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EARLY OLIGOCENE INSECT FAUNA FROM SEIFHENNERSDORF (SAXONY, GERMANY)

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Abstract. The present study provides an annotated list of the Early Oligocene entomofauna from the diatomite of Seifhennersdorf (Saxony, Germany). This study summarizes published and unpublished material gathered during the past four decades, concerning more than 30 insect specimens housed in two institutional and several private collections. The studied specimens were assigned to 13 families of seven insect orders. Trace fossils of two insect groups, i.e. damselflies egg-sets (Odonata: Zygoptera) and caddis fly larval cases (Trichoptera), were also examined. All taxa were compared to the previously described material from other Oligocene localities in the České středohoří Mts. These results were then correlated with those of paleobotanical research.

■ Insecta, Odonata, Isoptera, Auchenorrhyncha, Heteroptera, Coleoptera, Hymenoptera, Diptera, Trichoptera, catalogue, review, Early Oligocene, Germany

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Introduction

The Oligocene insect fauna is well known from compressed fossils and amber inclusions found at a number of localities, particularly in Europe and North America. The major European localities of compressed insect fossils, such as Bembridge Marls (UK), Céreste, Bois-d'Asson, and Aix-en-Provence (France), and Enspel and Rott (Germany) are well documented by hundreds and thousands of specimens (Jarzembowski 1980, Lutz 1996, Nel 1991, Wedmann 2000).

The Early Oligocene insect locality of Seifhennersdorf (Upper Lusatia, "Oberlausitz", Germany) is situated close to the border of the Czech Republic. It was first noted in the geological literature in the late nineteenth century, mainly due to its diatomite and coal deposits (see Walther 1996). Paleobotany was the main object of scientific interest in studying this locality, but paleozoological discoveries, such as fish and amphibian fossils, have also been made (Obrhelová 1970, Špinar 1972). The first description of a fossil insect from this site was that of a bee (Jeremies et al. 1998). Consequently the fossil insects were studied by Tietz et al. (1998). Both of those studies used specimens mainly from private collections.

The relatively diverse Oligocene (Ruppelian) insect fauna of Seifhennersdorf is preserved in several interbeddings of brownish diatomite within the magmatic complex (equivalent of the Loučeň Formation). This locality is one of several Tertiary insect sites situated mainly in northwestern Bohemia (Czech Republic), and preserved in fluviolacustrine deposits of the Krušné hory piedmont basins and volcanogenic facies of the České středohoří Mts. About 15 localities representing several different paleoenvironments, dated from Late Eocene to Early Miocene, are located on the Czech side of this area, while one (i.e. Seifhennersdorf) lies in Germany (Prokop 2003).

Material and methods

The material includes more than 30 insect specimens housed in two institutional and several private collections. Most of the material was collected by the paleobotanist Harald Walther (SMMG) during the past four decades (see paper by Walther & Kvaček in this volume) and housed in the Staatliches Museum für Mineralogie and Geologie in Dresden (SMMG). Other specimens obtained by amateur collectors were summarized by Tietz et al. (1998). This

material is deposited partly in the Staatliches Museum für Naturkunde in Görlitz, and in several private collections.

Material was loaned from the following collections as indicated by prefix: Staatliches Museum für Mineralogie and Geologie in Dresden (SaT), Staatliches Museum für Naturkunde in Görlitz (SMNG); and from private collections of the following owners: Thomas Berner (TB), Manfred Jeremies (MF) and Ekkehart Mättig (EM).

The fossil specimens were kept in dry state, without any special conservation methods. This preservation technique entails simple methods (e.g. preparation needle). The higher classification of insect taxa follows CSIRO (1991). The insect specimens are classified mostly up to the order or family level, less often to genera and species, depending on the state of their preservation. The description of significant fossil specimens will be published separately in detailed systematic studies (e.g., Fikáček et al. in press).

Annotated list of fossil insects from Seifhennersdorf

The following list of fossil insects has been compiled from the two papers summarizing the previous research (Jeremias et al. 1998, Tietz et al. 1998), and from unpublished material of the SMMG. For each taxon, the following data are given: material, including collection number and a short description of the state of preservation; remarks, including comments mainly concerning entomofauna from the nearby the Krušné hory piedmont basins and volcanic areas of the České středohoří Mts.; and references to studies by earlier authors who mentioned some of this material.

