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BATHYSIPHONS FROM THE EOCENE OF THE CARPATHIAN FLYSCH, POLAND

Abstract. — The occurrence of a sandstone horizon abounding in tubes of *Bathysiphon* Sars has been discovered ni the Eocene of the environs of Gródek on the Dunajec. A new species *B. inconstans* is here described, along with studies on the structure and occurrence of, as well as deformations underwent by its tubes in the process of flysch sedimentation. Since the writer considers them to be the tubes of the Annelida and not the tests of the foraminifers, he thus questions the so far accepted view on the systematic positions of the bathysiphons.

INTRODUCTION

The bathysiphons under study occur in beds of Ciężkowice sandstones on the shore of Lake Rożnów near Gródek on the Dunajec River (Text-fig. 1). These sandstones are yellowish, fine-grained, containing mica, fine-laminate and disintegrating to form thin plates. Among them, there occur clayey-marly intercalations, with many fine organic and current hieroglyphs formed at their contact surface.

The Carpathian bathysiphons were first mentioned by Dylążanka (1923) who found these fossils in the inoceram beds of the Magura group in Szymbark. Next, Bieda (1946, 1949) fairly accurately describes Carpathian specimens from Kłodne, Sowlin and Gródek, comparing them with Italian ones of *Bathysiphon appenninicus* Sacco, 1893 from the Cretaceous flysch of the Northern Apennines and with *B. taurinensis* Sacco, 1893 from the Oligocene-Miocene marls of the environs of Turin. Bieda notices that the bathysiphons found in the Carpathians are known only from their fragments obtained in washing flysch deposits. Danysz (1966) mentions a specimen 13 cm long which he has in his collections and large fragments of bathysiphons are also described by Vialov (1965, 1966, 1967) and Neagu (1964). The authors named above describe the fragments they own as agglutinating foraminifers and, on the basis of slight and freq-

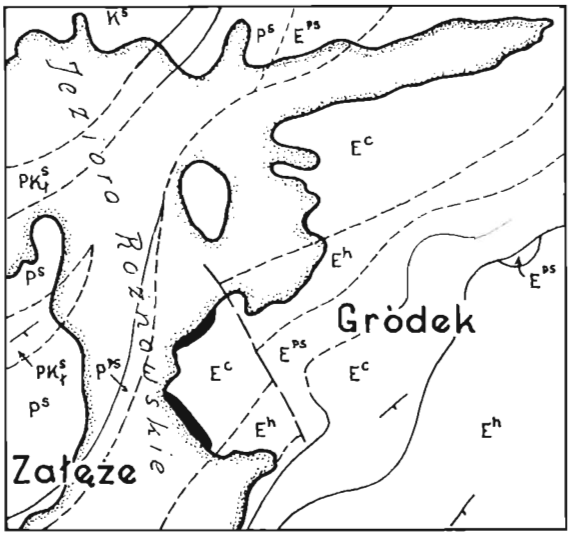

Fig. 1. A geological sketch of the vicinity of Gródek on the Dunajec. Blackened spots designate the occurrence of bathysiphons. Explanations: K_s Cretaceous, Istebna Beds; PK_t^s Cretaceous — Paleocene; P^{ps} Paleocene, spoted shales; P^s Paleocene, Istebna Beds; E^c Eocene, Ciężkowice sandstones; E^h Eocene, hieroglyphic beds; E^{ps} Eocene, spotted shales.

uently insignificant differences, assign them not only to different species, but also even genera.

Analyzing various authors' descriptions of bathysiphons and comparing them with complete specimens from the Carpathian Mts, the present writer concludes that the separation of so many species is not justified. These authors described separately the initial, central and apertural fragments of the tubes. Since they differ from each other in appearance, found separately they might be assigned to different species and even genera (Text-fig. 2). The present writer having at his disposal a rich material which includes almost complete specimens, believes that many species of the genus *Bathysiphon* known from literature should be assigned to one species.

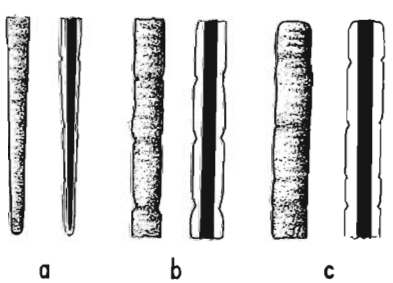

Fig. 2. Fragmentary tubes of bathysiphons and their longitudinal sections, parts: *a* initial, *b* central, *c* upper.

