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Paracupes svitkoi (Coleoptera: Cupedidae), a new species from the Cretaceous of New Jersey

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Abstract. *Paracupes svitkoi* is a new species based on a single specimen from the Raritan Formation of the Cretaceous of New Jersey. The fossil, a well-preserved, charcoalified head, is the first fossil member of the genus *Paracupes* KOLBE, 1898. It is very similar to the modern species in the genus.

Key words: Late Cretaceous, Turonian, Archostemata, Cupedidae, *Paracupes*, new species, New Jersey, Raritan Formation, fossil beetle.

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I. INTRODUCTION

The Old Crossman's clay pits of Sayreville, Middlesex County, New Jersey, one of the more prolific sites for New Jersey amber (GRIMALDI 2000), is also the source of an unusual flora of fusainized (charcoalified) plants and insects. This outcrop of the Raritan Formation of New Jersey contains more than 100 taxa of fossil flowers, fruits, seeds, cones and wood (GANDOLFO et al. 1998) including the first fossil evidence of many angiosperm groups such as Hamamelidaceae (ZHOU et al. 2001), Capparales (GANDOLFO et al. 1998) and the earliest known monocot flower (Tiuridaceae) (GANDOLFO et al. 1997). The insect remains include elytra, legs, mandibles and other parts mainly of Coleoptera, and Neuroptera. This is the first description of a fossil insect from the site and this is the first fossil *Paracupes*, a genus that until now was known only from two extant South American species.

A c k n o w l e d g m e n t s. The fossil was obtained by W. L. CREPET and K. C. NIXON using funds from NSF Grant # DEV-0108369. Processing and imaging of the specimen was done by J. L. SVITKO, Bailey Hortorium, Cornell University. I would also like to thank D. A. GRIMALDI for bringing the fossil to my attention.

II. GEOLOGY

The Raritan Formation of the Atlantic Coastal Plain is a series of interbedded gravels, sands and silty clays deposited in fluvial channels and as overbank flood deposits (JENGO et al. 1995). The

South Amboy Fire Clay is the uppermost of the five members of the Raritan Formation, and is conformably overlain by the Old Bridge Sand member of the Magothy Formation. It is a fine-grained, light gray sandy silty clay with mica, lignite, marcasite and traces of white feldspar (JENGO et al. 1995). At its base, the South Amboy Fire Clay is interbedded with the Sayreville Sand member of the Raritan Formation (JENGO 1995). The specimen described here was collected from an exposure of the Amboy Fire Clay at Old Crossman's Clay Pit near Sayreville, New Jersey.

Based on pollen analysis (GROOT et al. 1961), the age of the South Amboy Fire Clay is proposed to be Turonian. Fossil flowers collected from the Old Crossman's Clay pits suggest a tropical or subtropical climate (GANDOLFO et al. 2001) based on comparison of these fossil flowers to modern tropical angiosperms.

III. MATERIALS AND METHODS

The fossil is a single, three-dimensional fusainized (charcoalified) head of a beetle. Although, the cause of the fusainization is unknown, FRIIS et al. (1988) proposes that the charcoalification may be due to rapid heating during forest fires. New Jersey amber sometimes contains bits of fire-damaged wood and heat-produced bubbles, which may be evidence of forest fire (GRIMALDI 2000). In addition, GRIMALDI (2000) suggests the amber could be the result of fire-induced sap flow. While only the heavily sclerotized parts of the insects remain: legs, elytra, mandibles, and some heads, the fusainization allows minute details such as eye facets, scales, and setae to be preserved. Although many of the fragments cannot be easily identified, this specimen was readily recognized as a cupedid.

The specimen was found in sample collected from the Old Crossman's Clay Pit in Sayreville, New Jersey. The unconsolidated sediments were first dissolved in warm water and sieved through a series of progressively finer screens. The remaining material was washed with a strong detergent in order to remove any excess clay. The material was swirled in water to suspend the fossils and the suspended organic material was decanted to remove any sand. Other minerals were removed by treating with hydrofluoric acid (HF 49%) followed by several rinses in distilled water. Fossils were air dried and then sorted under a Zeiss SV-8 stereomicroscope.