Odonata

Anisoptera

Gomphidae

Lindeniinae

? *Ictinogomphus* Cowley, 1934

Pl. 1, fig. 1

M a t e r i a l : No. SMMG SaT 532 – distal part of fore wing with venation well preserved.

R e m a r k s : Despite the fact that the proximal part of the wing is missing, it belongs to the Gomphidae (Lindeniinae), because of the Rspl and Mspl strongly diverging from IR2 and MA respectively. This wing is nearly identical to the gomphid genus *Ictinogomphus* (secondary branch of IR2 very distinct and more parallel to it, therefore IR2 appears to be dichotomously forked distal of the lestine oblique vein, character of the Lindeniinae) (see Bechly 2007). This genus was previously recorded in Miocene of Japan and Turkey (Yasuno 1990, Nel and Paicheler 1994). It is the first record of this family from Tertiary of České středohoří Mts.

Isoptera

Hodotermitidae

Ulmeriela Meunier, 1920

Ulmeriella sp.

Pl. 1, figs 3, 4

M a t e r i a l : Nos. TB 864, TB 873, TB 874, TB 875.

R e m a r k s : These fossil wings share the characteristic wing venation pattern of the genus *Ulmeriella*: Cu well developed with numerous branches, RP with several branches directed posteriorly and reaching posterior margin, AA short (see Emerson 1968, Nel and Paicheler 1993). However, it is difficult to compare this fossil with other species due to the lack of the head structures.

This genus has been reported from many Cenozoic localities occurring from the Upper Oligocene to Pliocene in Europe, Asia, and North America. The presence in the early Oligocene deposits in Central Europe extends the range of this genus. This taxon has also been reported from the Most Basin (Prokop and Nel 1999).

R e f e r e n c e s : Tietz et al. 1998.

Auchenorrhyncha

Cicadidae gen. et sp. indet.

Pl. 1, fig 4

M a t e r i a l : No. TB 876 – fore wing with fragmentary body.

R e m a r k s : Tietz et al. (1998) described and compared this fossil with the recent species *Tibicina haematodes* (Scopoli, 1763). In our opinion, the material is rather fragmentary, not allowing a more precise identification at the present time. Another report on this genus, described as *Tibicina sakalai* Prokop et Boulard, 2000, comes from the Lower Miocene of Bílina mine (Prokop and Boulard 2000).

R e f e r e n c e s : Tietz et al. 1998.

Heteroptera

?Pentatomoidea

Family uncertain

Pl. 1, fig. 5

M a t e r i a l : No. SMMG SaT 538 – fore wing (hemelytron) with venation preserved.

R e m a r k s : This fossil elytron bears characteristics of the Pentatomomorpha group, mainly concerning the membrane structure. Although the hemelytron lacks the clavus commonly used for identification; the fossil could be attributed to any of the following three recent families: Acanthosomatidae, Coreidae s. str., or Pentatomidae. Last two families have also been found in the Lower – Middle Miocene of Bílina mine and the Cypris Shales (Prokop 2003).

Coleoptera

Adephaga

Carabidae

Pl. 1, fig. 6; Pl. 2, fig. 1

M a t e r i a l : Nos. TB 879 (former TB 10) – head, thorax and fore leg, SMMG SaT 269 – elytron.

R e m a r k s : Specimen TB 879 bears a cordiform pronotum with slightly protruding posterolateral angles, prognathous head with large mandibles, and long anterior leg. Based on these characteristics, it can be ascribed to the family Carabidae. Because of its size and general habitus, this fossil was previously attributed to the genus *Pterostichus* (TIETZ et al. 1998); the confirmation of this identification will require further detailed study. The elytron SaT 269 bears sharply but finely impressed striae, a slightly delimited apical part, and a rather elongated shape, all of which are also typical of the Carabidae. It probably belongs to the genus *Agonum* s. l. (†K. Hůrka identified).

R e f e r e n c e s : Tietz et al. 1998 (TB 879 – former TB 10).