The specimens decribed in the present paper are housed in the collections of the Department of Palaeontology and Stratigraphy of the Academy of Mining and Metallurgy in Cracow.

OCCURRENCE AND STATE OF PRESERVATION OF THE BATHYSIPHONS

The bathysiphons from Gródek on the Dunajec rest on the surface of sandstone beds or are embeded in clayey-marly intercalations and are accompanied by hieroglyphs. As an effect of the pressure exerted by sandy deposits during their formation and diagenesis, the tubes of bathysiphons were compressed (Text-fig. 3), bent and transversally deformed, with elongate depressions and lateral cracks (Text-figs 3, 4) formed on their bottom surface. As a result of bending, the tubes broke on contractions (Text-fig. 3c, *d*). So deformed became mostly the tubes lying on clays or half-submerged in them, while those lying on sand and filled with deposits remained intact (Text-fig. 4, Fig. 1). The bathysiphons lying

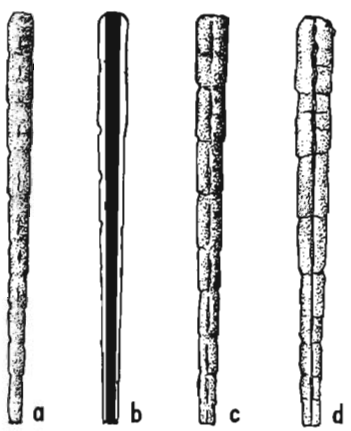

Fig. 3. Fragmentary bathysiphons. *a*, *c* and *d* various stages of deformation; *b* longitudinal section.

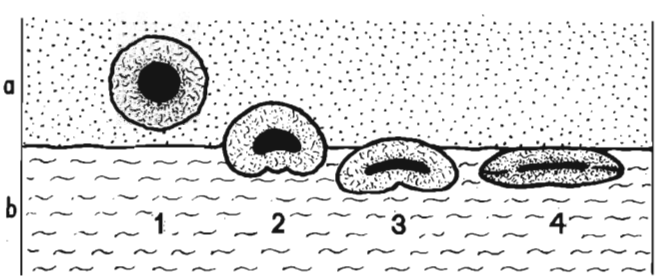

Fig. 4. Types of deformations of the tubes of bathysiphons: *a* sandstones, *b* clayey-marly deposits.

on the bottom, were scattered irregularly (Pl. II) or oriented. The latter position was mentioned by Książkiewicz (1961) as he described the bathysiphons from the Carpathian flysch of the Istebna sandstones at Tabaszowa. This author relates such an orientation with bottom currents. At Gródek on the Dunajec, the bathysiphons arranged parallel to each other are on the whole uniform in size (75 per cent of them about 3 cm long). Nearly all of them point with their sharp ends in the same direction and are usually very closely spaced. Most of them are not damaged and have no elongate cracks. In some parts of beds the tubes occur on almost even surfaces (Pl. II, Fig. 5) and are covered with fine sand grains. In some other parts, in which the tubes are widely scattered, elevations, representing casts of the depression formed near the wider ends of bathysiphons embedded in clay are visible (Pl. II, Fig. 8). The reconstruction of the process which led to the parallel arrangement of bathysiphons (Text-fig. 5*a*) shows one of the types of depositing bathysiphons, the terminal

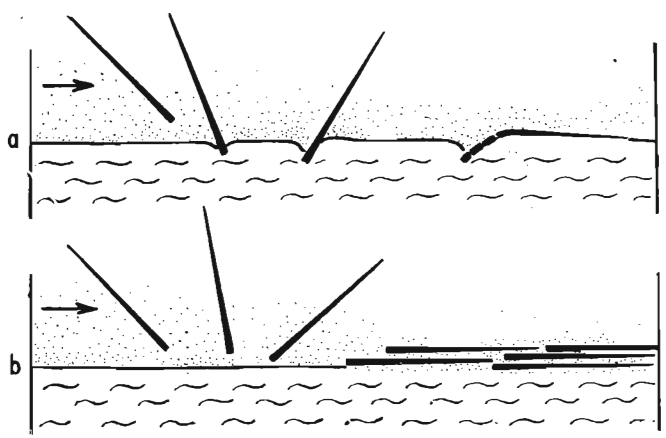

Fig. 5. A diagram showing the transportation and deposition of the tubes of bathysiphons by bottom currents.

