A new petalurid dragonfly from the Lower Cretaceous of southern England (Odonata: Petalurida: ?Cretapetaluridae)

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Abstract

The new petalurid genus and species *Anglopetalura magnifica* n. gen., n. sp. is described from the Lower Cretaceous of southern England, and tentatively attributed to the Mesozoic family Cretapetaluridae, already known by two genera from the Lower Cretaceous Crato Formation of Brazil.

Keywords: Insecta, Odonata, Petalurida, Cretapetaluridae, gen. et sp. n., Early Cretaceous, England.

Zusammenfassung

Die neue Petaluriden-Gattung und -Art *Anglopetalura magnifica* n. gen., n. sp. wird aus der Unter-Kreide Südenglands beschrieben und vorbehaltlich der mesozoischen Familie Cretapetaluridae zugeordnet. Diese war bislang nur durch zwei Gattungen aus der unter-kretazischen Crato-Formation in Brasilien bekannt.

1. Introduction

Living petalurid dragonflies, represented by the sole family Petaluridae, are very few compared to large anisopteran families like the Aeshnidae, Gomphidae or Libellulidae, comprising just five genera with semi-aquatic larvae and a mostly circum-Pacific distribution. The clade was much more diverse and disparate during the Mesozoic; no fewer than four families being present in the Late Jurassic-Early Cretaceous: the Protolindeniidae, the Cretapetaluridae, the Aktassiidae, and even possible representatives of the Petaluridae (Nel et al. 1998; Petrulevičius & Nel 2003). Their fossils are known from South America, Europe and Asia. Barremian deposits in southeast England have previously yielded the aktassiid *Pseudocymatophlebia hennigi* Nel et al., 1998. We describe herein a new genus and species of Early Cretaceous Petalurida from the Berriasian Purbeck Limestone Group of southern England, a predominantly lagoonal succession with a diverse fossil insect fauna. This new taxon shows strong similarities to the family Cretapetaluridae Nel et al., 1998 from the Aptian Crato Formation of Brazil.

Acknowledgements

We wish to thank Andy Webster (Swanage, Dorset) for providing the photograph in Fig. 2. We are grateful to Dr. Günter Bechly and Prof. Carsten Brauckmann for helpful comments on the manuscript.

Abbreviations

AA	anal anterior vein
Ax1, Ax2	primary antenodal cross-veins
CuAa	distal branch of cubitus anterior
CuAb	proximal branch of cubitus anterior
IRi	intercalary radial veins
MA	median anterior
MAb	posterior branch of median anterior
MP	median posterior
N	nodus
O	oblique vein
Pt	pterostigma
RA	radius anterior
RP	radius posterior
tp	trigonal planate (a vein emerging directly from the distal side of the discoidal triangle and situated between RP3/4 and MA)

2. Systematic palaeontology

In the description below we follow the wing venation nomenclature of Riek & Kukalová-Peck (1984), amended by Nel et al. (1993) and Bechly (1996). The higher classification of fossil and extant Odonatoptera, as well as familial and generic characters followed in the present work, are based on the phylogenetic system proposed by Bechly (1996) and Nel et al. (1998) for the Mesozoic Petalurida.

Order Odonata Fabricius, 1793
Clade Petalurida Bechly, 1996
Family ?Cretapetaluridae Nel et al., 1998

Genus *Anglopetalura* n. gen.

Type species: *Anglopetalura magnifica* n. sp.
Derivation of name: Named after Anglia, Latin name for England, and *Petalura*.

Diagnosis. – Hind wing characters only. Absence of second oblique cross-vein between RP2 and IR2 distal

of lestine oblique vein 'O'; true lestine oblique vein shifted basally, separated by only one cell from subnodus; postnodal space very narrow, with many cells distal of pterostigma; pterostigma not very elongate; pterostigmal brace vein shifted to basal 3/4 of wing, about midway between nodus and apex; IR1 well-defined, only weakly zigzagged, and rather long; wing space between RP1 and RP2 strongly expanded; three rows of cells in basal part of postdiscoidal area between level of distal angle of discoidal triangle and level of midfork; CuAb very distinctly curved at its base in male hind wings, strongly approaching secondary anal vein AA1b; MP somewhat shortened, and terminating at posterior margin only slightly distal of nodus; distal side of discoidal triangle (MAb) distinctly angulated, correlated with a strongly developed intercalary vein in postdiscoidal space; subdiscoidal triangle free; anal loop posteriorly opened; wing not falcate, veins RP3/4 and MA moderately undulate; RP3/4 not distally strongly diverging from MA.