Polyphaga

Hydrophilidae

Hydrobiomorpha BLACKBURN, 1888

Hydrobiomorpha enspelense WEDMANN, 2000

Pl. 2, fig. 2

M a t e r i a l : No. SMMG SaT 533 – nearly complete body.

R e m a r k s : The body shape and long maxillary palpus of this fossil clearly show that it belongs to the family Hydrophilidae. Based on the body proportions, excised anterior margin of the clypeus, and large body size, it was identified as *Hydrobiomorpha enspelense* WEDMANN, 2000 (see Fikáček et al., in press., for detailed discussion).

The representatives of the genus *Hydrobiomorpha* are aquatic, occurring in permanent, shallow, well-vegetated water bodies. *H. enpelense* was described by Wedmann (2000) from the Late Oligocene locality of Enspel, Germany.

Geotrupidae

Typhaeus LEACH, 1815

Typhaeus sp.

Pl. 2, fig. 3

M a t e r i a l : No. SMMG SaT 532 – nearly complete body.

R e m a r k s : The fossil has a wide, strongly sclerotized body, striate elytra, and strong legs with spines on outer edges, all of which are characteristics typical of the Geotrupidae. Within this family, it can be assigned to the genus *Typhaeus*, the females of which bear the sharply pointed, anteriorly slightly projecting anterolateral corners of the pronotum observed on this specimen.

Cerambycidae

Lamiinae gen et sp. indet.

Pl. 2, fig. 4

M a t e r i a l : No. SMMG SaT 524– nearly complete body.

R e m a r k s : This fossil bears the hypognathous head, long antenna, pronotum with a large and sharp lateral tooth, and elongate elytra. Based on these characteristics, it most probably represents the subfamily Lamiinae of the family Cerambycidae.

Curculionidae gen. et sp. indet.

Pl. 2, figs 5, 6

M a t e r i a l : Nos. SMMG SaT 261 – fragmentary body, SaT 515 – elytron, SaT 536 – fragmentary body, SaT 542 – fragmentary body, TB 880 – nearly complete body.

R e m a r k s : On the basis of the general habitus and morphology of the head, which bears long rostrum, all fossils clearly belong to the family Curculionidae. Based on the shape of the rostrum, they most probably represent the subfamily Molytinae, though the subfamily Lixinae cannot be excluded by the preserved characteristics (Morrone 2000). Tietz et al. (1998) ascribed the fossil No. TB 880 to the subfamily Alcidinae (= tribe Mecysolobini of the subfamily Molytinae, according to recent classification (Kuschel 1987; Alonso-Zarazaga and Lyal 1999)). The identification of tribes of the subfamily Molytinae is, however, possible only on the basis of morphology of the antennal scrobe and female genitalia, which are not preserved in any of the fossils examined here.

R e f e r e n c e s : Tietz et al. 1998 (TB 880 – former EM)

Diptera

Bibionidae

Pl. 3, fig. 1, 2

M a t e r i a l : Nos MJ 243 – fore wing with venation well preserved, PAL 96/59 – fragmentary body, TB 877 (former TB 13) – fragmentary body with fore wing venation.

R e m a r k s : The wing venation clearly corresponds to Bibioninae, and probably to *Bibio* GEOFFROY, 1762. Fossil Bibionidae of two genera (*Bibio* and *Plecia* WIEDEMANN, 1828) frequently occur in Cenozoic localities. Regardless of their exact taxonomic position, their occurrence in lake

deposits and their state of preservation could indicate lacustrine paleoenvironmental conditions as well as climatic signals (see Wedmann 1998). Bibionidae have been reported from Miocene deposits of the Bílina mine and of the Cypris shales in northern Bohemia (Prokop 2003, Říha 1979).

References: Tietz et al. 1998 (TB 877 – former TB 13).

Hippoboscoidea

?Hippoboscidae

Pl. 3, fig. 3

Material: No. TB 878 – nearly complete body in rather poor state of preservation.

