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SPIROBOLOID MILLIPEDS FROM THE LATE CRETACEOUS OF THE GOBI DESERT, MONGOLIA

(Plate VII)

Abstract. — From the Barun Goyot Formation (? Middle Campanian) of the Gobi Desert a new milliped genus *Gobiulus* gen. n. with two species, *Gobiulus sabulosus* sp. n. and *Gobiulus* sp., is described. It differs from the remaining milliped genera in extraordinarily developed collar sternite. On the basis of the structure of gnathochilarium, shape of collum, and sculpture of thoracal tergites the genus is assigned to the order Spirobolida and tentatively to the family Atopetholidae.

INTRODUCTION

In the course of the Polish-Mongolian Palaeontological Expeditions to the Gobi Desert in 1970-1971, numerous well preserved fossil millipeds (Diplopoda) were found in sandstones of the Barun Goyot Formation. The formation, previously known as Lower Nemegt Beds, is assigned to the Late Cretaceous, and, on the basis of the multituberculate fauna, to the ? Middle Campanian (KIELAN-JAWOROWSKA, 1974). The milliped assemblage was made available to the present author through the courtesy of Professor Z. KIELAN-JAWOROWSKA. The manuscript was kindly revised by Professor A. URBANEK.

The material is housed in the Palaeozoological Institute of the Polish Academy of Sciences in Warsaw (abbreviated as ZPAL).

DESCRIPTIONS

Class MYRIAPODA LEACH, 1814
Subclass DIPLOPODA POCK, 1893
Superorder HELMINTHOMORPHA POCK, 1887
Order SPIROBOLIDA ATTEMS, 1926
? Family ATOPETHOLIDAE CHAMBERLIN, 1918
Genus **Gobiulus** gen. n.

Type species: *Gobiulus sabulosus* sp. n.

Derivation of the name: From the Gobi Desert and (Lat.) *iulus* — millipede.

Diagnosis. — Collar sternite (hypostome, gula) giant, covering large part of mentum. Striae limited to lower parts of tergites.

Stratigraphical and geographical range. — Late Cretaceous, ? Middle Campanian, Barun Goyot Formation, Gobi Desert.

Gobiulus sabulosus sp. n.

(Pl. VII; Text-figs. 1-5)

Holotype: ZPAL Mg Myr/6.*Type horizon and locality*: Late Cretaceous, ? Middle Campanian, Barun Goyot Formation, Gobi Desert, Mongolia.*Derivation of the name*: Lat. *sabulosus* — sandy.

Diagnosis. — Collar tergite sharpened downwards, with short furrow in the mid-height, close to anterior margin. Mandibular stipes triangular; scala analis uniformly rounded.

Material. — Thirteen specimens, all housed in ZPAL collection. From Khulsan (Barun Goyot Formation): the holotype, MgMyr/6, head with over a dozen segments, two fragments of thorax, and poorly preserved telson with a few segments, ? ♀; and specimen MgMyr/7 — poorly preserved, deformed. From Khermeen Tsav (Khermeen Tsav formation, informally designated by KIELAN-JAWOROWSKA, 1975, as a stratigraphic equivalent of the Barun Goyot Formation): specimens: MgMyr/1 — almost complete, MgMyr/2 — head with a few segments and telson with some segments, presumably belonging to the same juvenile individual, Mg Myr/5 — coiled incomplete thorax.

The calcareous body covers were found in red, coarse-grained sandstones (GRADZIŃSKI, 1972) which are highly calcareous, especially in the fossiliferous locality. No traces of organic matter. The calcareous fossils are empty inside or infilled with calcite drouses.

Description. — Number of thoracal segments (specimen ZPAL MgMyr/1), not counting telson and collar segments — 38.

