UDC 565.61:551.734/574/ Paleontological Journal, 26(3), 1992

MYRIAPOD-LIKE ARTHROPODS FROM THE LOWER DEVONIAN OF CENTRAL KAZAKHSTAN

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Abstract: Some myriapod-like arthropods from the Lower Devonian of central Kazakhstan, where they occur extensively, are described as *Lophodesmus mirabilis* gen. et sp. nov.

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The initial stages of the invasion of terrestrial biotopes by animals have attracted special attention in recent years, since the development of the continental biota still remains unclear. The few scattered available data show that the arthropods were an important component of the Early Devonian continental biota. However, their fossil remains have been found mainly in the "Old Red sandstone continent," which is most typically represented on the British Isles.

In the Commonwealth of Independent States (CIS), besides quite numerous agnathans and fishes, rare eurypterids and limulids have also been found in the Lower Devonian from Podolia [1], from Tuva and the Minusinsk Basin [1, 2] and also from Taymyr [1, 7]. No finds of other arthropod groups were mentioned earlier. This article will describe some animals resembling myriapods, from the Lower Devonian of central Kazakhstan.

The arthropods studied were collected by the Central Kazakahstan Expedition of the Geological Faculty of Moscow University, under the direction of S. P. Malinovskaya, at the Maldybulak locality, which was first described by Khromykh and Grechushkin [3] as a section through the Devonian deposits. This locality, in the Bayan-Aul district of the Pavlodar region of Kazakhstan, 14 km northeast of Bayan-Aul, is the slope and watershed of a small coniform hill 200 m north of the Maldybulak farm, and consists of rock fragments, disintegrated blocks and rare bedrock outcrops. The lower part of the Sheshen'karinskaya Formation, composed of lavas of andesite-basalt basalt composition with rare stringers of tuffaceous-sedimentary rocks, is exposed here. Other thin beds of tuffaceous siltstones yielded about 50 impressions of arthropods, predominantly disarticulated tergites. The plants *Lidasimophyton*, *Drepanophycus* and *Oricilla* were found with them. This floristic assemblage, in the opinion of Yurina, is Lower Devonian, evidently Pragian-Emsian, as indicated by the genus *Oricilla*, previously described from the Lower Devonian of Canada [6].

Translated from: Mnogonozhkopodobnyye chlenistonogiye iz nizhnego devona Tsentral'nogo Kazakhstana. Paleont. zhur., No. 3, pp. 15-19, 1992.

ISSN0031-0301/92/0003-0018

The fossil burial is confined to fine-grained tuffs that accumulated in a lake, in which only the impressions of the outer carapaces of the arthropods were preserved. In spite of this type of preservation, the impressions sometimes show the smallest details of sculpture on the outer surface of the tergites and fragments of silicified cuticle.

The greater part of these remains are impressions of disarticulated homonomous tergites 1-2 cm wide. They have a distinct two-part structure, and therefore, can be regarded as diplotergites. The general appearance of the segments, as well as the discovery of four diplosegments still articulated, suggests that they belonged to a myriapod-like animal.

Tergites of simple structure and rounded-rectangular outline were found in considerably smaller numbers (fig. 1*g-i*). Their posterolateral margins are segregated in the form of short processes. The anterior margin of the tergite bears a ridge. At the center of the tergite is an X-shaped inflation, and at its sides lie two less prominent lateral inflations, which are round or rounded-rectangular in shape. Between the base of the posterolateral projection and the lateral inflation runs a short slanting costa or rib separating these elements. The length of the simple tergites is 1.2-10.0 mm, their width 3-32 mm.

The taxonomic position of these tergites is a matter of doubt. In their sculpture, which is identical to that of the diplotergites (fig. 1), they might well have belonged to the same myriapod-like animal, which seems very likely. The simple tergites would then probably have been neck segments. But the quantitative ratio of these two types of tergites (32 diplotergites, 12 simple tergites) is against this conclusion. Since the animal had at least four diplosegments, the neck segments should amount to no more than a quarter of the number of diplosegments; but in the collection under study they are one and one-half to two times more. Nevertheless, it can be supposed that the primary ratios of the numbers of segments of different types may have been distorted in burial. It is also possible that these segments belong to *Lophodesmus* but are not neck tergites. It is likewise possible, finally, that the tergites of simple structure belonged to a completely different animal. Thus, they will be regarded as neck tergites with a question mark.