The specimen was mounted on an aluminum stub and sputter coated with gold palladium. The micrographs were produced using the Hitachi 4500 scanning electron microscope at Cornell's Integrated Microscopy Center.

IV. SYSTEMATIC PALEONTOLOGY

Order: **Coleoptera** LINNAEUS, 1758

Suborder: **Archostemat**a KOLBE, 1908

Family: **Cupedidae** LACORDAIRE, 1857

Tribe: **Cupedini** CROWSON, 1962

Genus: ***Paracupes*** KOLBE, 1898

Paracupes svitkoi LUBKIN, sp. nov.

Figs 1, 2

D i f f e r e n t i a l d i a g n o s i s. The specimen belongs in *Paracupes* and is diagnosable from all other genera of Cupedidae by the lack of posterior tubercles (KOLBE 1908). Species of *Paracupes* have only a single pair of conical tubercles that is located at the base of antennae.

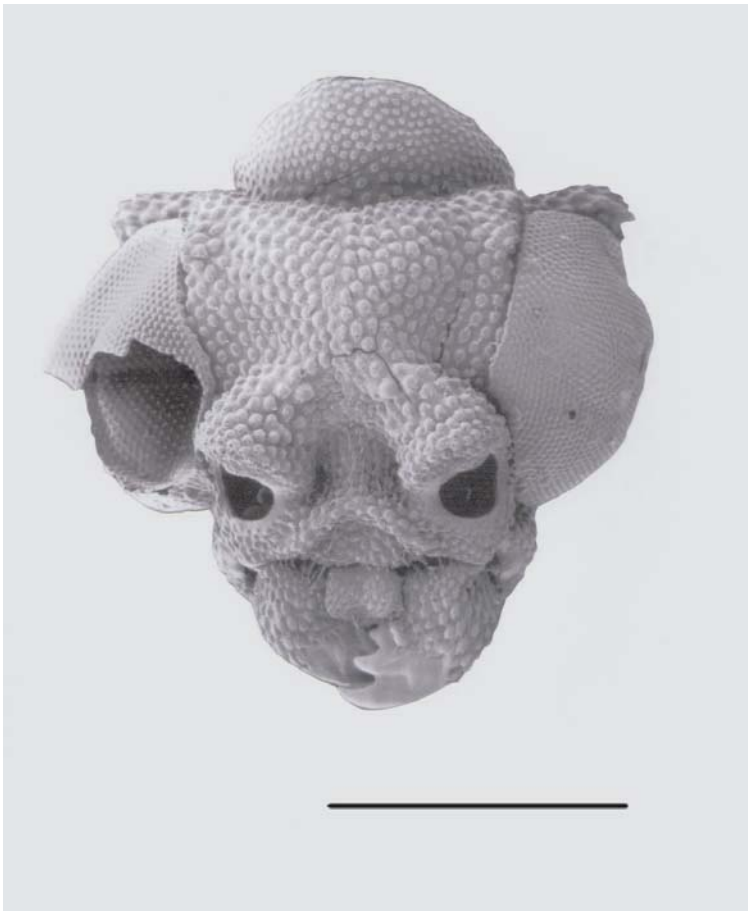


Fig. 1. Scanning electron micrograph – dorsal view of *Paracupes svitkoi.* Scale bar = 500 μm.

