ISSN 0031-0301, Paleontological Journal, 2013, Vol. 47, No. 1, pp. 89–93. © Pleiades Publishing, Ltd., 2013.
Original Russian Text © A.A. Prokin, A.G. Ponomarenko, 2013, published in Paleontologicheskii Zhurnal, 2013, No. 1, pp. 68–71.

The First Record of Crawling Water Beetles (Coleoptera, Haliplidae) in the Lower Cretaceous of Mongolia

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Received February 20, 2012

Abstract—A new species of crawling water beetles (Coleoptera, Haliplidae), *Haliplus* (subgenus unclear) *cretaceus* sp. nov., is described from the Lower Cretaceous of Mongolia, Bon-Tsagan (Böönтsagaan) locality.

Keywords: Coleoptera, Haliplidae, new taxon, Cretaceous, Mongolia

DOI: 10.1134/S0031030113010115

INTRODUCTION

The family Haliplidae Aubé, 1836 (crawling water beetles) is represented in the recent fauna by 206 species (Vondel, 2007), belonging to five genera: *Haliplus* Latreille, 1802, *Brychius* C.G. Thomson, 1859, *Peltodytes* Régimbart, 1879, *Algophilus* Zimmerman, 1924, *Apteraliplus* Chandler, 1943 (Vondel, 2005a). The largest of these by number of species is *Haliplus*, which has a worldwide distribution, with the exception of Antarctica and New Zealand.

Larvae and adults live in continental water bodies of different types; most species prefer stagnant and slowly flowing ones, sometimes brackish; members of the genus *Brychius* are confined to watercourses with high levels of dissolved oxygen. The larvae feed on algae, preferring filamentous Chlorophyta and Charophyta; adults are typically characterized by mixed feeding, in some species mostly phytophagous, in others zoophagous and necrophagous (Vondel, 2005b).

Findings of fossil haliplids are extremely rare and fragmentary. The genus *Haliplus* was for the first time recorded from fossils in the Miocene of Germany (Eningen) (Schöberlin, 1888). An isolated haliplid elytron was recently described from the Paleocene of Moravia as close to *Peltodytes* (Prokop et al., 2004). In the Mesozoic, isolated elytra were recorded twice: one similar to *Peltodytes* from the Lower Cretaceous (Upper Albian–Cenomanian) of Labrador (Canada) (Ponomarenko, 1969) and another from China, Hebei Province (Ren, Yin, and Huang, 1999). In addition, two species, *Cretihaliplus chifengensis* Ren, Zhu et Lu, 1995 and *C. sidaojingensis* Ren, Zhu et Lu, 1995, were described from the Lower Cretaceous of China (Inner Mongolia, Chifeng) (Ren, Zhu, and Lu, 1995). However, these two species almost certainly do not belong to Haliplidae, because the former has metacoxal plates covering only the second ventrite and elongate elytra with deep grooves, and the latter displays no characters of the family at all.

Having studied the base of abdomen, the venation, and the wing-folding of Haliplidae, Ponomarenko (2002) put forward the hypothesis that this family was the most primitive among the recent Adephaga (Ponomarenko, 2002) and comprised together with the Triassic Triaplidae Ponomarenko, 1977 a separate superfamily Haliploidea; therefore, findings of Haliplidae in the Mesozoic were to be expected. The results of cladistic analysis performed by Beutel (1997) also placed this family among the most primitive aquatic Adephaga.

As a result of the study of the collection stored in the Arthropoda Laboratory, Borissiak Paleontological Institute, Russian Academy of Sciences, Moscow (PIN), a new member of the family Haliplidae was found among fossil beetles from the locality of Bon-Tsagan (Böönтsagaan; Mongolia, Bayankhongor Province, foothills of Mount Dund-Ula, south of Lake Böönтsagaan Nuur; Lower Cretaceous, ?Aptian, Bon-Tsagan Group, Khurilt Sequence; Sinitza, 1993). This specimens is described here in the genus *Haliplus* as a new species of unclear subgenus, because the preservation quality of the specimen is insufficient for comparison with members of the known subgenera of this genus.

