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A slender new archaic beetle in Burmese amber (Coleoptera: Archostemata)

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A new archostematan beetle, *Clessidromma palmeri* gen. et sp. nov. (Insecta: Coleoptera) is described from mid-Cretaceous Burmese amber from northern Myanmar. It has a uniquely specialized body form for which a new stem tribe, Clessidromatini trib. nov., is proposed in the subfamily Ommatinae of the family Cupedidae *sensu lato*.

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Key words: fossil resin, Myanmar, Cretaceous, Coleoptera, cupedid, *Clessidromma*.

Dedication: In memoriam Phil Palmer (1927–2015) palaeontologist and photographer

SEVERAL hundred species of fossil Cupedina (Archostemata + Myxophaga) have been described from Permian and younger strata, and archostematans are notable constituents of Mesozoic insect faunas, even occurring in regions from which they have now vanished (Kirejtshuk & Ponomarenko 2015). Previously known from adpressions in Cretaceous non-marine sediments, some exceptionally well preserved as in north-eastern China (Zhang *et al.* 2015), these archaic beetles have been discovered recently as amber inclusions in northern Myanmar (Xia *et al.* 2015). Archostematans are, nevertheless, scarce in Burmese amber, which is surprising considering the modern association of these beetles with wood, and they are usually represented by smaller forms as might be expected. The beetle described below (Fig. 1A–C), almost 1 cm long, belongs to a rare species, only one specimen being known from over 100 000 inclusions examined. This uniquely slender form is considered to be an extinct ommatine, a group of ‘living fossils’ peculiar to Australia and South America. Opinion is divided as to whether ommatines are a subfamily of reticulated beetles or cupedids *sensu lato* (Kirejtshuk *et al.* 2016),

or a separate family (with the tetraphalerins; Lawrence & Ślipiński 2013). For consistency with other burgeoning studies of amber-hosted archostematans (Jarzembowski & Wang 2016), we consider cupedids and ommatines in the broad sense (the latter including extant tetraphalerins and extinct brochocoleins; Yamamoto *in press*; Jarzembowski *et al.* *in press a*).

Geological setting

Burmese amber (amber from northern Myanmar, ‘birmite’ or burmite) contains the most diverse amberized biota known from the Cretaceous; it has been traded with China for over one thousand years but no scientific research on the insect inclusions was undertaken there until recently (Wang *et al.* 2015). All the major divisions of extant insects (orders) are represented, beetles (Order Coleoptera Linnaeus 1758) being one of the most diverse, but most species are still undescribed. The fossil resin is dated stratigraphically and radiometrically as late Albian to early Cenomanian (about 100 million years old; Cruickshank & Ko 2003, Ross *et al.* 2010). Uranium-Lead (U–Pb) dating of zircons from the tuffaceous matrix gave a maximum age of 98.8 ± 0.6 million years (Shi *et al.* 2012), but evidence of reworking (rolling and boring of the amber pebbles) indicates that this is a minimum age.

Amber has been found in several districts of Myanmar, but the current supply is from Myitkyina