ends of tubes being drifted by currents. In the case of drifts (Text-fig. 5*b*) stronger bottom currents transported great amounts of the terminal ends of bathysiphons, which were deposited in layers piled on each other. The orientations of bathysiphons sometimes are not parallel in neighbouring layers, this may be due to changes in the direction of bottom currents.

SYSTEMATIC POSITIONS OF THE BATHYSIPHONS

The tubes of hitherto described bathysiphons are composed mostly of sponge spiculae. Studying the bathysiphons from Gródek on the Dunajec, the writer has found that their material was mostly of the sponge origin and less frequently consisted of fine quarz grains cemented by silica.

Thus, the doubt arises if these are actually tests of foraminifers or maybe they come from other organisms. The Annelida, some of which have agglutinated tubes nearly identical with the tests of foraminifers, may be considered as possible builders. In the case of the bathysiphons, there is no certainty if they are the tests of foraminifers, but on the other hand there is no evidence of their belonging to the Annelida. The structure of their initial part may be an argument against their foraminiferal origin. After making many longitudinal sections through the initial stages of bathysiphons the writer found that these parts tapered (Pl. II, Fig. 8; Text-fig. 2*a*) to form very thin, sharp terminations. If these fossils were of the foraminiferal origin they would certainly have embryonic chamber (proloculus), which, however, does not occur in the bathysiphons.

Their size is one more argument against their being tests of foraminifers. Some tubes of bathysiphons from Gródek on the Dunajec are very long. Such lengths have never been recorded in both Recent and fossil foraminifers. The size alone cannot be considered as evidence of their being annelids, but it arises a doubt if they might be foraminifers.

Comparing the tubes of Recent and fossil annelids with those of the bathysiphons, we observe that their growth takes place identically in both cases, that is, that the calcareous or agglutinated rings grow in succession and that alternate extensions and contractions, causing segmentation, are visible on the tubes.

It is also the environment in which the bathysiphons lived that may evidence of their belonging to the Annelida. The bathysiphons are primarily found in clayey or marly sediments, which were subsequently covered with sandy deposits (frequently they are "stuck" to the surface of sandstone beds). Only few of them are found inside sandstones, in which — as follows from their arrangement — they are allochthonous. Neither small nor large foraminifers have ever been found in the deposits containing bathysiphons. On the other hand, the surfaces of the beds are covered with many and various hieroglyphs, most of them being traces of the annelids. We may conclude that the environment was favorable to the annelids and, therefore, the sessile, agglutinating annelids might live in it.

DESCRIPTION

Genus *Bathysiphon* Sars, 1872

In 1872, Sars erected this genus for fragmentary tests of indeterminate organisms which he considered to be foraminifers. Further species of the genus *Bathysiphon* have also been described on the basis of fragmentary materials. Thus, the question arises, whether or not fragmen-

tary fossil tubes belong to one or several species of this genus. Comparing the descriptions and illustrations, the present writer believes that Sars (1872) and Sacco (1893) described fragments of one and the same species of the genus *Bathysiphon* giving them different names. The drawing enclosed (Text-fig. 6) shows a complete test of the genus *Bathysiphon* (on the basis of *B. inconstans* n.sp.) with marked segments described as: (1) *B. apenninicus* Sacco; (2) *B. filiformis* Sars and (3) *B. taurinensis* Sacco. Since the species mentioned above are in part identical with *B. inconstans n.sp.*, it is not unlikely that all of them are synonymic species.

Fig. 6. A complete specimen of a bathysiphon (*Bathysiphon inconstans* n.sp.) with marked segments which were described as the following species: 1 *Bathysiphon apenninicus* Sacco; 2 *B. filiformis* Sars; 3 *B. tauracensis* Sacco.

Bathysiphon inconstans n.sp.

