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A Miocene fossil of long-armed scarabaeid beetle from Tottori, Japan

Kyoichiro UEDA

Kitakyushu Museum of Natural History, Nishihonmachi 3,
Yahatahigashiku, Kitakyushu 805, Japan
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Abstract A new fossil species of long-armed scarabaeid beetle is described from Tottori, San-in district, Japan, the Middle Miocene. It is tentatively assigned to the genus *Cheirotonus* HOPE.

Introduction

On the 31th of July 1980 Dr. M. OTA and Mr. Y. OKAZAKI, Kitakyushu Museum of Natural History and Dr. Y. Hôjô, Nakama High School, Nakama City, surveyed the Okamasu area near Tottori City, Honshu, Japan to collect the fossil plants and fishes for the Kitakyushu Museum of Natural History. In this survey Dr. OTA found a fossil of large scarabaeid beetle. The fossil was unfortunately broken into some parts. The head and pronotum with fore legs are remained only their moulds, and the moulds of the abdomen with elytra are missing. Moreover the abdomen itself was broken into two along the median line. Mr. OKAZAKI consolidated them with polymethyl-methacrylate solution correctly.

Recently I examined this fossil in detail and found that it belongs to the long-armed scarabaeid beetles, of which any fossil has not been found from Japan.

Eleven species have been recognized in the living long-armed scarabaeid beetles. They compose the subfamily Euchirinae, and have been classified into three genera, *Propomacrus* NEWMAN (2 species), *Cheirotonus* HOPE (7 species) and *Euchirus* BURMEISTER (2 species). The genera *Propomacrus* and *Cheirotonus* are characterized by the presence of terminal and second process on the male fore tibia. The second process of male fore tibia is absent in the genus *Euchirus* and the fore tibia is exceedingly long. The genus *Propomacrus* is characterized by a dense fringe of golden hairs on the inner edge of the male fore tibia but this fringe is absent in the genus *Cheirotonus*. Most species of Euchirinae are distributed in tropic or subtropic oriental region and only *Propomacrus bimucronatus* (PALLAS) is found in temperate region of Asia Minor isolated from other species (MIZUNUMA, 1984). Only the known Japanese species of this subfamily is *Cheirotonus jambar*, which was recently described by KUROSAWA (1984) from the northern part of Okinawa Is. located in southernmost area of Japan.

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Geology and Fossil Flora

The stratigraphy and geological structures of the San-in district have been

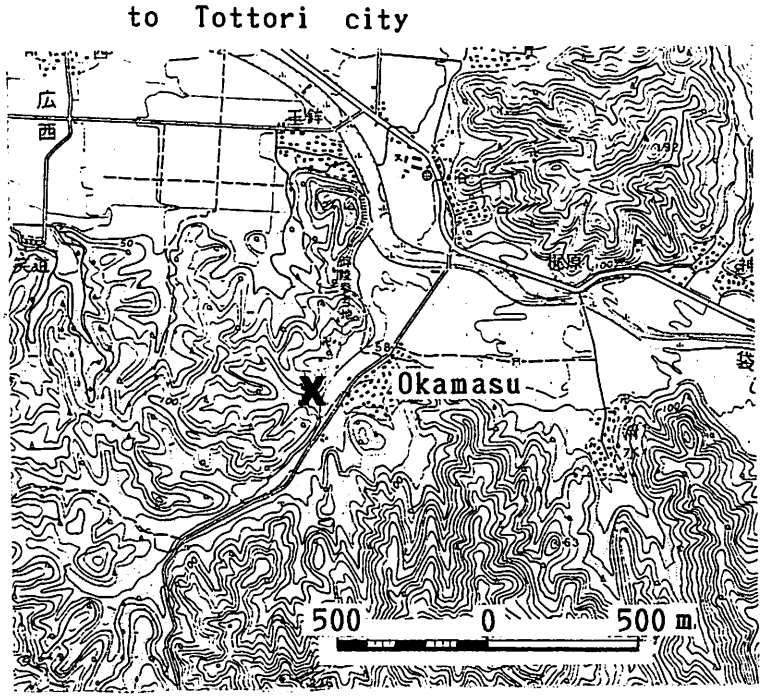

Fig. 1. A map showing the locality (×) for the fossil insect from the Fuganji Mudstone Formation at Okamasu, Kokufu Town in Tottori Prefecture.

studied by many geologists (MURAYAMA *et al.*, 1963; NISHIYAMA and MIURA, 1963; Tottori Prefecture, 1966). The locality of this fossil insect at Okamasu is in Kokufu Town (Fig. 1). It belongs to the Fuganji Mudstone Formation which is the middle unit in the Tottori Group, Middle Miocene (Hôjô, 1968, 1973 and 1978). At Okamasu, the Fuganji Mudstone Formation consists of grayish brown or pale brown shale bearing a large number of fossil plants, among which the fossil insect in question was found. This shale is intercalated with fine sandstone and white fine tuff, then stratification is well developed.