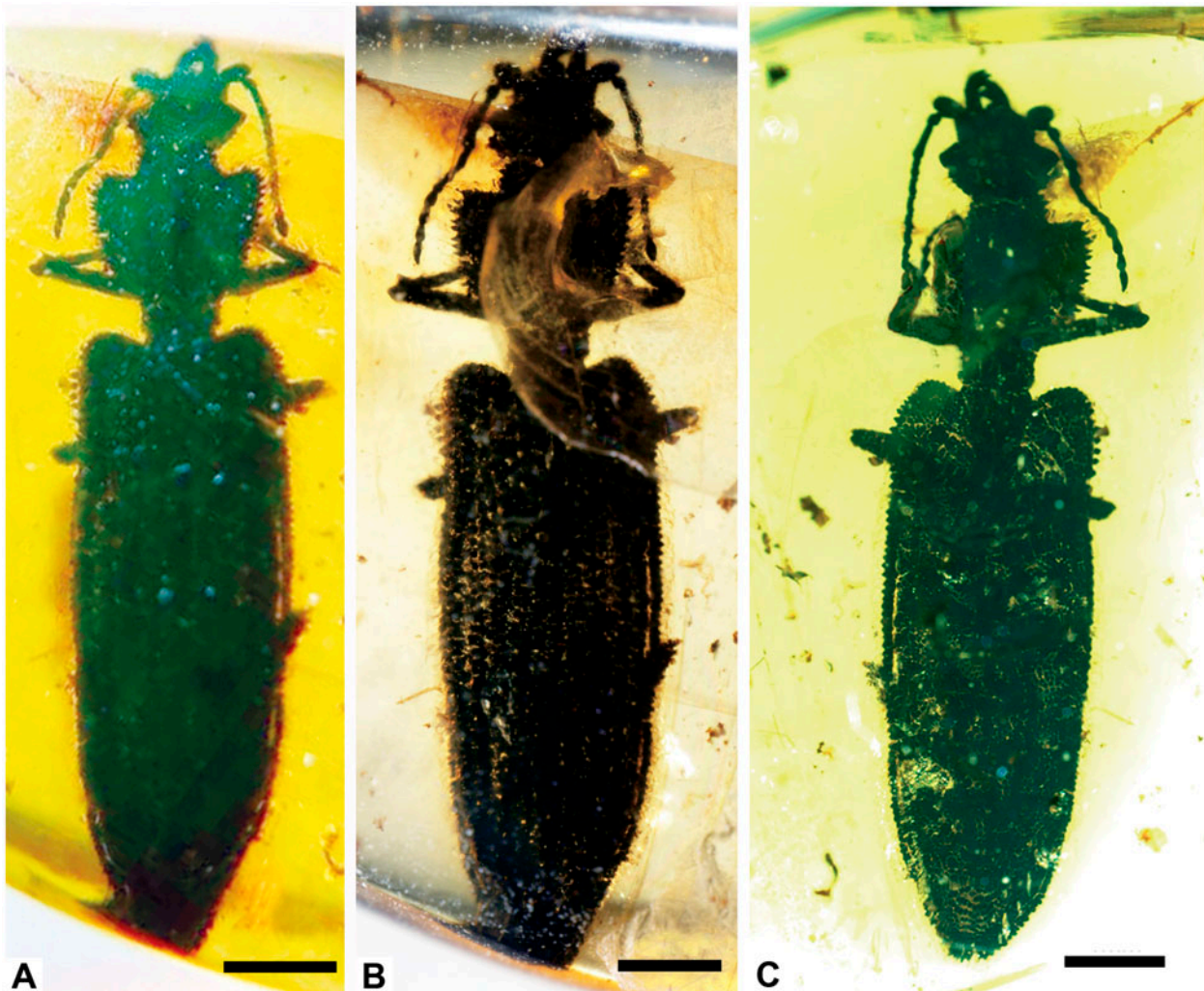


Fig. 1. *Clessidromma palmeri* gen. et sp. nov. Holotype, NIGP 166270. A–C. Photographs of habitus; dorsal view in different lights (A, B); ventral view (C). Scale bars = 1 mm.

District, Kachin State, in the Hukawng Valley of northern Myanmar; an active mine is located near Noiye Bum Village, Tanaing (Tanai) Township (Kania *et al.* 2015, fig. 1: map; Jarzembowski *et al.* 2017a, fig. S1: view). Amber has also been reported from Tilin (Hti Lin) in central Burma (Sun *et al.* 2015) and this material has recently yielded some insect inclusions, but has not come on line yet in the commercial quantities of the northern burmite from the Hukawng Valley. It may be noted that the unworked ‘tilinite’ is some 30 million years younger (Late Cretaceous: early Maastrichtian) and faunal differences are anticipated. As is the normal practice in Myanmar, the burmite inclusion studied herein has been prepared as a jewellery piece (cabochon) and is affected by a conchoidal fracture exposed during polishing. Burmite inclusions may show some deformation (Xia *et al.* 2015, Jarzembowski & Wang 2016) but this one is only slightly affected (left side in front of the mid-thorax).