Anglopetalura magnifica n. sp.
Figs. 1–2

H o l o t y p e : Specimen MNEMG 2009.68 [DB175/ODON 63], Maidstone Museum and Bentlif Art Gallery, Kent, UK ME14 1LH, coll. R. A. CORAM (male hind wing).

D e r i v a t i o n o f n a m e : Named after the superb preservation of the holotype.

S t a t u m t y p i c u m : Bed DB175 of CLEMENTS (1993), Corbula beds, Durlston Formation, Purbeck Limestone Group, Upper Berriasian.

L o c u s t y p i c u s : Durlston Bay, Swanage, Dorset, UK (National Grid Reference SZ 035 780).

D i a g n o s i s . – As for genus.

D e s c r i p t i o n . – Wings hyaline; hind wing 42.3 mm long, 14.3 mm wide; distance from base to arculus 5.0 mm; from arculus to nodus 14.0 mm; from arculus to base of RP3/4 7.3 mm; no secondary antenodal cross-vein basal of primary antenodal cross-vein Ax1, three complete antenodal cross-veins between Ax1 and Ax2, eight of first row and six of second row distal of Ax2; distance from wing base to Ax1 4.3 mm, between Ax1 and Ax2 5.3 mm; Ax2 just basal of apex of discoidal triangle; RP and MA strongly separated in arculus; hypertriangle 5.2 mm long, free; discoidal triangle 0.7 mm distal of arculus, divided into two smaller cells, elongate and narrow, with basal side 1.7 mm long, anterior side 4.3 mm long, and MAb 5.0 mm long; a distinct angle in MAb and a well defined convex trigonal planate tp; postdiscoidal area with three rows of cells; no Mspl; no pseudo-ScP distal of nodus; basal part of area between RA and RP with four cross-veins basal of RP3/4, and four distal of base of RP3/4 and basal of subnodus; area between RP and MA with five cross-veins basal of RP3/4; only one oblique vein 'O', one cell distal of base of RP2; RP2 and IR2 parallel and weakly curved; one row of cells between RP2 and IR2; area between RP1 and RP2 basal of pterostigma narrow but with two rows of cells; IR1 long, straight and well defined; five rows of cells between IR1 and RP2 and six rows between IR1 and RP1; no Rspl; RP3/4 and MA with a weak double curve and with the space between them not distinctly widened but with two rows of cells near posterior wing margin; pterostigma rather short, 4.0 mm long, 0.8 mm wide, covering four cells; pterostigmal brace oblique but seven cells basal of basal side of pterostigma, 8.0 mm distal of subnodus; 14 postnodal cross-veins not aligned with 16 postsubnodal cross-veins; space between C and RA distal of pterostigma elongate with about 12 cross-veins; one row of cells between MP and CuAa, with a narrowing of area between these veins opposite base of RP3/4; median area free; submedian area crossed by CuP-crossing; subdiscoidal space free, PsA straight; posterior wing margin angular at base with a long and broad anal triangle (male specimen); anal area broad, with two posterior branches of AA directed towards posterior wing margin, and eight rows of cells between AA and posterior wing margin; anal loop rather small, not elongate, pentagonal, posteriorly opened, divided into five cells; CuAb very distinctly curved at its base, strongly approaching secondary anal vein AA1b; cubito-anal area broad, with eight rows of cells between CuAa and posterior wing margin; CuAa with six posterior branches.

