, dense.

Material: A forewing with anal area missing; total length 14.5mm, width 4.5mm. 58SK15/K1, holotype.

Description: Vein Sc long, straight, close to and ending in anterior margin at three-fourths of wing length. Vein R bending posteriorly at one-fifth of wing length where Rs forks from R, parallel to Sc and ending in anterior margin just behind end of Sc. Pterostigma not obvious. Rs branching at one-third of wing length from base into Rs1+2 and Rs3+4; Rs1 with 4 comblike branches; Rs2 single; stem of Rs1+2 1.75 times as long as that of Rs3+4 and equal to that of Rs in length; stem of R about 1.5 times as long as that of Rs; Rs3, Rs4 long and straight. Vein M forking just behind first forking of Rs with 5 branches, stem of M1+2 about 3 times as long as that of M3+4; M1, M2, M3 single, M4 branching into 2. Vein CuA long, curved slightly, connected to M near base by a short cross vein.



Text-fig. 3 *Mesopanorpa densa* sp. nov.
forewings with anal area missing, X15, holotype

Comparison: The new species is similar to *M. kuliki* in the forewing, but differs in the smaller forewing in size with Rs, Rs1+2 and Rs3+4 forking earlier.

Locality and Horizon: Tuzigou of Karamay, Xinjiang; Lower Jurassic Badaowan Formation.

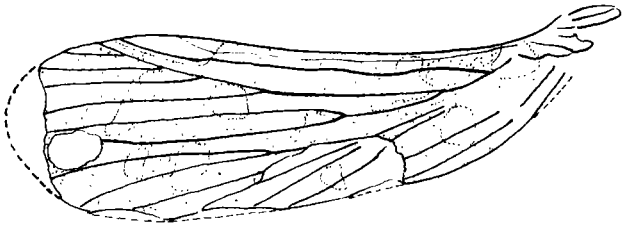
Mesopanorpa monstrosa sp. nov.

(Pl. Ⅰ, fig. 5; Text-fig. 4)

Etymology: "monstrosus", Latin, abnormal.

Material: Two overlapping forewings in brown color, with the one above and the one below separately bearing strongly and slightly damaged apex and posterior border; length 14mm, preserved width 5mm. 92-T-47/K1, holotype.

Description: Anterior margin concave for basal half. Vein Sc long, nearly parallel to anterior margin, extending into pterostigma and ending in anterior margin at one-fouth of wing length near apex, with a short branch near its end. Vein R stout, close to Sc, concave in pterostigma demarcated by a line just below posterior border and ending in anterior margin; Rs slightly concave, with 7 comblike branches; stem of Rs1+2 very long, about 4 times as long as that of Rs and 1.7 times as long as that of Rs3+4; Rs1 with 4 branches; stems of Rs1+2 and Rs3+4 respectively two-thirds and one-third of its branches in length. Vein M poor-preserved, M1+2 branching at the same level of first forking of Rs1+2; only end of M3 seen in the wing above and M4b in the wing below. Vein CuA slightly bending; CuP poor-preserved. Al straight. Wing surface decorated with white specks.



Text-fig. 4 *Mesopanorpa monstrosa* sp. nov. forewings overlapping, X5, holotype

Comparison: The species is very special in forewing, with concave veins C and Sc, long stem of Rs1+2, and can be easily distinguished from other species of the genus.

Locality and Horizon: Tuzigou of Karamay, Xinjiang; Lower Jurassic Badaowan Formation.

Genus *Protorthophlebia* Tillyard, 1933

Type species: *Protorthophlebia latipennis* Tillyard, 1933

Generic characters: Forewing with Rs1+2 and Rs3+4 forking at about the same level; Rs1 2-branched.

Geologic and geographic distribution: Late Triassic—Middle Jurassic; Australia, England, former USSR and China.

Protorthophlebia latipennis Tillyard, 1933

(Pl. Ⅱ, fig. 5)

1933 *Protorthophlebia latipennis* Tillyard, p. 29, text-fig. 6.

1948 *Protorthophlebia latipennis*, Martynova, p. 63, fig. 46.

1986 *Protorthophlebia latipennis*, Lin, pp. 82—83, text-fig. 80, pl. 15, fig. 5.

Material: A hindwing with base missing; preserved length 7mm, width 3. 2mm. 92-T-30/K.

Description: Vein Sc short, ending in anterior margin. Vein R1 close to and parallel to Sc, concave distally and ending in anterior margin near apex; Rs1 with 2 branches; stems of Rs1+2, Rs1 and branch of Rs1 equal in length; stem Rs3+4 a little shorter than stem Rs1+2. Vein M forking behind first branching of Rs with 4 branches, stem M1+2 long and convex; M1, M2 long, straight and ending in apex; stem M3+4 short; stem M, stem M3+4 and M4 arranged in line. CuA, CuP straight and parallel to M4. Stem M3+4 connected to CuA by a short cross vein.

Comparison: This specimen is a little different from the Sogyuty specimen (Martynova, 1948); in the latter, stem M, stem M1+2 and M1 are arranged in a line.

Locality and Horizon: Tuzigou of Karamay, Xinjiang; Lower Jurassic Badaowan Formation.

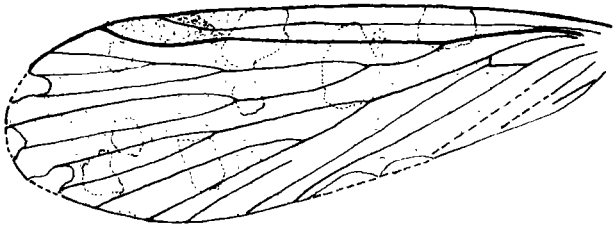
Protorthophlebia strigata sp. nov.