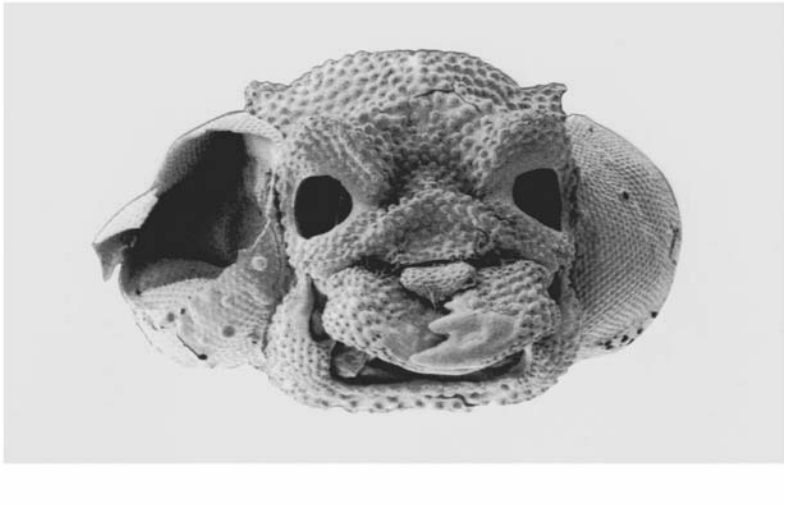
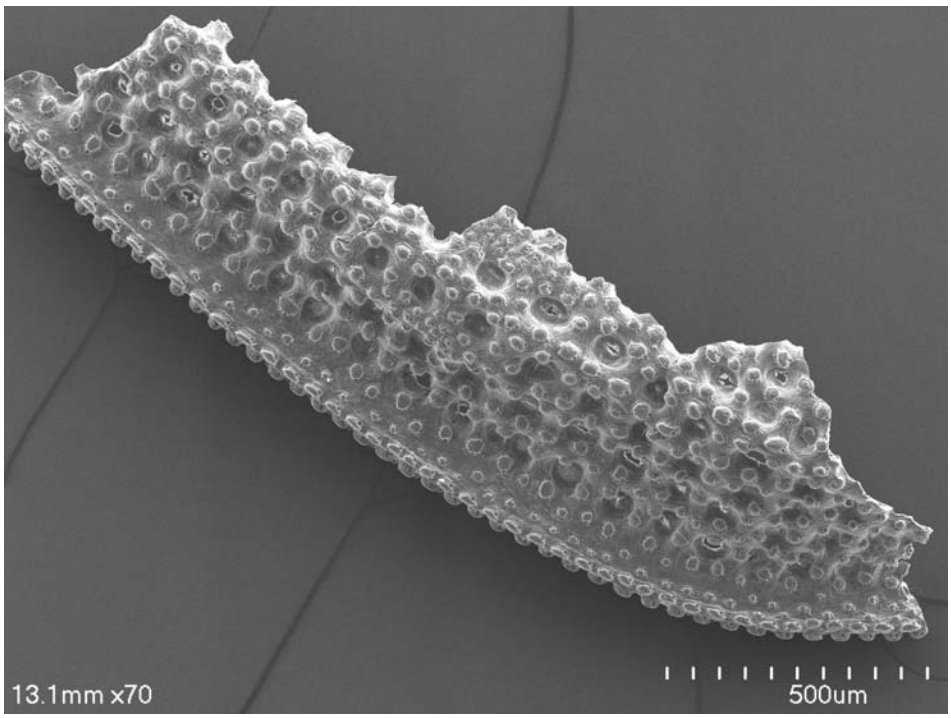
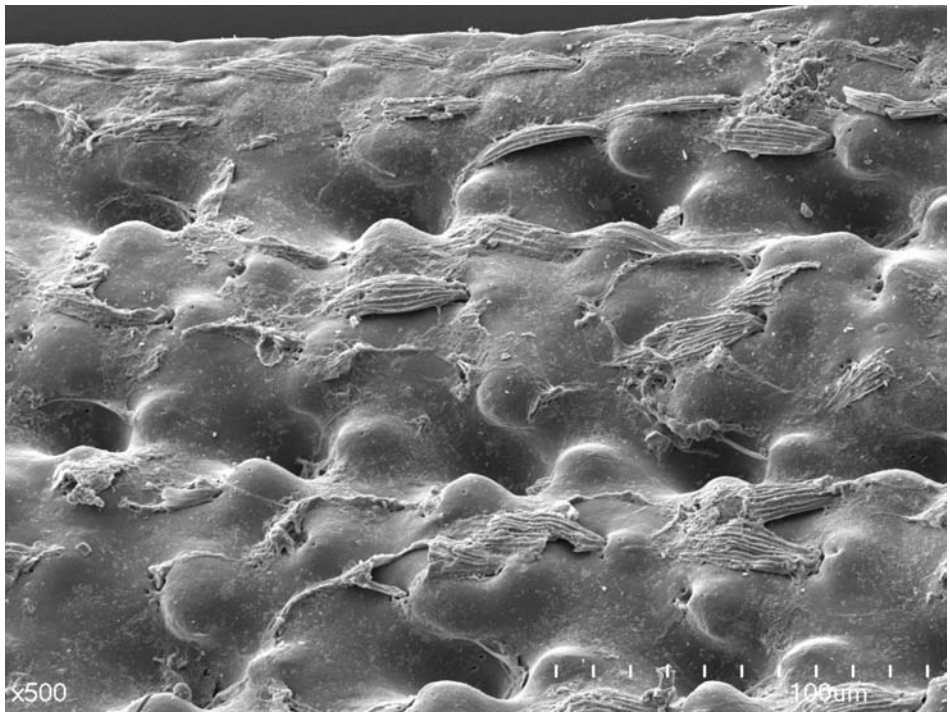