D i s c u s s i o n . – *Anglopetalura magnifica* n. gen., n. sp. falls in the Petalurida for the following synapomorphies: postnodal space very narrow, with many cells distal of the pterostigma; pterostigmal brace vein shifted to basal 3/4 of wing, midway between nodus and apex; IR1 well-defined, only weakly zigzagged, and rather long; wing space between RP1 and RP2 strongly expanded, with many more than eight to nine rows of cells at the wing margin; more than two rows of cells in basal part of postdiscoidal area between level of distal angle of discoidal triangle and level of midfork; CuAb very distinctly curved at its base in male hind wings, strongly approaching secondary anal vein AA1b. Affinities with the Petalurodea BECHLY, 1996 (= Cretapetaluridae + Petaluroidea NEEDHAM, 1903) are supported by the character 'hind wing MP at least somewhat shortened, and terminating at posterior margin only slightly distal of nodus', more shortened than in the Protolindeniidae HANDLIRSCH, 1906, putative sister group of the Petalurodea. *Anglopetalura* n. gen. shares with the Cretapetaluridae (two Early Cretaceous genera: *Cretapetalura* NEL et al., 1998 and *Eotanypteryx* BECHLY, 2007) the following putative synapomorphies: true lestine oblique vein (basal oblique vein between RP2 and IR2) shifted basally (convergent to Recent *Phenes* RAMBUR, 1842 and Petalurinae), separated by only one cell from subnodus; distal side of discoidal triangle (MAb) distinctly angulated, correlated with a strongly developed

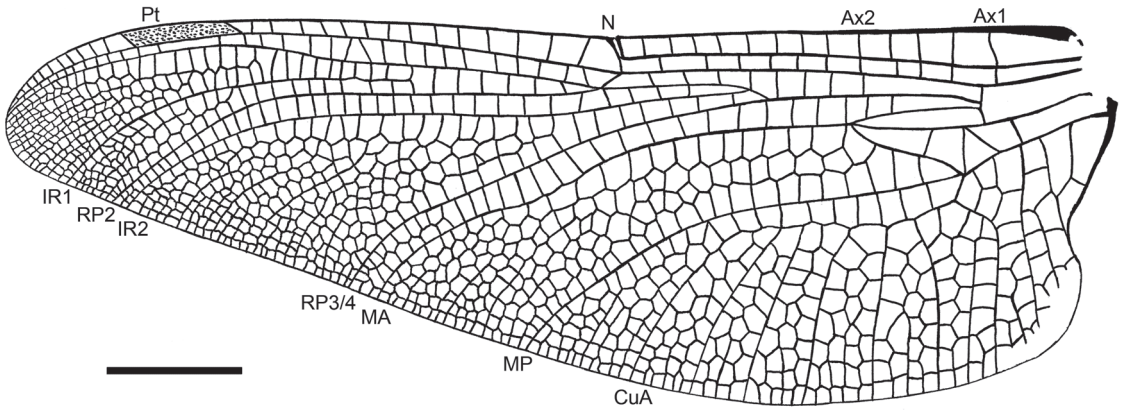

Fig. 1. *Anglopetalura magnifica* n. gen., n. sp., holotype MNEMG 2009.68, hind wing. – Scale bar: 5.0 mm.

