1 The first Cretaceous damselfly of the Jurassic family Steleopteridae (Odonata: Zygoptera),
2 from Surrey, England

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4 Daran Zheng^a, A. Nel^{b,*}, E.A. Jarzembowski^{a,c}

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6 ^a*State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and*
7 *Palaeontology and Center for Excellence in Life and Palaeoenvironment, Chinese Academy of*
8 *Sciences, 39 East Beijing Road, Nanjing 210008, China*

9 ^b*Institut Systématique Evolution Biodiversité (ISYEB), Muséum national d'Histoire naturelle,*
10 *CNRS, Sorbonne Université, EPHE, 57 rue Cuvier, CP 50, 75005 Paris, France.*

11 ^c*Department of Earth Sciences, The Natural History Museum, London SW7 5BD, UK*

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13 * Corresponding author. E-mail address: anel@mnhn.fr (A. Nel)

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15 ABSTRACT

16 *Steleopteron cretacicus* sp. nov., first Cretaceous and most recent representative of the small
17 Mesozoic family Steleopteridae, is described from the Wealden of the UK. This discovery
18 shows that this Jurassic family survived into the Cretaceous. It probably became extinct
19 during or after the great entomofaunal changes of the Albian – Cenomanian event.

20
21 *Keywords:*

22 Insecta; Odonata; Zygoptera; Steleopteridae; sp. nov.; Lower Cretaceous; UK

1. Introduction

The Steleopteridae Handlirsch, 1906 is a small family of very slender damselfly-like Odonata-known from four genera in the Upper Jurassic of Germany and Kazakhstan (Fleck et al., 2001). This group is currently placed in the stem Zygoptera, but its position remains enigmatic. It is characterized by a series of synapomorphies (see Bechly, 2016); the most remarkable being the presence of a very long ovipositor and a very characteristic pattern of transverse pleats between the longitudinal veins (see Fleck et al., 2001). To date, the family was only known from the Jurassic, even if it had a wide distribution. Here we described its first Lower Cretaceous representative, on the basis of a fragmentary fossil wing that shows enough characters to be safely placed in a precise genus.

2. Material and method

The wing was observed and photographed dry and under ethanol with a Nikon D800 digital microscope camera after minor preparation with a pneumatic hammer. We mainly follow the wing venation nomenclature of Riek & Kukalová-Peck (1984), modified by Nel *et al.* (1993). The venational symbols used here are: RA/RP: radial anterior/posterior, IR: convex intercalary radial vein. The wing fragment of late Hauterivian age is from a well-cemented, slightly ferruginous, yellow siltstone scour fill found in the Lower Weald Clay Formation of the former Clockhouse brickworks, UK (for site geology, map and photo. see Jarzembowski and Soszyn'ska-Maj, 2018: fig. 1).

3. Systematic palaeontology

Class: Insecta Linneaus, 1758

Order: Odonata Fabricius, 1793

Family: Steleopteridae Handlirsch, 1906

Genus *Steleopteron* Handlirsch, 1906

Type species: *Steleopteron deichmuelleri* Handlirsch, 1906. Other species. *Steleopteron cretacicus* sp. nov.

Steleopteron cretacicus sp. nov.

(Figs. 1-2)

Etymology. Named after the Cretaceous period.

Holotype. Specimen NHMUK CH 879viii (Jarzembowski coll.), stored in the Department of Earth Sciences, The Natural History Museum, London, UK.

ZooBank number: urn:lsid:zoobank.org:act:2ECA5141-DA58-4B52-869D-AFDAE84388D3

Age and outcrop. Upper Hauterivian, Lower Cretaceous; Lower Weald Clay Fm beneath BGS bed 3/3a; Clockhouse brickworks, near Capel, Surrey England, UK (latitude 51 deg.8 min. N., longitude 0 deg. 19.5 min. W.).

Diagnosis. Wing characters only. Pterostigma covering only one and a half cells and narrower wing than the type species.

Description. A small fragment of the costo-apical part of a wing, without any trace of coloration except dark wing venation and pterostigma, 9.6 mm long, 3.7 mm wide (distance between C and RP3/4); pterostigma 2.0 mm long, 0.5 mm wide, covering one cell and a half; microsculpture of pterostigma not preserved; pterostigmal brace very weak, identical in strength to the other crossveins near it; eight preserved oblique postnodal crossveins, not aligned with the five preserved postnodal crossveins; at least four sigmoidal crossveins between C and RA distal of pterostigma; area between RP1 and RP2 with a long zigzagged vein and two rows of cells; area between RP2 and IR2 very narrow, 0.3 mm wide, with only one row of cells; area between IR2 and RP3/4 with specialized cells and crossveins, viz.

convex veins nearly perpendicular to IR2 separated by concave veins, each group of concave – convex crossveins ~~are~~ defining a set of four cells; RP2, IR2 and RP3/4 straight.

Discussion. Although fragmentary, this wing shows some very special characters allowing its accurate placement. The very weak pterostigmal brace, the long pterostigma, the strongly zigzagged IR1, the postnodals and postsubnodals not aligned, and the straight RP2 and IR2 are present in the two Mesozoic families Protomyrmeleontidae and Steleopteridae. This fossil, however, has a highly specialized pattern of the cells below IR2, described above. This character is absent in the Protomyrmelontidae and is only present in some Steleopteridae (Fleck et al., 2001). This fossil differs from *Parasteleopteron* Fleck et al. 2001 and *Euparasteleopteron* Fleck et al. 2001 in the presence of only two rows of cells between RP1 and RP2. *Auliella* Pritykina, 1968 has specialized rows of cells similar to those of this fossil, but these are in the cubito-anal area, and not in the area between IR2 and RP3/4. The pattern of venation of this fossil is only found in monobasic *Steleopteron* Handlirsch, 1906. *Steleopteron deichmuelleri* Handlirsch, 1906 from the Upper Jurassic of Bavaria (Solnhofen), Germany, differs from this fossil in the longer pterostigma covering two cells and a half, while in *Steleopteron cretacicus* sp. nov., it only covers one and a half cells. Also, the wing of *Steleopteron deichmuelleri* is broader than that of *Steleopteron cretacicus* (distance between C and RP3/4 4.7 mm in *Steleopteron deichmuelleri*, instead of 3.7 mm in *Steleopteron cretacicus*). We therefore propose a new species as more complete material is unlikely in the near future due to excavation having ceased and landfill commenced at the type locality (a SSSI).

4. Conclusion

This discovery extends the distribution of the extinct Steleopteridae. The family has been recorded from the mainly marine palaeobiota of Sol[e]nhofen to the palaeolake of Karatau.

This discovery from a Wealden mudplain demonstrates that it was widely distributed—in Eurasia. It also shows that this Jurassic family survived into the Cretaceous. It probably became extinct during or after the great entomofaunal changes of the Albian – Cenomanian, a major period of extinction and renewal for the clade Odonata (Nel et al., 2010).

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130 **Fig. 1.** *Steleopteron cretacicus* sp. nov., holotype. Photograph (scale bar represents 2 mm).

131 **Fig. 2.** *Steleopteron cretacicus* sp. nov., holotype. Line drawing (scale bar represents 2 mm).

132

133

Pt

RP2

IR2

IR1

RP3/4