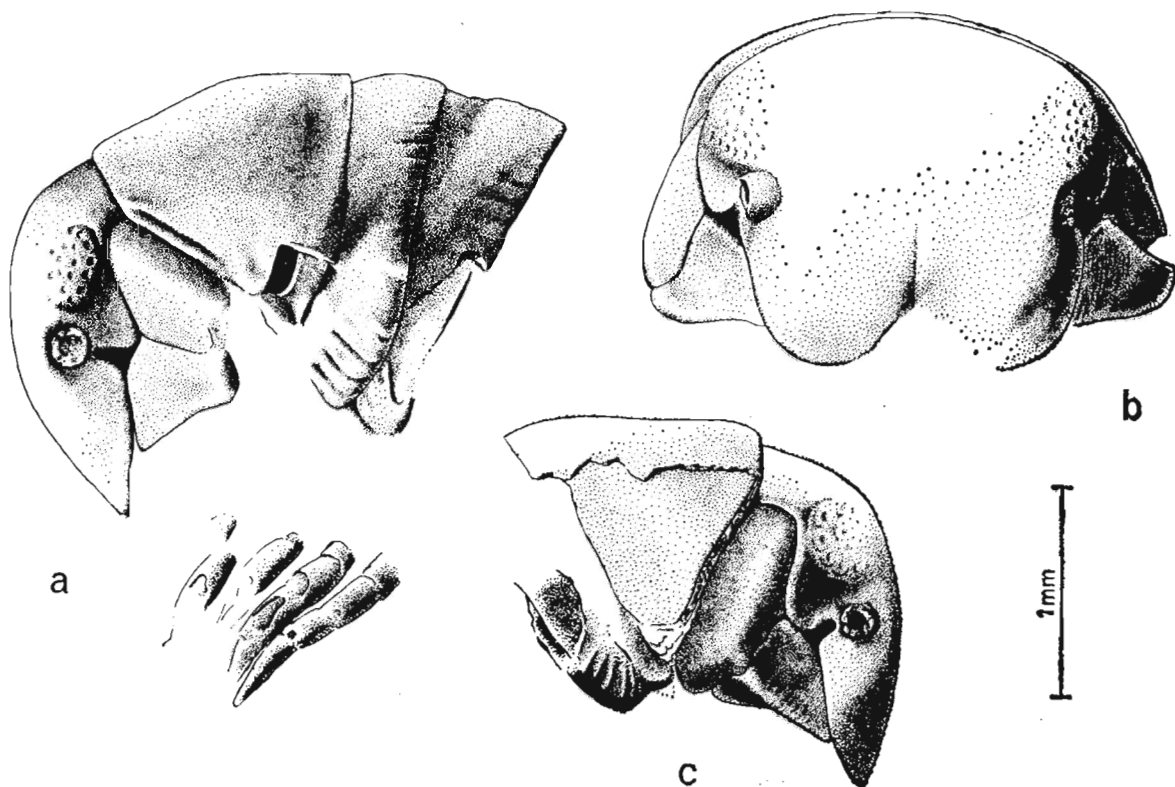


Fig. 1

Gobiulus sabulosus sp.n., holotype, ZPAL Mg Myr/6; Khulsan, *a* — right side of head; note part of collar tergite cast; *b* — head in front view; *c* — left side of head; lower margin of collar tergite damaged; note terminal parts of appendages.

Head capsule (Text-fig. 1a-c) with smooth surface; labrum with deep, sharp cut passing upwards into narrow furrow. Eyes set widely apart, consisting of about 30 ocelli. Antennae basis situated in depression below the eyes.

Dimensions of head (in mm):

	width	height
ZPAL Mg Myr/6	2.0	1.7
ZPAL Mg Myr/1	?	2.0
ZPAL Mg Myr/2	?	1.4

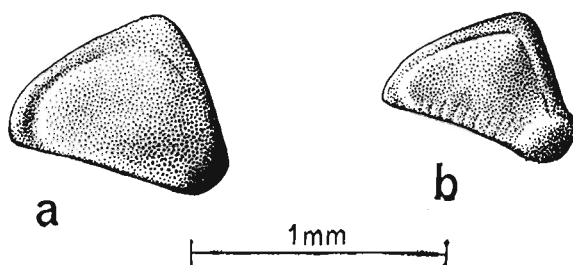


Fig. 2

Gobiulus sabulosus sp. n.; left mandibular stipes; a — ZPAL Mg Myr/1, Khermeen Tsav; b — holotype, ZPAL Mg Myr/6, Khulsan.