(Pl. II; Text-figs 1—6)

Syntypes: specimens shown in Pl. XXVII, Figs 2 and 8.
Type horizon: Eocene, Ciężkowice sandstones.
Type locality: Gródek on the Dunajec.
Derivation of the name: Lat. *inconstans* = inconstant, variable, after a considerable variability of its tubes.

Diagnosis. — Tube slightly bent, to 20 cm in length, round in transverse section, tapering in the initial and extended in the apertural part, with more or less distinct contractions irregularly spaced over the entire length. Walls of tubes thick and, consequently, the internal canal small in diameter. Walls composed of sponge spicules of a fine-grained sand cemented with silica.

Material. — Several hundred specimens varying in size. All the complete and fragmentary tubes found within Carpathian sandstones display both transverse and longitudinal deformations, which were formed during the sedimentation and diagenesis of the rock.

Dimensions (in mm):

Length of tests to 20,

diameter of the apertural part 2.0 to 2.8

diameter of canal 0.4 to 0.6

length of segments — strongly variable

Description. — Tube conglomeratic, round or slightly compressed in transverse section, nearly uniform in diameter over the entire length, except for the initial, contracted part. Surface of tubes smooth, glossy or slightly rough, white, yellowish or ashen-blue. Contractions varying in length occur over the entire length, some of the segments being very long, some others resembling rings. In the initial part, the contractions are only slightly marked, frequently hardly visible. Walls very thick, the lumen of tubes very small. Walls composed primarily of sponge spicules and, less frequently, of fine quartz grains cemented with silica.

Remarks. — Being unable to identify this form with a complete certainty with any of so for described species, based on fragmentary tubes. the writer erects a new name for the completely preserved form from Gródek on the Dunajec.

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BATYSYFONY Z EOCENU FLISZU KARPACKIEGO (POLSKA)

Streszczenie

W eoceńskich piaskowcach ciężkowickich koło Gródka n.D. znaleziono masowo występujące, prawie kompletne rurki *Bathysiphon inconstans* n.sp. Są one znajdowane przede wszystkim w marglistych przeławiceniach, „przylepione" do powierzchni piaskowców, rzadko w samym piaskowcu. W ułożeniu wykazują one orientację zgodnie z osią rurki lub są bezładnie rozrzucone. Rurki osiągają do 20 cm długości, mają średnicę poniżej 3 mm przy szerszym końcu i stosunkowo grubą ściankę. Ścianka jest zbudowana z igieł gąbek, z małą domieszką drobnych ziaren piasku kwarcowego, spoiwo jest krzemionkowe. Wbrew dotychczasowemu poglądowi autor uważa, że nie są to otwornice, lecz rurki pierścienic. Przemawia za tym przede wszystkim budowa rurki, która na proksymalnym końcu nie ma komory embrionalnej, cechy charakterystycznej otwornic. Poza tym są duże analogie w sposobie przyrostu rurek u dzisiejszych pierścienic i batysyfonów. Są również przesłanki, że środowisko nie sprzyjało rozwojowi otwornic, natomiast napewno obficie było zasiedlone przez różne Annelida.

Autor zwraca uwagę, że dotychczas opisane gatunki batysyfonów oparte są na niewystarczających, fragmentarycznych materiałach. Wydaje się, że oligoceńsko-mioceńskie gatunki opisane na niekompletnych okazach z Włoch mogą być gatunkami synonimicznymi, jak i nowy eoceński gatunek z Karpat.

ЕЖИ МАЛЭЦКИ

БАТИСИФОНЫ ИЗ ЭОЦЕНОВЫХ ПОРОД КАРПАТСКОГО ФЛИША (ПОЛЬША)