Remarks: This specimen is difficult to identify because its probably apterous form and tiny structures are badly preserved in the diatomite. However, on the basis of the leg shape, thorax and abdomen with visibly fused tergites, and large, rounded head without protruding antennae, we tentatively attribute this fossil to the parasitic Diptera of the superfamily Hippoboscoidea, probably belonging to the family Hippoboscidae. This family was reported by Statz (1940) in the Oligocene of Rott (Germany).

Hymenoptera

Formicidae gen. et sp. indet.

Pl. 3, figs. 4, 5

Material: Nos. SMMG SaT 539 – fragmentary fore wing, MJ 244 – fragmentary fore wing, PAL 96/60 – nearly complete worker, TB 986 – nearly complete worker.

Remarks: Ants are very common fossils in Cenozoic deposits, but they are difficult to systematically identify when occurring in a compressed state. Isolated wings are especially problematic due to polymorphism. All specimens presented herein are attributable to the family Formicidae, but more detailed identification would be possible only after examination of the material by a specialist on this group. Fossil ants are recorded from nearly all deposits in northern Bohemia containing insect remains, ranging from Late Eocene to Middle Miocene (Prokop 2003).

References: Tietz et al. 1998 (PAL 96/60, MJ 244).

Apidae

Apis Linnaeus, 1758

Apis sp.

Material: MJ coll. – nearly complete body with fore wing venation preserved.

Remarks: Jeremies et al. (1998) described this fossil and considered it as being close to the recent species *Apis mellifera* Linnaeus, 1758. However, there is no clear evidence for this attribution, because of the lack of several characters and the necessity of comparing it to other Cenozoic species (Nel et al. 1999). A complete revision would be necessary before any subgeneric attribution. This specimen was not available for the present study, but Prokop and Nel (2003) have previously described several specimens attributable to *Apis* Linnaeus, 1758 from Lower Miocene of Bílina mine.

References: Jeremies et al. 1998, Tietz et al. 1998.

Insect trace fossils

Odonata

Zygoptera

?Lestidae

Material: SMMG No. Sf 5026.

Remarks: Egg sets of damselflies (type Lestidae) on an angiosperm leaf of *Carpinus grandis* Unger, described by Hellmund & Hellmund (1996).

References: Hellmund & Hellmund 1996.

Trichoptera

Family uncertain

Pl. 3, figs 6, 7

Material: Nos TB 887, TB 888, SaT 527 – all larval cases.

Remarks: Caddisfly larval cases are commonly found in Cenozoic deposits, but their taxonomic attribution is often difficult. However, their presence in lake deposits has undisputed significance for paleoecology and the reconstruction of the paleoenvironment. Trichoptera larval cases have been reported at several northern Bohemian localities containing Oligocene and Miocene deposits (Prokop 2003).

References: Tietz et al. 1998 (TB 887, TB 888).

Conclusion

The Early Oligocene entomofauna of Seifhennersdorf provides a view into the diversity of insect fauna living in and around a Paleogene diatom lake and its surroundings. A systematic study of almost 30 specimens, classified into 13 families of seven insect orders, enables the comparison of selected, well preserved insect taxa, and broader considerations about the living conditions. The insect taphocoenosis shows predominantly terrestrial insects, the majority of which are beetles (Coleoptera) represented mostly by Curculionidae. Accessory aquatic elements are also present, such as fossilized caddis fly cases and water beetles of the family Hydrophilidae. Many of the terrestrial groups considered here were either living along the edges of water bodies (as e.g. adult Odonata) or indicate a relatively humid environment (e.g. genus *Agonum* s. l. (Carabidae)). However, the data set from this locality is still quite small (less than 100 specimens), while many taxa are represented only by single specimens (e.g., Cerambycidae, Geotrupidae); it therefore cannot yet be suitably compared with other sites around the world.

Paleobotanical data on this locality suggest vegetation of a riparian forest with deciduous elements. The local

paleoenvironmental conditions at Seifhennersdorf indicate the presence of more aquatic and near shore elements than at other localities, such as Kučlín near Bílina (Late Eocene diatom lake, Czech Republic). It also seems to have had a broader circumlittoral zone accompanied by a characteristic flora (*Alnus* sp.), and a lowland forest insect element (e.g., Geotrupidae: *Typhaeus* sp.). The higher abundance of aquatic elements at Seifhennersdorf (e.g., fossilized caddisfly cases, Coleoptera: Hydrophilidae) than at Kučlín indicate lower water salinity at the former site, and thus better living conditions for aquatic invertebrates.