Shape of mandibulae (holotype and specimen ZPAL Mg Myr/1): cardo short, high, closely adjoining head capsule and triangular stipes (Text-fig. 2a-b). Lower surface of mandibular stipes shows distinct ridge separating triangular and concave internal parts; gnathochilarial stipes situated in the concave internal part of the mandibular stipes (Text-figs 3a, 4a). *Gnathochilarium* (Text-fig. 3a-b) preserved only in holotype, narrow and damaged. Mentum large, triangular, with short furrows marked in apical part. Lamellae linguales coarse, contacting along a short section. Stipes fairly large, lamellate, convex, originally situated in depressed part of stipes mandibulae, poorly preserved, damaged. Details of collum structure may be

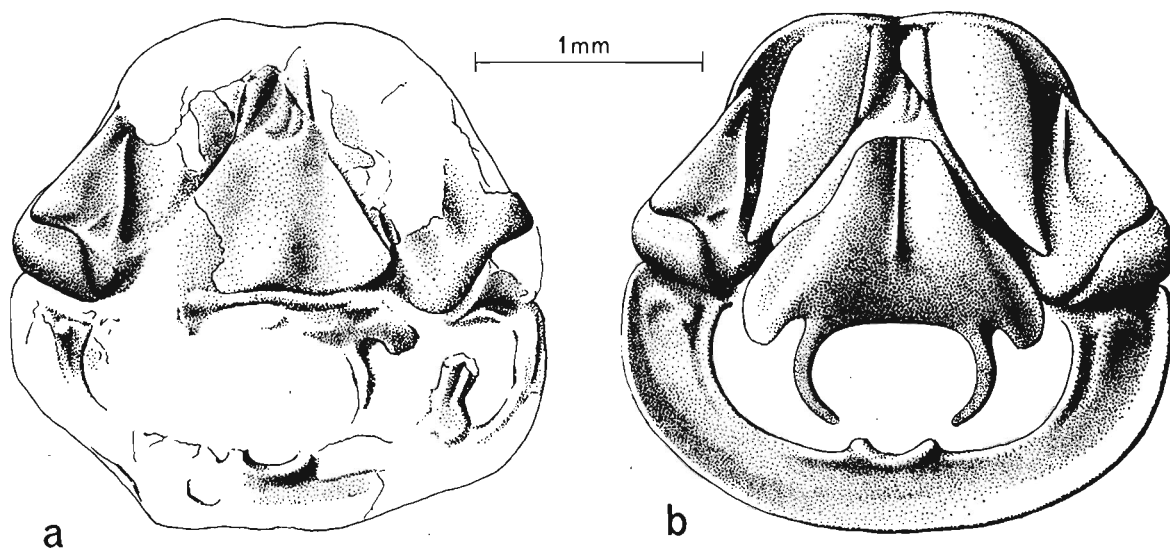


Fig. 3

Gobiulus sabulosus sp. n., holotype, ZPAL Mg Myr/6, Khulsan; a — head with collum seen from below; b — reconstruction.

noted on left side of the holotype and specimen ZPALMgMyr/1, as collum is preserved in the form of cast (Text-figs 1a, 3). Collar tergite wide, sharpened downwards, with fairly deep furrow marked close to anterior margin, and reaching upwards the end of cardo mandibulae, and continuing downwards toward anterior margin half way through the distance to the end of collum; the furrow is also discernible on the cast. Behind the end of the furrow there begins a depression presumably continuing up to the end of collum. Posterior part of the collum with internal, transversally oriented ledge with dorsal condyles articulating with tergite of first thoracic segment. Collar sternite (Hypostome, gula; Text-fig. 3b) very large, forming two arcuate arms surrounding body axis; its anterior lingual-like lobe almost reaches mentum apex; narrow ventral crest extends along the middle of this anterior lobe.