Fig. 2. Scanning electron micrograph – anterior view of *Paracupes svitkoi*.



a



b

Fig. 3. a – Scanning electron micrograph showing a fragment of a fusainized elytron from the Turonian of New Jersey; b – Detail of another charcoalified elytron showing the scales and punctures that are characteristic of Cupedoid elytra.

It was compared with a specimen of *P. brasiliensis* from the Canadian National Insect Collection and with the original description of *P. asicus* (NEBOISS 1989). It is similar to the extant *Paracupes* species, *P. brasiliensis* KOLBE 1898 and *P. asicus* NEBOISS 1989, but can be distinguished from those species by the shape of the head and by the strongly serrated mandibular teeth. The head is somewhat similar to that of *P. asicus* in that the head is abruptly marginate behind the eyes with a ridge that extends posteriorly; however, in *P. svitkoi* the posterio-lateral angles of the head are flattened and project slightly beyond the eye. In *P. brasiliensis* the head rises gradually above the eyes, and the posterio-lateral angles are rounded. However, the scales on the dorsal surface of the head are slender and tapering like those on *P. brasiliensis*. On *P. ascius*, the scales are stout and widen distally.

E t y m o l o g y. Named for Jennifer SVITKO, of the Bailey Hortorium, who prepared and photographed the specimen.

T y p e m a t e r i a l. Holotype, a fossil head, CUPC#1339. Type locality: Old Crossman's Clay Pit, Middlesex County, New Jersey. Age and stratigraphy: Turonian, Late Cretaceous; South Amboy Fire Clay, Raritan Formation. Deposited in the Cornell University Paleobotanical Collection at Bailey Hortorium, Cornell University.

O t h e r m a t e r i a l. Isolated Cupedoid elytra are also present in the New Jersey sediments (Fig. 3); however, it is not possible to determine if they belong to the same species.

D e s c r i p t i o n. Length of head is c. 1.15 mm. Greatest width c. 1.35 mm. Neck-like constriction behind eyes wider than long, about half width of head (500 μm). Eyes large, diameter 1/3 width of head (c. 0.38 mm). Entire surface of head covered with small tubercles and remains of scales.

Antennal insertions located dorsally, separated by much less than diameter of eyes. Antennae missing. Single pair of conical tubercles located behind antennal insertions.

Mandibles large (~20% total length of head), three distinct mandibular teeth. Mandibles covered with tubercles except near teeth. Labrum easily visible, appears semi-rectangular from above, but triangular at tip. Gula short, almost as wide as long.

D i s c u s s i o n. The family Cupedidae includes some of the earliest known fossil beetles (Permian, LABANDEIRA 1994) and some of the most primitive living beetles (LAWRENCE 1999). Although the group was quite diverse in the Permian and early Mesozoic (PONOMARENKO 1995), there are only about 25 extant species and nine extant genera.

Four of the nine genera have a fossil record. *Cupes* is known from Eocene aged Baltic amber (IABLOKOFF-KHNZORIAN 1960), and from the Pliocene of northern Germany (GERSDORF 1976). *Tenomerga* (NEBOISS 1984) is described from German sediments of Eocene age (TRÖSTER 1993), and *Priacma* is known both from Baltic amber (MOTSCHOULSKY 1856) and from the Cretaceous of Mongolia (PONOMARENKO 1986, 1997). With the specimen described here, *Paracupes* makes the fourth.

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