Material and methods

The holotype was examined using an Olympus SZX7 binocular microscope with fibreoptics and top and bottom illumination; it was photographed with a Zeiss Axiocam 506 digital camera with Combine ZP software mounted on a Zeiss AX10 Zoom.v16 binocular microscope. Drawings were prepared from both photographs and specimens by hand (EAJ). Only standard degreasing and partial immersion in glycerol (under a cover slip) was undertaken during examination to minimize intervention. Drawing conventions are: solid line, distinct margin; dashed, indistinct or damaged; dashed-and-dotted, folded; dotted, extrapolated. The institutional abbreviations used are NIGP and NIGPAS, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences (CAS).

For morphology, we follow the terminology used by Jarzembowski & Wang (2016: see figs 1 and 2; for additional terminology, see Fig. 2). Also, in segmented

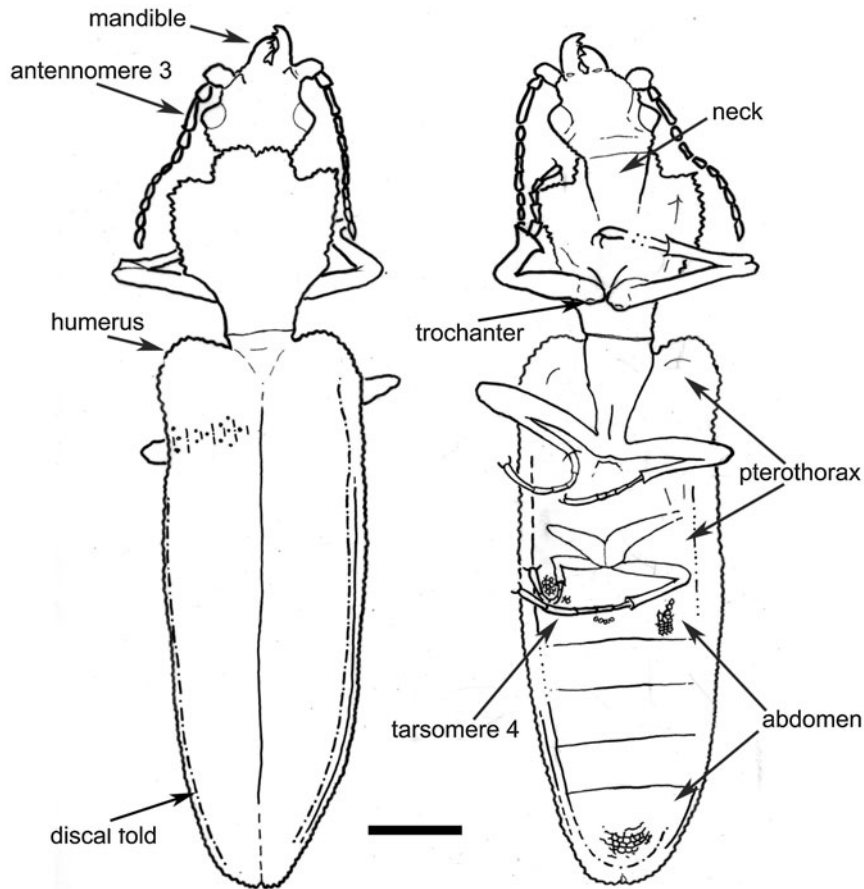


Fig. 2. *Clessidromma palmeri* gen. et sp. nov. Holotype, NIGP 166270. Drawings of dorsal (left) and ventral (right) views. Representative striae and window cells shown in oblique strip on left elytral disc; representative tuberculation on first and fifth ventrites. Irregular margins represent serration. Scale bar = 1 mm.

organs and appendages, pro- = fore, meso- = mid/middle, meta- = hind, -mere/s = segment/s; hind-body = pterothorax + abdomen.