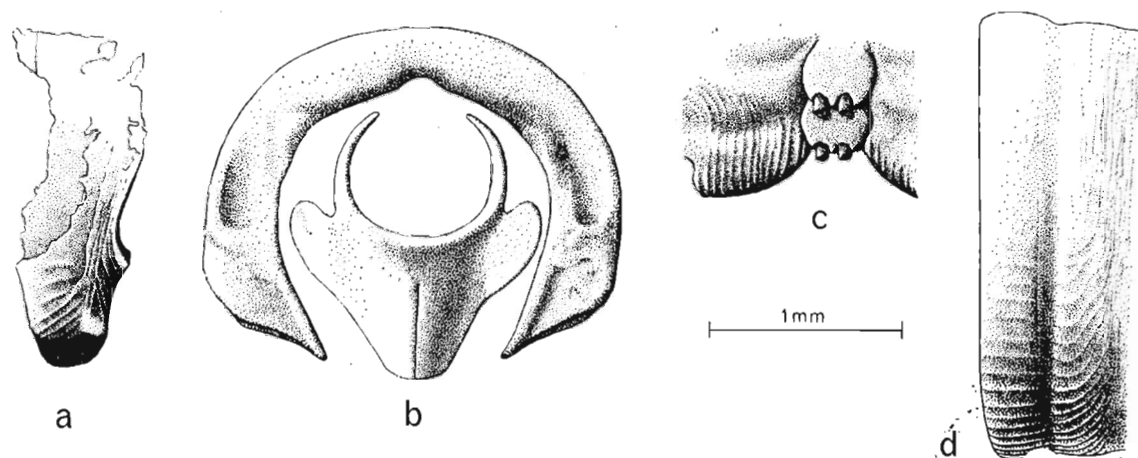


Fig. 4

Gobiulus sabulosus sp.n., holotype, ZPAL Mg Myr/6, Khulsan. a — first thoracic segment seen from the right; b — reconstruction of first thoracic segment and collar sternite, front view; c — sternite and ventral parts of thorax tergite; d — thoracic tergite seen from the right.

First thoracic segment (Text-fig. 4a-b) differs from the remaining ones in shape. Front part of prozonite ring-like, narrowed, articulating with collum. In arcuate depression of upper part of prozonite ring articulation with collum condyles occurred. From a nodule at lower part of prozonite surface the tergite is bent towards body axis at obtuse angle. Prozonite with vertical, and metazonite with oblique and horizontal striations. Two subsequent segments, the vertical part of which is preserved in the form of cast (ZPAL MgMyr/1), are similar to the first one. Thoracic diplosegments (Text-fig. 4c-d) display tergites with horizontal striation in lower parts of metazonites and oblique and vertical striations in corresponding parts of prozonites. Sutures separating meta-, meso- and prozonites are obscure, except for vertical furrow running through anterior part of metazonite, which may represent a rudimentary or incipient suture. Pori repugnatoriales and scobinae obscure. Metazonite forming a small projection at the contact with sternite. Sternites smooth, overlapping one another in the imbricate way, long. The last tergite shorter than the remaining ones; presumably it was originally provided with appendages. Telson tergite (Text-fig. 5a-b) tapered, longer than thoracic tergites, with innumerable, short furrows on ventral side. Scala analis semicircular, uniformly rounded. Valvae anales convex, with somewhat flattened sides.