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Komentovaný seznam spodnooligocénní entomofauny ze Seifhennersdorfu (Sasko)

Jakub Prokop – Martin Fikáček

V práci jsou shrnuty publikované a nepublikované nálezy zástupců hmyzu (Insecta) pocházející z lokality Seifhennersdorf (spodní oligocén, Německo). Entomofauna, čítající materiál více než 30 kompresních fosílií zachovaných v diatomitu, zahrnuje zástupce 13 čeledí ze 7 řádů uložených ve dvou institucionálních a několika privátních sbírkách. Navíc jsou v práci zahrnuty i nalezené stopy po činnosti hmyzu, tj. vajíčka šidélek (Odonata: Zygoptera) na listech příbřežní vegetace (*Carpinus grandis* UNGER) a anorganické schránky larev chrostíků (Trichoptera). Nové je systematické zpracování nálezů pocházejících ze sbírek muzea přírodních věd v Drážďanech (SMMG), které přineslo několik významných nálezů (např. potvrzení přítomnosti zástupců rodu *Ulmeriella* ve spodním oligocénu střední Evropy, nález druhu *Hydrobiomorpha enspelense* WEDMANN, 2000 dříve popsaného ze svrchně oligocenní lokality Enspel nebo unikátně zachovaná parasitická moucha z nadčeledi Hippoboscoidea). Jednotlivé taxony jsou srovnávány především s faunou ostatních oligocenních lokalit Českého středohoří a miocénních lokalit podkrušnohorských pánví. Obecnější výsledky týkající se interpretace lokálního paleoprostředí a klimatických podmínek souhlasí s dříve postulovanými paleobotanickými závěry a jsou k nim i částečně vztaženy.

Appendix

PLATE 1

Insecta

1. Odonata: Gomphidae: Lindeniinae: ?*Ictinogomphus* sp. (distal wing fragment), SaT 532 (scale bar 5 mm).
2. Isoptera: Hodotermitidae: *Ulmeriella* sp. (wing), TB 3239 (scale bar 5 mm).
3. Isoptera: Hodotermitidae: *Ulmeriella* sp. (wing), TB No 865 (scale bar 5 mm).
4. Auchenorrhyncha: Cicadidae (fragmentary thorax and fore wing), TB 876 (scale bar 5 mm).
5. Heteroptera: Pentatomoidea (hemelytron), SaT 538 (scale bar 3 mm).
6. Coleoptera: Carabidae (fragmentary head and thorax), TB 879 (former 10) (scale bar 5 mm).

PLATE 2

1. Coleoptera: Carabidae: ?*Agonum* sp. (elytron), SaT 269 (scale bar 3 mm).
2. Coleoptera: Hydrophilidae: *Hydrobiomorpha enspelense* WEDMANN, 2000 (head, thorax and fragmentary elytra), SaT 533 (scale bar 5 mm).
3. Coleoptera: Geotrupidae: *Typhaeus* sp. (nearly complete body), SaT 532 (scale bar 5 mm).
4. Coleoptera: Cerambycidae (fragmentary body), SaT 543 (scale bar 5 mm).
5. Coleoptera: Curculionidae (fragmentary body), TB 880 (scale bar 3 mm).
6. Coleoptera: Curculionidae (fragmentary body), SaT 261 (scale bar 3 mm).

PLATE 3

1. Diptera: Bibionidae (fore wing), MJ 243 (scale bar 3 mm).
2. Diptera: Bibionidae (fragmentary body and fore wing), TB 877 (former 13) (scale bar 3 mm).
3. Diptera: ?Hippoboscidae (fragmentary body), TB 878 (scale bar 3 mm).
4. Hymenoptera: Formicidae (fore wing), TB 866 (scale bar 3 mm).
5. Hymenoptera: Formicidae (fragmentary body), TB 986 (scale bar 3 mm).
6. Trichoptera (larval cases), TB 888 (scale bar 3 mm).
7. Trichoptera (larval cases), TB 890 (scale bar 3 mm).