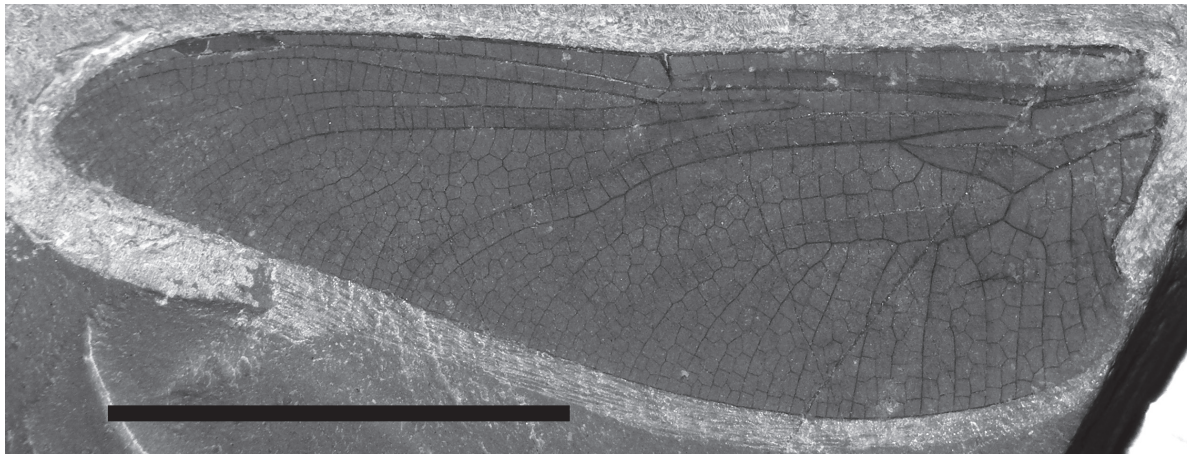

Fig. 2. *Anglopetalura magnifica* n. gen., n. sp., holotype MNEMG 2009.68, hind wing. – Scale bar: 18 mm.

intercalary vein in postdiscoidal space. However, *Anglopetalura* n. gen. lacks the following putative synapomorphies of this family: hind wing subdiscoidal triangle widened and traversed by a cross-vein; hind wing anal loop longitudinally elongated. *Anglopetalura* n. gen. also differs from *Cretapetalura* in its wing not being falcate, veins RP3/4 and MA being more distinctly undulate, and the anal loop posteriorly opened as in *Protolindenia* Deichmüller, 1886, but these characters are probably symplesiomorphies as they are present in the Liassogomphidae Tillyard, 1935 and Juragomphidae Nel et al., 2001, potential sister group of the Anisoptera (Bechly 1996; Nel et al. 1998, 2001a, b). On the other hand, *Anglopetalura* n. gen. lacks the synapomorphies of the Petaluroidea, viz. elongate pterostigma; RP3/4 distally strongly diverging from MA; hind wing MP distinctly shortened, and terminating at posterior margin at level of nodus, or even somewhat basal of nodus.

The reduction of the second oblique cross-vein between RP2 and IR2 distal of the lestine oblique vein 'O' in *Anglopetalura* n. gen. is a character infrequently seen in the Petalurida (there are two oblique veins in the ground plan of this group), but occurs also in the cretapetalurid *Eotanypteryx paradoxa* Bechly, 2007 from the Lower Cretaceous of Brazil (Bechly 2007). The same character convergently occurs in the petalurid group Tachopteryginae Fraser, 1933 (*Tanypteryx* Kennedy, 1917, *Tachopteryx* Uhler in Selys, 1859 and *Phenes*), but these Recent Petaluridae have extremely elongate and narrow pterostigmata (at least 12–17 % of wing length, and at least 10 times longer than broad), and since their basal margins are shifted basally to the pterostigmal brace vein (situated in basal 3/4 of the wing), the pterostigmata appear to be curved, unlike in *Anglopetalura* n. gen.

Anglopetalura n. gen. shares with *Eotanypteryx* the unexpanded wing space between RP1 and RP2, the rather

broad bridge space (area between RP1/2, base of RP2 and IR2), and the area between RP3/4 and MA not being strongly widened near the wing margin. However *Anglopetalura* n. gen. differs from *Eotanypteryx* in that the hind wing discoidal triangle is crossed and MA is distinctly undulate.

At this stage of knowledge of *Anglopetalura* n. gen., it is not possible to erect a new family for this fossil because the characters of its forewing are not known. *Anglopetalura* n. gen. is either the sister group of the Cretapetaluridae, or a cretapetalurid genus, or even the sister group of the Petalurodea, the Protolindeniidae being the sister group of (*Anglopetalura* n. gen. + Petalurodea). We provisionally include *Anglopetalura* n. gen. in the Cretapetaluridae because of the numerous synapomorphies of the family that are present in this fossil.

R e m a r k s . – The Early Cretaceous petalurid genus *Argentinopetala* Petrulevičius & Nel, 2003 differs from *Anglopetalura* n. gen. in the very elongate pterostigma, and very broad area between IR1 and RP2 with nine rows of cells (Petrulevičius & Nel 2003). *Anglopetalura* n. gen. differs from *Aeshnopsis perampla* (Brodie, 1845) and *Necrogomphus* Campion, 1923, (both Anisoptera of uncertain position from the Purbeck Limestone Group of southern England) in the presence of a trigonal planate and posteriorly opened anal loop (Nel et al. 1998).

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Manuscript received: 13.3.2009, accepted: 21.5.2009.