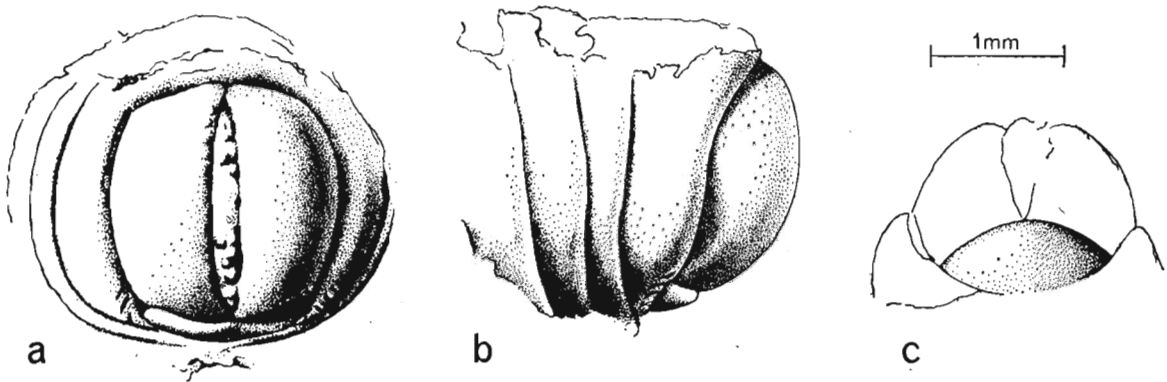


Fig. 5

Gobiulus sabulosus sp. n., ZPAL Mg Myr/1, Khermeen Tsav. *a* — anal end of thorax, posterior view; *b* — anal end of thorax seen from the left; *c* — scala analis seen from below.

Appendages best preserved in the holotype; however, only four segments of the appendages were freed from the rock (Text-fig. 1*a*). Trochanter and tarsus longer than femur and fibia.

***Gobiulus* sp.**

(Pl. VII; Fig. 3; Text-fig. 6)

Material. — Single specimen (ZPAL MgMyr/4) from the Barun Goyot Formation, Nemegt, ?♀, almost complete, with head and collum translocated.

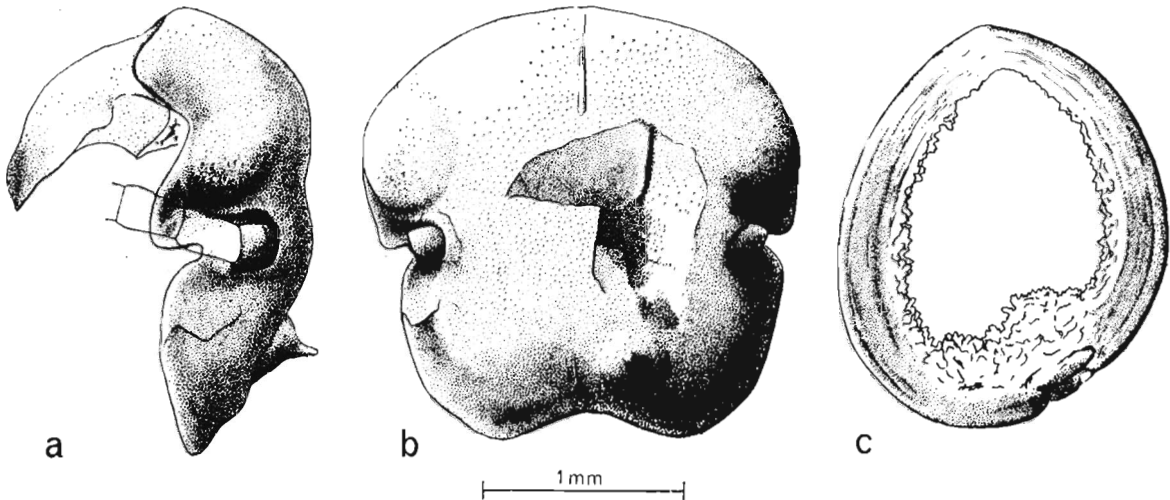


Fig. 6

Gobiulus sp., ZPAL Mg Myr/4, Nemegt. *a* — front view of head; *b* — side view of head; note wart above lip and three first segments of antennae; *c* — front view of thoracic tergite.