Systematic palaeontology

Class INSECTA Linnaeus, 1758

Order COLEOPTERA Linnaeus, 1758

Suborder ARCHOSTEMATA Kolbe, 1908

Family CUPEDIDAE Laporte, 1836 s. l.

Subfamily OMMATINAE Sharp & Muir, 1912

Tribe CLESSIDROMMATINI trib. nov.

Taxonomic lsid. 695F8AC1-F274-4177-9298-5BE3C5DF2051

Diagnosis. Ommatine Archostemata with procoxae (foreleg bases) located on the prothorax; third antennomere (antennal segment) longer than fourth; depressed fronto-clypeal area on head; epipleural rim on elytron narrow without rows of cells; small window cells and intercalaries on elytral disc (upper side); and abdominal ventrites (exposed segments) flat (coplanar).

Discussion. Leg insertion on the prothorax (as opposed to its hind margin) is otherwise unknown in post-Palaeozoic archostematans (e.g., seen in basalmost Permian tshekardocoleids) and is interpreted as convergent

(cf. Lawrence 1999, Tan & Ren 2009) or ancestral (Kirejtshuk *et al.* 2016).

Moniliform/filiform antennae inserted on the side of the head and shorter than the length of the head and pronotum combined, adjacent procoxae, upright tridentate mandibles (jaws) and unbilobed fourth tarsomeres (tarsal segments) are also evident in the fossil below and are characteristic of ommatine (versus cupedine) cupedids (cf. Jarzembowski *et al.* 2017b, *in press b*).

The relatively weak development of elytral venation/window cells and unraised abdominal ventrites readily distinguish this tribe from notocupedins; the narrow, unpunctured epipleural rim from brochocoleins; the expanded pronotum from ommatins; and simple head form from tetraphalerins. The fronto-clypeal depression (above) may be taphonomically enhanced.

Clessidromma gen. nov. (type genus)

Taxonomic lsid. 78B35ECF-0A62-4745-8BA9-E092363855AC

Etymology. From the generic names *Clessidra* and *Omma*, the former referring to the curvaceous shape and the latter to the type ommatine; gender neuter.

Type species. *Clessidromma palmeri* gen. et sp. nov., by monotypy.

Diagnosis. Small ommatine with elongate body (including mandibles) but squat head, beady (slightly pointed) eyes, moderately short antennae, third antennomere as long as second and fourth combined, long mesoventrite and mesocoxae, short metaventrite, short metafemur (only reaching edge of abdomen), tuberculation well developed (passing into serration)—elytral striation less so, cells small (obscured).

Discussion. The long central mesothorax joins the posteriorly narrowed prothorax; the curvaceous pronotum and hindbody, coupled with narrow pro-/mesothoracic junction and slight pterothoracic constriction give the body an hourglass-like shape unique among known archostematan. The eye angulation may be taphonomically enhanced.

Clessidromma palmeri sp. nov. (Figs 1A–C, 2)

Etymology. After the late Phil Palmer, palaeontologist and photographer (also conchologist and stratigrapher).

Holotype. NIGP 166270; fossil beetle in polished amber cabochon from northern Myanmar.

Taxonomic lsid. 08B52A20-3134-487F-B486-4E524621F02C.

Publication lsid. 0B5F3442-9125-4F48-BA0A-379B20497BC5.

Type locality, stratigraphical unit and age. Burmese amber, Kabaw Formation, mid-Cretaceous (minimum age early Cenomanian); mine near Noiye Bum Village, Tanaing Township, Myitkyina District, Kachin State, 26°15'N, 96°33'E.

Diagnosis. Clessidrommatine beetle about a centimetre long, body 4.2 times as long as broad, antennae reaching mid-length of pronotum; pronotum with emarginate and serrated anterior margin, rounded and serrated anterior angles and nearly rectangular posterior angles; last visible ventrite (ventrite 5) 1.4 times as long as penultimate (fourth) one; meta- (hind) tarsi moderately long.