The following combination of characters points to the placement of the new species in the family Haliplidae:

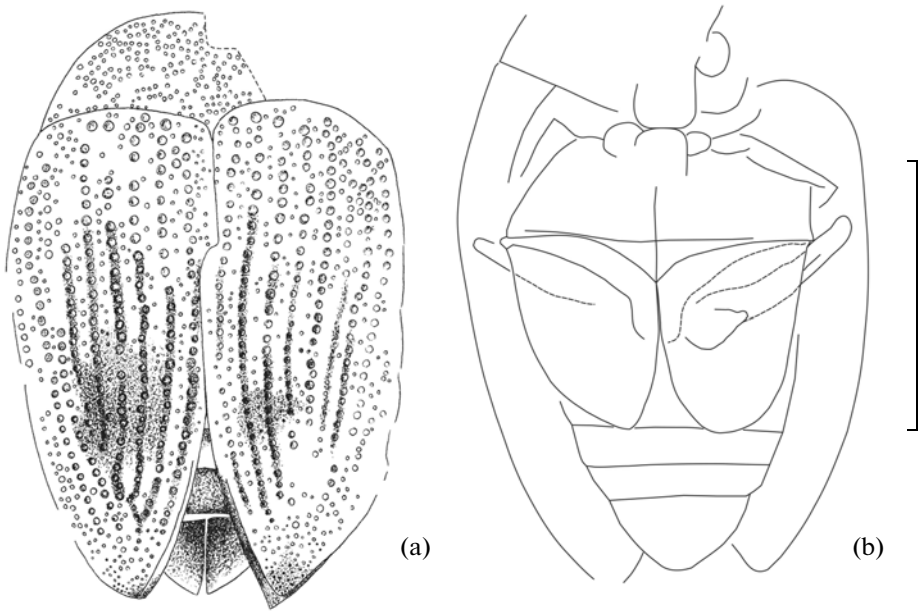


Fig. 1. *Haliplus cretaceus* sp. nov., holotype PIN, no. 3559/6371: (a) in dorsal view; (b) in ventral view. Scale bar, 1 mm.

—metacoxae dilated into large femora-covering plates, covering metafemora and basal abdominal ventrites (the function of these plates, under which air is delivered from the subelytral cavity, in addition to increasing buoyancy, is probably in decreasing the resistance to the movement of hindlegs in the plane of the beetle's body);

—metaventral suture present;

—mesocoxae and procoxae set apart, with prosternal process and metaventral process between two coxae of each pair, straightened apices of these processes touching each other at level of anterior margin of mesocoxae;

—elytra with longitudinal rows of large punctures and rows of smaller punctures between them;

—scutellum covered by protrusion of pronotum.

The placement of the new species in the genus *Haliplus* is suggested by the following characters:

—metacoxal plates without denticle on posterior margin (difference from the genus *Peltodytes*);

—sublateral plicae on pronotum absent (difference from the genera *Peltodytes*, *Brychius, Apteraliplus*, and some species of *Haliplus*);

—pronotum and elytra with one common outline (difference from the genera *Brychius, Apteraliplus*, and *Algophilus*);

—distance between primary rows of punctures greater than puncture diameter (difference from *Peltodytes*);

—darkened, non-parallel primary rows of punctures 2–4 (difference from *Apteraliplus*);

—not tangled, regular rows of punctures (difference from *Algophilus*).

The absence of the head, most of the legs, and genitalia, and the poor preservation quality of characters of the underside and some other morphological details do not allow unambiguously comparing the new species with different subgenera of the genus *Haliplus*; therefore, it is described as a species of unclear placement within this genus.

A Tescan Vega XMU scanning electron microscope and a Leica M165c stereomicroscope with a Leica DFC420 digital camera were used in this study.

SYSTEMATIC PALEONTOLOGY

Family Haliplidae Aubé, 1836

Genus *Haliplus* Latreille, 1802

***Haliplus cretaceus* Prokin et Ponomarenko, sp. nov.**

Plate 12, fig. 1

Etymology. From the Cretaceous period.