Hôjô (1973) listed and described 17 species of fossil plants from the Fuganji Mudstone Formation. In the Fuganji flora, the following species are characteristic: *Carya* sp., *Liquidamber miocenica*, *Entada* cf. *mioformosana* and *Wistaria* sp. According to Hôjô (l. c.), the living equivalents of these fossil species are now limited in growth only in Taiwan and South China. However, most of them are deciduous trees, being found today in mountainous high-land of warm region in Asia, and as a whole, the Fuganji flora corresponds to that of Mitoku-type (TANAI, 1961; Hôjô, 1980a, b).

Description

Family Scarabaeidae
Subfamily Euchirinae
***Cheirotonus otai* sp. nov.**
(Plate 1, Fig. 2)

Japanese name: Inaba-tenaga-kogane

Material. A male specimen fairly depressed. Moulds of head, pronotum, scutellum and anterior portions of elytra. Fore leg; distal part of left femur, incomplete left tibia; almost complete right femur and tibia. Hind leg; left femur and incomplete left tibia. Most part of elytra missing; apical half of right hind wing missing. Right distal portion of abdomen missing. Body length; 45 mm.

Head; Small; anterior margin of clypeus straight; right distal corner of clypeus missing; a part of maxillary palpus present on the left distal corner of clypeus; eyes traceable; flagellar segments of both antennae remained close to outer margins of both eyes; punctures untraceable on cranium.

Pronotum; about 1.7×as broad as long; lateral margin evenly curved from posterior angle, slightly expanded at the middle, then strongly curved to anterior angle; anterior margin incompletely retaining; posterior margin almost straight; lateral margin irregularly denticulate; disc broadly convex, with a deep and semi-circular depression along lateral and anterior margins of anterior 2/3 of pronotum; the convexity being bipartite by the median longitudinal groove, which is deeper posteriorly and reaches posterior margin, but disappears on anterior half of pronotum; surface scattered with round punctures; the punctures large on the convexities

Fig. 2. *Cheirotonus otai* UEDA, sp. nov. Holotype, KMNH IP 000, 001. Scale 10 mm.

on each side of the median groove. Scutellum seemingly lingulate, scattered with a few punctures, with median line untraceable.

Elytra almost missing except the moulds of each anterior portion.

Hind wing: Left hind wing; C, R, M and Cu traceable; a part of M abruptly

curved anteriorly just before its confluent portion with the main M vein.

Abdomen with distal segment incomplete, but short and rounded posteriorly.

Fore leg moderately long; femur stout and the interior dentation untraceable; tibia longer than femur and curved inwardly; denticulations of inner margin untraceable and those of outer margin obsolete; the terminal process short and acute apically; second process untraceable; a fringe of hairs on the inner edge of tibia untraceable. Posterior tibia with two distinct fine denticulations of the outer margin; terminal processes short and acute.

Holotype: ♂ (KMNH IP 000, 001).
Locality: Okamasu, Kokufu Town, Tottori Pref., Honshu, Japan.
Fuganji Mudstone Formation. Middle Miocene.
M. OTA coll.

Remarks. This fossil species has the same characteristic, the elongation of fore-legs in male, that all the living species of Euchirinae have. The structure of its pronotum well corresponds to the generic characters of *Cheirotonus*. Although the second process of fore tibia could not be found from the fossil specimen, short fore tibia, the moderately long and acute terminal process of the tibia and the punctures of pronotum suggest that this specimen is not related to the genus *Euchirus*. A dense fringe of golden hairs on the inner edge of fore tibia is the only one character that separates the genus *Propomacrus* from the genus *Cheirotonus*, and there is no trace of such hairs in this fossil specimen. Therefore, this fossil is tentatively classified into the genus *Cheirotonus* in this paper. Judging from the shape of its terminal process of the fore tibia, *C. otai* may belong to the *macleayi* group, which has no small hook at the apex of the terminal process. However, *otai* is easily distinguished from other species of the group by its larger punctures on the pronotum and scutellum, and probably by the lack of second process of fore tibia.

The specific name of the new species is dedicated to Dr. Masamichi OTA, Director of Kitakyushu Museum of Natural History, who found this important fossil insect and encouraged me during this study.

The fossil records from marine animals suggest that the plaeoclimate of this district was subtropical or tropical in the Middle Miocene (CHIJI *et al.*, 1989). As already mentioned, HÔJÔ inferred the warm temperate climate as the palaeoclimate of this district from the Fuganji flora. Generally we tend to consider the *Cheirotonus* species as tropical or subtropical inhabitants. However, the living *Cheirotonus macleayi* mainly inhabits in high mountainous region higher than 1,000 m alt. in Taiwan. In Thailand, *Cheirotonus* species are also inhabitants of mountainous region above 700 m alt. (T. MIZUNUMA and H. MATSUKA, pers. comm.). So the fossil *C. otai* might also suggest that the palaeoclimate of this district was warm temperate. The inconsistency arises between the palaeoclimates inferred from the fossil records of marine animals and from those of plants and the insect. If we assume that the

Okamasu area was such high mountainous region in the Middle Miocene like that of recent Taiwan or Thailand, the palaeoclimate from plant fossils and the insect is not necessary inconsistent with that from marine animals.

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Plate 1

Explanation of Plate 1

Fig. 1. *Cheirotonus otai* UEDA, sp. nov. Holotype, KMNH IP 000, 001.