The Silurian and Devonian deposits in a number of regions of the world have yielded a few small (up to 2 cm long) myriapod-like arthropods with diplotergites. These, from the Devonian of Scotland, were first described by Page [8] under the name *Kampecaris*. Peach [9, 10] insisted on the myriapod and diplopod nature of these animals. Subsequent finds of fossils of similar animals were also assigned to *Kampecaris* [5, 14].

In 1985 Almond [4] synthesized all the data then available on the Silurian and Devonian myriapod-like organisms. Almond refrained from assigning these fossils to the class of Diplopoda only because of the presence of homonomous diplosegments among them. But to justify such a conclusion, there must be a combination of data on the structure of the head, the extremities, the respiratory organs, and the trunk segments.

In the Kazakhstan arthropod, described below as *Lophodesmus mirabilis* gen. et sp. nov., the head segments and the extremities are unknown. However, the structure of the trunk and anal diplotergites, the presence of neck (?) tergites, and the large size of the animal (which was apparently up to 10 cm long or more) do not permit their identification as a member of the order Kampecarida. The structure of the trunk segments also excludes the possibility of a genetic relationship to *Euthycarcinoidea* Gill et Grauvogel [12] and *Arthropleurida* Waterlot [11]. At the present level of study, it would clearly be premature to assign *Lophodesmus mirabilis* gen. et sp.

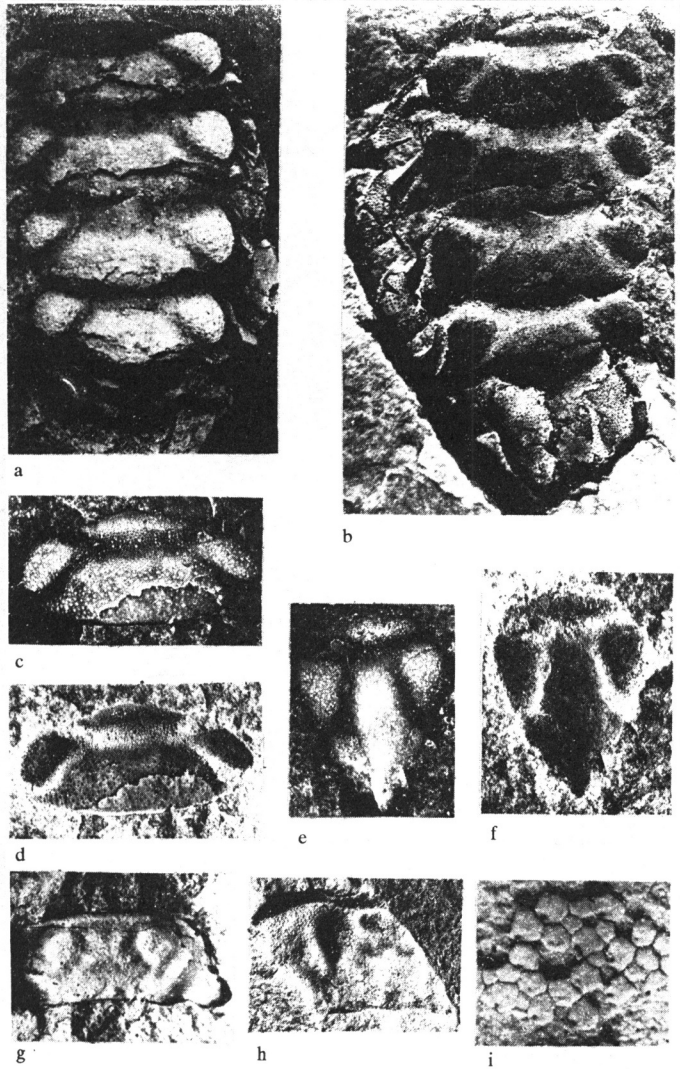

Fig. 1

nov. to any group of arthropods. Almond, who has studied photographs of the most complete remnant of *Lophodesmus*, is inclined to the same view (letter to the authors, 1988).

The discovery of myriapod-like arthropods in the Devonian continental deposits of Kazakhstan shows the great potential of this region for contributing to an understanding of the oldest land-dwelling communities.