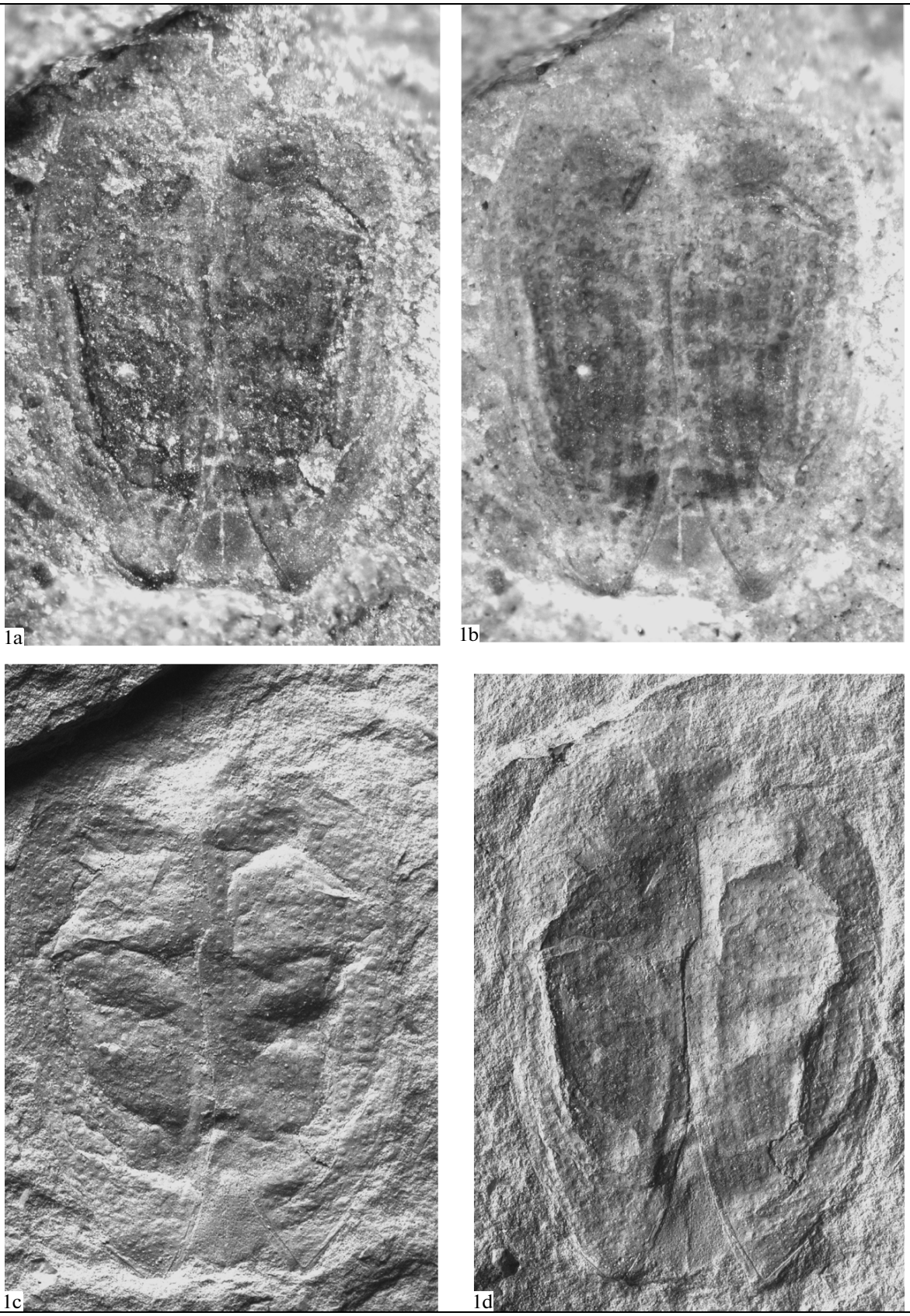
Holotype. PIN, no. 3559/6371, positive impression of beetle without head and tarsi; locality Bon-Tsagan, outcrop 87/8; Lower Cretaceous, Barremian–Aptian, Bon-Tsagan Group, Khurilt Sequence.

Description (Fig. 1). Rather small, oval beetle. The lateral outline of the body forms a single

Explanation of Plate 12

Fig. 1. *Haliplus cretaceus* sp. nov., holotype PIN, no. 3559/6371, ×42: (a) dry specimen; (b) specimen immersed in ethanol; (c, d) electron microscope image at two different positions of the detector.