Резюме

В ценжковицких песчаниках эоценового возраста, распространенных в районе местности Грудек на р. Дунаец, наблюдались массовые скопления почти комплектных трубок *Bathysiphon inconstans* n.sp. Они приурочены к мерглистым прослоям, могут быть „прикреплены" к поверхностям песчаниковых слоев, редко встречаются в самом песчанике. Местами наблюдается закономерная ориентировка трубок, местами же они разбросаны беспорядочно. Длина трубок достигает 20 см, диаметр на расширенном конце до 3 мм. Сравнительно толстые стенки трубок состоят из спикул губок с незначительной примесью мелких кварцевых песчинок, сцементированных кремнистым веществом. Вопреки установившимся взглядам, автор считает, что эти трубки относятся не к фораминиферам, а к кольчатым червям. Такое заключение можно сделать, прежде всего, на основании строения трубок, на проксимальном конце которых отсутствуют эмбриональные камеры, представляющие характерный признак фораминифер. Кроме того, современные кольчатые черви и батисифоны проявляют большое сходство в способе прикрепления трубок. Имеются также предпосылки, что данная среда отличалась неблагоприятными условиями для развития фораминифер, но несомненно была обильно заселена разными аннелидами.

Автор отмечает, что описания видов батисифонов основываются на неполных и мало достоверных материалах. Предполагается, что олигоцен-миоценовые виды из Италии, изученные по неполным экземплярам, как и новый эоценовый вид из Карпат, могут представлять синонимические виды.

EXPLANATION OF PLATES

Plate I

Bathysiphons occurring on the surface of Ciężkowice sandstones at Gródek on the Dunajec. × 1

Plate II

Fig. 1—4, 6, 7. Fragmentary tubes of bathysiphons on the surface of sandstones; visible are the deformations they underwent during sedimentation. × 2

Fig. 5. Fragments of rock abounding in fragmentary initial segments of the tubes of bathysiphons arranged parallel to each other. × 1.

Fig. 8. Current hieroglyphs, together with oriented tubes of bathysiphons. × 1.

Fig. 9. A longitudinal section through a tube of bathysiphon with visible sponge spines of which the walls of tubes are composed. × 15.


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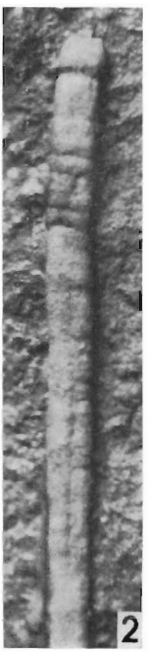
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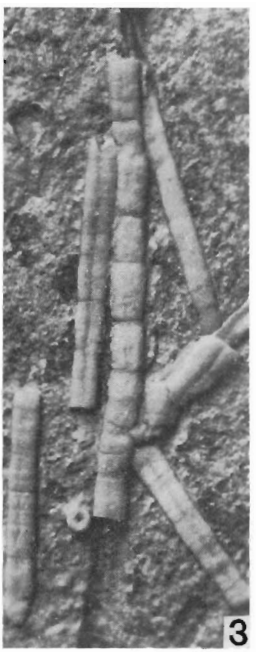
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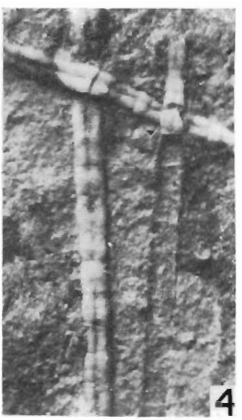
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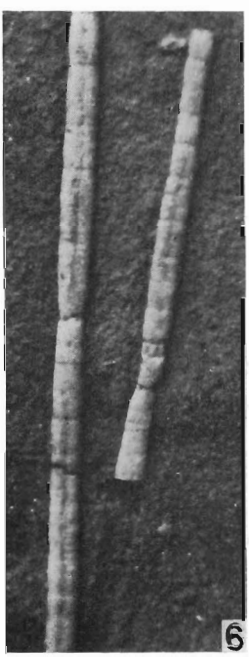
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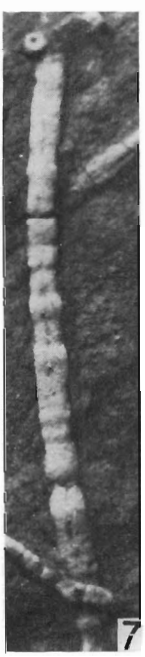
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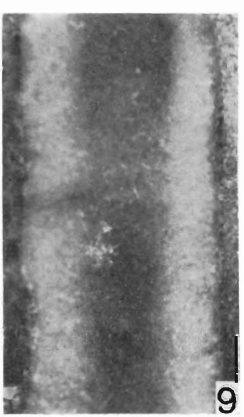
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