PLATE 1

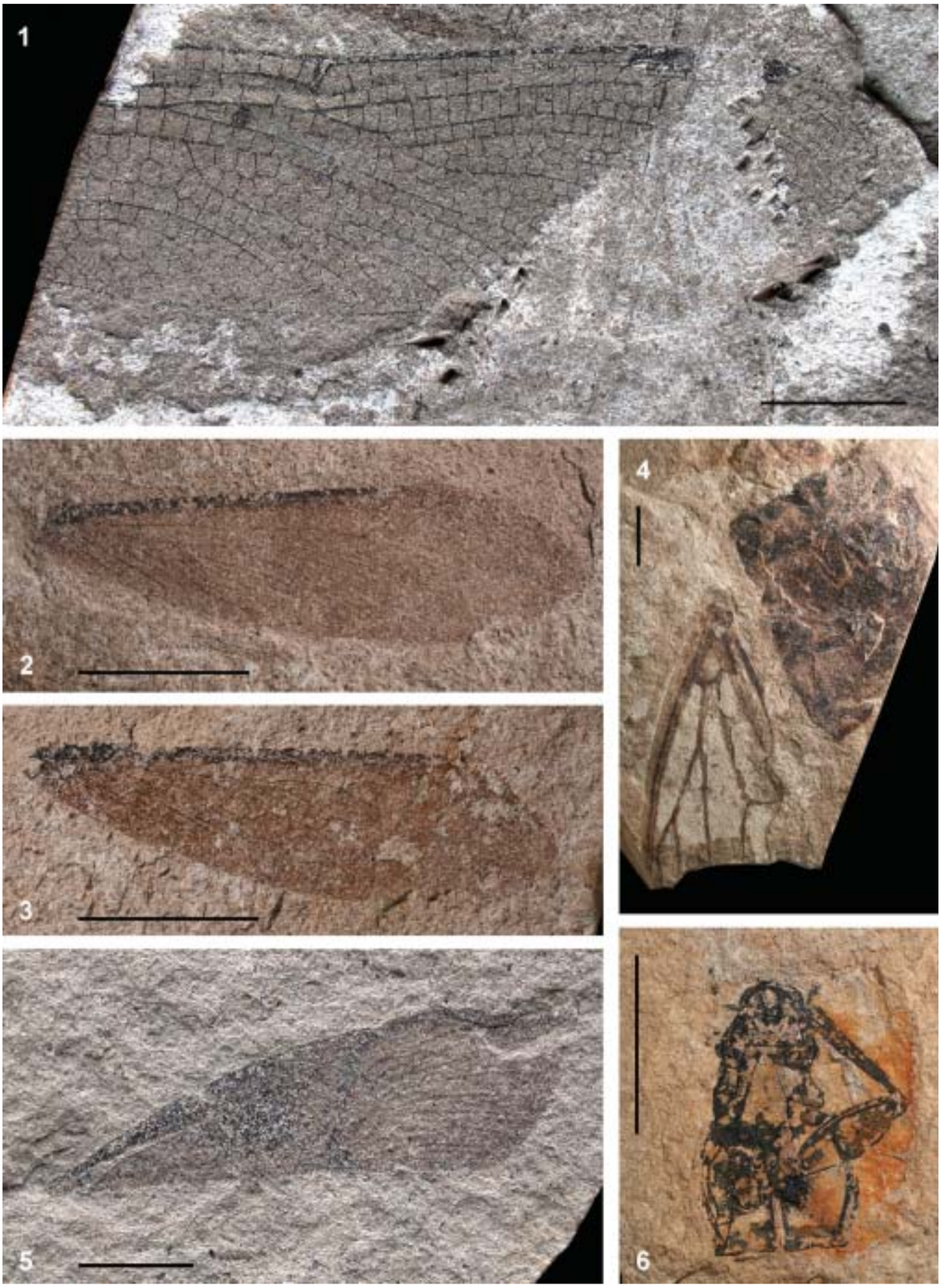

PLATE 2

PLATE 3