Plate 12



smooth line, without a constriction between the pronotum and elytra. The pronotum is transverse, almost semicircular, evenly punctate, with the distance between the punctures somewhat greater than their diameter, without impressed sublateral plicae. Elytron with nine visible primary puncture rows, the distance between which is two diameters of the punctures; the first punctures at the base of the elytron are somewhat larger; the diameter of the punctures decreases towards the elytral apex. Rows 1–5 run parallel to the suture (which is provided with a sutural groove in the apical portion); rows 2–4 join row 6 in the apical third of the elytron; rows 6–9 run parallel to the external margin of the elytron; rows 1–6 are darkened. The sutural interval and the intervals between the primary puncture rows contain secondary rows of small punctures, the diameter of which is two to three times as small as that of the punctures in the primary rows and more or less comparable to the diameter of the punctures on the pronotum.

The prosternal process is wide; the part of this process behind the procoxae is approximately square, contiguous with the elevated platform of the metaventrite. The procoxae and mesocoxae are rather small, rounded. The mesoventrite is transverse, three times as wide as long, narrowing and rounding anteriad, and with the posterior margin angulate and protruding posteriad. The mesepisternum is somewhat dilated anteriad, reaching a level far behind the mesocoxa. The femora-covering plate of the metacoxa is three times as wide as long, narrowing posteriad, without a denticle on the posterior margin. Three apical abdominal ventrites are visible.

Measurements, mm. Length of fossil, 2.26; body length of beetle, about 2.5; body width without elytra, 1.16; elytral length, 1.86, elytral width, 0.73.

Material. Holotype.

DISCUSSION

Although the impression is preserved poorly, insufficiently for unambiguous comparison with the recent subgenera of the genus *Haliplus*, the absence of sublateral pronotal plicae clearly distinguishes it from most members of the subgenus *Haliplus* Latreille, 1802 and from all known members of the subgenera *Neohaliplus* Netolitzky, 1911 and *Haliplidius* Guignot, 1928, and suggests its relatedness to the subgenera *Paraliaphlus* Guignot, 1930, from which it differs in the single outline of the pronotum and elytra, and *Liaphlus* Guignot, 1928, from which, in turn, it differs in the absence of larger punctures at the base of the pronotum. The new species differs from members of the subgenus *Phalilus* Guignot, 1935 in the absence of posterior angles of the pronotum protruding beyond the margins of the elytra.

It has to be noted that all previously known members of the aquatic superfamilies Haliploidea and Dytiscoidea of the suborder Adephaga were represented exclusively by fossil taxa of family rank (Colymbothetidae Ponomarenko, 1993, Triaplidae Ponomarenko, 1977, Parahygrobiidae Ponomarenko, 1977, Coptoclavidae Ponomarenko, 1961, and Liadytidae Ponomarenko, 1977) or subfamily rank (Liadytiscinae Prokin et Ren, 2010); only for whirligigs (Gyrinoidea: Gyrinidae) no Mesozoic taxa of suprageneric rank have been described, but all known Mesozoic whirligigs have been placed in extinct genera (Ponomarenko and Kirejtshuk, 2012). The finding in the Lower Cretaceous of a member of the family Haliplidae belonging to an extant genus supports the considerable age of this family.

The feeding of larvae on algae is also a good indirect evidence of the relatively old age of the family, which probably emerged even earlier than angiosperms appeared and colonized the aquatic environment. It is known that members of the subgenus *Liaphlus*, to which the species described here is especially close, prefer feeding on Charophyta (Nilsson, 1996). Judging by the frequent presence of gyrogonites in Mesozoic deposits, including those of the Bon-Tsagan locality (Sinitza, 1993), Charophyta were a very common component of early lake ecosystems, suggesting that *Haliplus cretaceus* could develop feeding on Charophyta. However, it is also quite probable that it fed on algal accretions on floating aggregates, since the fossil was found in deposits of deep-water parts of the lake, remote from its shoreline.

ACKNOWLEDGMENTS

The authors are grateful to R.A. Rakitov (PIN) for performing the electron microscopy part of this study.

This study was supported by the program "Origin of the Biosphere and Evolution of Geo-Biological Systems" of the Presidium, Russian Academy of Sciences, and by the Russian Foundation for Basic Research, project no. 11-04-01712.

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