(Pl. 1, fig. 2; Text-fig. 5)

Etymoloty: "strigatus", Latin, striped.

Material: Two forewings, part and counterpart; length 10mm, width 3. 5mm. Holotype, 93-HE-2/K1, 2.

Description: Forewing very narrow at base, widest nearly at middle of pterostigma. Vein Sc long, straight, ending in anterior margin. Pterostigma obvious. Vein R stout; Rs1 straight but concave below pterostigma; Rs thinner than R; stem of Rs1+2 long and twice longer than that of Rs; Rs1 with 2 branches; Rs2 single; stem of Rs3+4 a little shorter than that of Rs1+2. Vein M with 5 branches, dividing into M1+2 and M3+4 at the same forking level of Rs; M1+2 with stem long, branching into M1 and M2 just behind forking of Rs3+4; stem of M3+4 short, about half that of M1+2. Vein CuA connected with M basically by a short cross vein, CuP straight. A1, A2, A3 straight. Wing surface clothed with brown stripes.



Text-fig. 5 *Protorthophlebia strigata* sp. nov. forewing, X8, holotype

Comparison: The new species is similar to *P. latipennis* Tillyard, but differs in the obviously longer stems of Rs1+2 and Rs3+4, and the wing surface clothed with stripes.

Locality and Horizon: Harsala of Wusu, Xinjiang; Upper Triassic Xiaoquangou Group.

4 ACKNOWLEDGEMENTS

The author is grateful to Dr. Lin Qi-bin for comments on the manuscript and to Mr. Hu Shang-qing for photographic work. This program is supported by the National Science Foundation of China and the Special Funds for Palaeontology and Palaeoanthropology, Academia Sinica.

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[1996年1月22日收到]

EXPLANATION OF PLATES

All specimens illustrated with photographs taken by Mr. Hu Shang-qing of Photographic Unit are deposited in Nanjing Institute of Geology and Palaeontology, Academia Sinica.

PLATE I

1. *Orthophlebia exculpta* sp. nov.
   Forewing, X8, holotype, NIGP 126368.
2. *Protorthophlebia strigata* sp. nov.
   2a, 2b. Part and counterpart. Forewings, X8, holotype. NIGP126369, 126370.
3. *Orthophlebia latebrosa* Sukatsheva, 1985
   Forewing, X6.8. NIGP126371.
4. *Mesopanorpa brodiei* (Tillyard, 1933)
   Forewing, X6.7, NIGP126372.
5. *Mesopanorpa monstrosa* sp. nov.
   Forewings overlapping, X5, holotype. NIGP126373.
6. *Orthophlebia colorata* sp. nov.
   Forewing with base missing, X5, holotype. NIGP126374.

PLATE II

1. *Mesopanorpa kuliki* Martynova, 1948
   Forewing with base and anterior part missing, X10. NIGP126375.

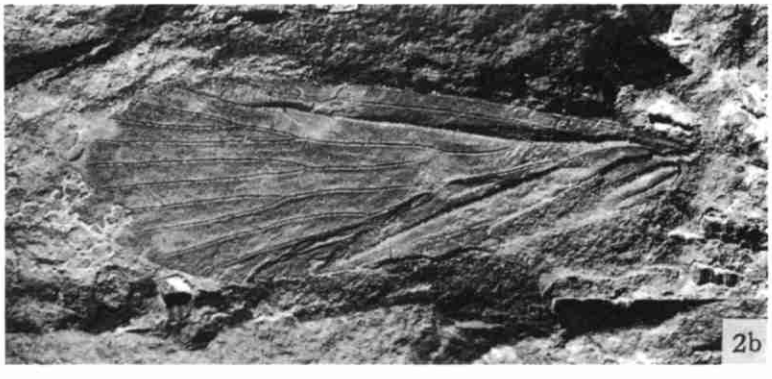
2—4. *Mesopanorpa obscura* (Martynov), 1927

2. Forewing with a small part of base missing, X10. NIGP126376.
3. Forewing, X7. NIGP126377.
4. Forewing with base and anal area missing, X10. NIGP126378.

5. *Protorthophlebia latipennis* Tillyard, 1933
   Hindwing with base missing, X15. NIGP126379.
6. *Mesopanorpa densa* sp. nov.
   Forewing with anal area missing, X15, holotype. NIGP126380.

Mesozoic Insects of Orthophlebiidae (Insecta, Mecoptera) from Junggar Basin, Xinjiang, China

Plate I



Mesozoic Insects of Orthophlebiidae (Insecta, Mecoptera) from Junggar Basin, Xinjiang, China

Plate Ⅱ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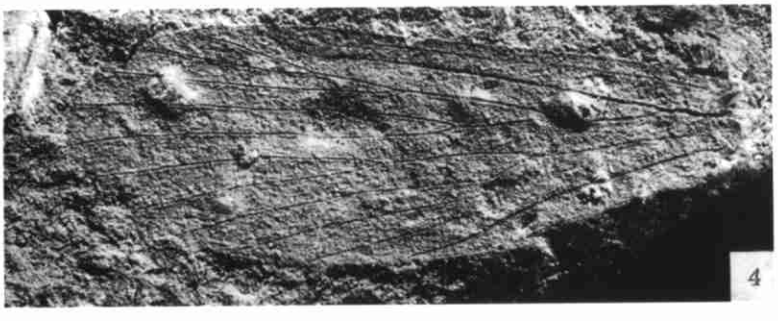
2


3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