It has recently been found that similar arthropods occur extensively in the middle part of the Lower Devonian of central Kazakhstan. Myriapod-like animals have been found, in addition to the locality in the Bayan-Aul district, in the Cis-Chingiz area, where they sometimes form mass accumulations like those in the burials of arthropleurids from the Lower Devonian of Canada [13], and also from the Selety Basin of Kazakhstan. The beds with *Lophodesmus* gen. nov. may represent a particular marker level in the section through the Devonian deposits of central Kazakhstan.

ARTHROPODA INCERTAE SEDIS

Genus ***Lophodesmus*** Tesakov et Alekseev, gen. nov.

Generic name. Greek *lophos* (tubercle) and Greek *desmos* (bond).

Type species. *L. mirabilis* sp. nov.

Diagnosis. Large myriapod-like animals up to 10 cm or more long. Body of flat diplosegments. Lateral parts of metazonae in form of round swellings. Each diplosegment with one pair of spinelike lateral processes. Last trunk segment with unpaired spinelike process.

Specific composition. Type species.

Lophodesmus mirabilis Tesakov et Alekseev, sp. nov.

Specific name. Latin *mirabilis* (wonderful).

Holotype. Paleontology Department, Moscow State University, Spec. No. 249/1, cast and counterpart of four trunk diplosegments, still articulated; central Kazakhstan, Bayan-Aul district of Pavlodar region, vicinity of Maldybulak farm; Lower Devonian, Emsian (?) stage, lower part of Sheshen'karinskaya Formation.

Fig. 1. *Lophodesmus mirabilis* Tesakov, sp. nov.: *a, b* - Holotype No. 149/1, four still articulated diplosegments (×1.3): *a* - cast, *b* - counterpart; *c, d* - Spec. 149/4, thoracic tergite (×4): *c* - negative image, *d* - positive image; *e, f* - Spec. 149/8a, caudal tergite (×4): *e* - negative image, *f* - positive image; *g* - Spec. 149/6, neck (?) tergite (×3.5); *h, i* - Spec. 149/2a, neck (?) tergite: *h* - general view (×2), *i* - part of microsculpture of surface (×20).

Description (fig. 1). Body consists of numerous (more than 5) diplosegments overlapping by length of prozonae. Trunk tergites consist of two parts. Prozona narrow and fusiform. Metazona consists of central area and two lateral tubercles. Central area has form of trapezium with convex base and concave upper side. Lateral tubercles are on both lateral sides of central area and somewhat forward of it. Tubercles are rounded-triangular; behind each of them and somewhat outward of it is small additional tubercle. Spinelike processes extend rearward from each lateral side of metazona, and are round in section. At posterior end of body is anal diplosegment, whose tergite is modified trunk tergite. Prozona retains typical fusiform shape, but all elements of metazona are strongly drawn out anteroposteriorly. Distal part of central area of metazona ends in spinelike caudal process.

Cuticle of exoskeleton has complex multilaminar structure. Surface of impressions has polygonal-porous mesosculpture on one of inner laminae of cuticle, outer surface of which is smooth and ornamented only with small tubercles. Common element of mesosculpture in all parts of tergites is polygonal, 5-7 sided granules. In addition, lateral tubercles on prozona and many granules in central area of metazona are pierced by pores. Pores on prozona have small diameter, and various diameters on metazona. Pores are usually located at posterior margin of granule, more rarely in center, whereas granules of sutural grooves have no pores. Diameter of granules ranges from 0.1 mm on prozona and sutural granules between tubercles and other elements of diplotergites to 0.2 mm on central area of metazona, lateral tubercles, and on central part of sutural groove between pro- and metazonae. Spinelike processes of diplotergites also have mesosculpture of polygonal granules. Granules on this element are elongated along longer axis of processes.

Dimensions in mm:

	Length	Width
Holotype No. 249/1	30.0	18.0
Trunk diplotergites	1.5-11.0	2.0-21.5
Anal diplotergites	8.0-15.0	8.0-10.0

Remarks. The wide range of sizes of the isolated tergites indicates that the oryctocoenosis contains the animals of very different individual ages, but even the very smallest tergites have clear distinctive features.

Material. Part of body consisting of four articulated segments, 28 trunk diplotergites, and 3 anal diplotergites, all well or satisfactorily preserved, from type locality.

We thank S. P. Malinovskaya, under whose direction and with whose direct participation the arthropods were collected, A. L. Yurin for identifying the flora, and A. G. Ponomarenko and J. Almond for their valuable advice in discussing the materials described in this article.

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