Distribution. Currently known only from the type locality.

Description. Small, black (carbonized) beetle, body flattened, very elongate, hirsute, covered with small setae (with a suggestion of scales) (Fig. 1A–C); cuticular serration and appendage spurs developed locally, cuticle generally heavily tuberculated. Head ovoid, short and broad; temples rounded, edge serrated in profile, narrower but slightly longer than eyes; eyes beady, slightly pointed; neck thick (Fig. 2). Occipital suture apparent. Mandibles arched forward, elongated. Antennae short, not reaching posterior end of prothorax, 11-segmented, fili-moniliform, inserted anterolaterally on head; third antennal segment tubular, last one (11th) spindle-shaped.

Prothorax longer than broad and wider than head but narrower than hindbody. Pronotum narrowed posteriorly to mesothorax, expanded anterolaterally and anteriorly towards head developing a serrated edge; anterior extension forming a collar-like, centrally notched neck shield; forward anterior angle acute, posterior one obtuse producing nearly straight sides neatly curving posteriorly to junction with mesothorax. Prosternum prominent (broad and rounded) anteriorly. Procoxae somewhat conical, inserted together three- to four-fifths of length of prothorax from anterior margin. Protrochanter small. Profemur thick, elbowed, extending well beyond edge of prothorax; protibia thinner and shorter, likewise protarsus; fifth (last) protarsomere elongated.

Pterothorax slightly contracted. Mesoventrite long and narrow like subadjacent mesocoxae (and propleuron in front). Mesofemur extending beyond hindbody, only slightly shorter than profemur. Mesotibia thinner and slightly shorter than mesofemur. Mesotarsus about same length and thinner than protarsus, 1st mesotarsomere elongate (slightly) like fifth. Metaventrite poorly discernible but evidently short and broad, metacoxa larger than anterior coxae and transverse, subtriangular. Metafemur shorter than mesofemur, only reaching edge of abdomen; metatibia about same length and metatarsus elongated, longer than mesotarsus. Elytra very elongate, overlapping abdomen, serrated especially anteriorly; humerus (shoulders) and apex rounded; disc flat, with about seven longitudinal rows of veins and intercalaries (coarse raised striae) and irregular small cells (obscured by coarse tubercles), outer edge shallowly stepped below discal fold (above laterotergites underneath); discal fold runs near to narrow epipleuron.

Abdomen elongate, flat and rounded apically, widest opposite first ventrite; first and fifth ventrites longer than others, fifth longer than fourth but shorter than first.

Measurements. Holotype. Body length (from anterior end of mandibles to posterior end of folded elytra) 9.3 mm; maximum width (across elytra) 2.0 mm.

Discussion. Invertebrate and vertebrate predators, including entomophagous geckos (Arnold & Poinar 2008) are diverse in Burmese amber and the specialized body form of *Clessidromma* gen. nov. may be an adaptation for an arboreal thanatosis lifestyle, which we intend to document elsewhere.

Like the first ommatine to be described from Myanmar (*Stegocoleus* Jarzembowski & Wang, 2016), *Clessidromma* gen. nov. has several features not represented in crown group/extant ommatines. The notable tshekardocoleid-like forelegs could be an atavistic trait (see above) unlike the cupedine-like forelegs of *Stegocoleus*, which hint at transition. Kirejtshuk *et al.* (2016) recently proposed the relationship tshekardocoleids + (schizophorids + (cupedines + (ommatines + other archostematan))) for archaic beetles, which would

support atavism (reversal vs unparsimonious novelty), while implying cupedids in the broad sense are paraphyletic, and the extinct schizophorid beetles are still known only from adpressions. Hopefully, more amber inclusions showing additional morphological detail (including terminalia) will be found in response to the current level of interest in Burmese amber. In the mean time, the new find shows that the mid-Cretaceous fauna was enriched by stem- and crown group archaic beetles with unusual features (Jarzembowski *et al.* 2017a).

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Disclosure statement

No potential conflict of interest was reported by the authors.

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