Description. — Number of thoracic segments, excluding telson and collum, 38. Head capsule (Text-fig. 6) narrower than in *G. sabulosus* sp. n., 2.2 mm wide and 2.15 mm high. Labrum cut shallow. Eyes composed of about 30 ocelli. Three basal segments of antennae underwent destruction in the course of preparation; first segment short, two subsequent ones longer, flattened. Mouth parts not preserved. Thorax similar to that of *G. sabulosus* sp. n.

Remarks. — Lower left part of lip with large wart, presumably pathological. It is not excluded that the head capsule dimensions are pathologically modified and that the specimen actually belongs to the species *G. sabulosus* sp. n.

SYSTEMATIC POSITION OF THE GENUS *Gobiulus*

The systematics of millipeds is primarily based on gonopod and gnathochilarium structure and on body shape. These features underwent remarkable evolutionary changes. Original features of millipeds include: the lack of morphological specialization of appendages of sixth (not counting collum) thoracic segments, flattened body with paranotal projections, and gnathochilarium with small mentum not subjected to transversal subdivision (HOFFMAN, 1963; SHEAR, 1972). Although no traces of gonopods are found in *Gobiulus* gen. n., it may be inferred that this form is highly advanced from the evolutionary point of view. The structure of gnathochilarium is identical with that of the Recent Spirobolida; mentum shape is close to that found in Rhinocricidae and Atopetholidae (HOFFMAN & ORCUTT, 1960; ATTEMS, 1926) and somewhat differing from that of Trigoniulidae and Spirobolidae (KEETON, 1960, 1964). The affinity to the first two of the above families is also suggested by the structure of collar sternite. It should be admitted that the sternite indicates a specialization unusual in Diplopoda, but it appears somewhat similar to the sternite typical of Rhinocricidae and Atopetholidae, particularly in the collum surrounded by sternite arms. The lack of scobinae and the shape of collum differentiate *Gobiulus* gen. n. from Rhinocricidae. In turn, the lack of specialization of collum (poorly developed anterior furrow) and indistinct division of tergites differentiate this genus from the representatives of Atopetholidae. Moreover, it differs from Spirobolidae in the shape of mentum and triangular mandibular stipes.

The genus *Gobiulus* nov. may be tentatively assigned to the family Atopetholidae CHAMBERLIN, 1918. However, it is possible that erection of a new family for this genus will be necessary in the future. Recent Atopetholidae live in Central America and tropical regions of Asia and North and South Africa, whereas Spirobolidae having essentially the same distribution enter also northern China in Asia but they are not known from more northern areas in Asia (including Mongolia). From the fossil milliped faunas only *Tomiulus angulatus* MARTYNOV (MARTYNOW, 1936), known from the Upper Triassic of Kuznetsk Basin, somewhat resembles *Gobiulus* in arcuate, somewhat irregular striation. Any affinity of Lower Cretaceous *Xylobius mexicanus* MULLERIED (MULLERIED, 1942) to millipeds is doubtful.

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EXPLANATION OF PLATES

PLATE VII

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| <i>Gobiulus sabulosus</i> sp. n. | 18 |
| <p>Fig. 1. ZPAL Mg Myr/1; Khermeen Tsav, Gobi Desert, ? Middle Campanian, Barun Goyot Formation; <i>a, b</i>, complete, coiled specimen in two positions; $\times 5$.</p> <p>Fig. 2. Holotype, ZPAL Mg Myr/6; Khulsan, Nemegt Basin, Gobi Desert, ? Middle Campanian, Barun Goyot Formation; <i>a</i> — first thoracic segment and collar sternite in front view; $\times 15$; <i>b</i> — head and collum seen from below; $\times 15$; <i>c</i> — ventral side of thorax; $\times 15$.</p> | |
| <i>Gobiulus</i> sp. | 21 |
| <p>Fig. 3. Complete specimen with broken off head, ZPAL Mg Myr/4; Nemegt Basin, Gobi Desert, ? Middle Campanian, Barun Goyot Formation; $\times 5$.</p> | |

Photo: M. Czarnocka

