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Sphenothallus »Vermes« in the Early Devonian Hunsrück Slate, West Germany

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With 5 figures

Kurzfassung: Im Unterdevonischen Hunsrückschiefer wurden durch Röntgenaufnahmen 5 Exemplare von *Sphenothallus* gefunden. Bisher wurde von verschiedenen Autoren die Meinung geäußert, daß *Sphenothallus* eine Wurmröhre ist oder aber zu den Conulata einzuordnen sei. Einige Exemplare zeigen von der Öffnung ausgehend vermutliche Weichteile. Alle haben einen bilateral symmetrischen Tentakel-Apparat. *Sphenothallus* kann man in die Nähe der Anneliden stellen, aber nicht zum Phylum, da keine Segmentierung zu erkennen ist. Bei Exemplaren von *Sphenothallus* von anderen Fundorten wurde eine chitino-phosphatische Röhre gefunden, wie sie bei lebenden Anneliden nicht zu beobachten ist, die in einer Kalzitröhre wohnen. Soweit man aus den Weichteilen erkennen kann, waren die Lebensgewohnheiten ähnlich denen der heutigen Anneliden-Ordnung Sabellida.

Abstract: Five specimens of *Sphenothallus* have been observed in Early Devonian slates from West Germany which have been studied by radiographs. This genus has been assumed by several authors to be a "worm tube" or that it may belong to the Conulata. Some individuals show soft parts extending from the aperture. All preserve a bilaterally symmetrical tentacular apparatus. *Sphenothallus* could be related to the Annelida, but cannot be placed in that phylum since no evidence of segmentation is preserved. In specimens from other localities, *Sphenothallus* has been observed to have a chitinophosphatic tube, unlike the calcareous tube of living tube-dwelling annelids. What can be observed of the apertural soft parts indicates a mode of life similar to that of members of the modern-day annelid order Sabellida.

Introduction

The well-known Hunsrück Slate in western Germany has produced a large number of paleontological treasures. Because many specimens are replaced by pyrite, soft parts are occasionally preserved and these can be studied by radiographic methods. The mode of study of the Hunsrück material has been described in earlier publications on fossils from the area. A general summary has been given recently by Stürmer (1984). We report here a few features of the body of an extinct "worm". The two specimens of WS 515 were published in a paper (Kutscher 1972) on associated crinoids, and were identified only as unknown fossils.

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Fig. 1. Radiograph WS 11295, showing a specimen of *Sphenothallus* sp., bar = 10 mm. Collection of W. STÜRMER, Erlangen.

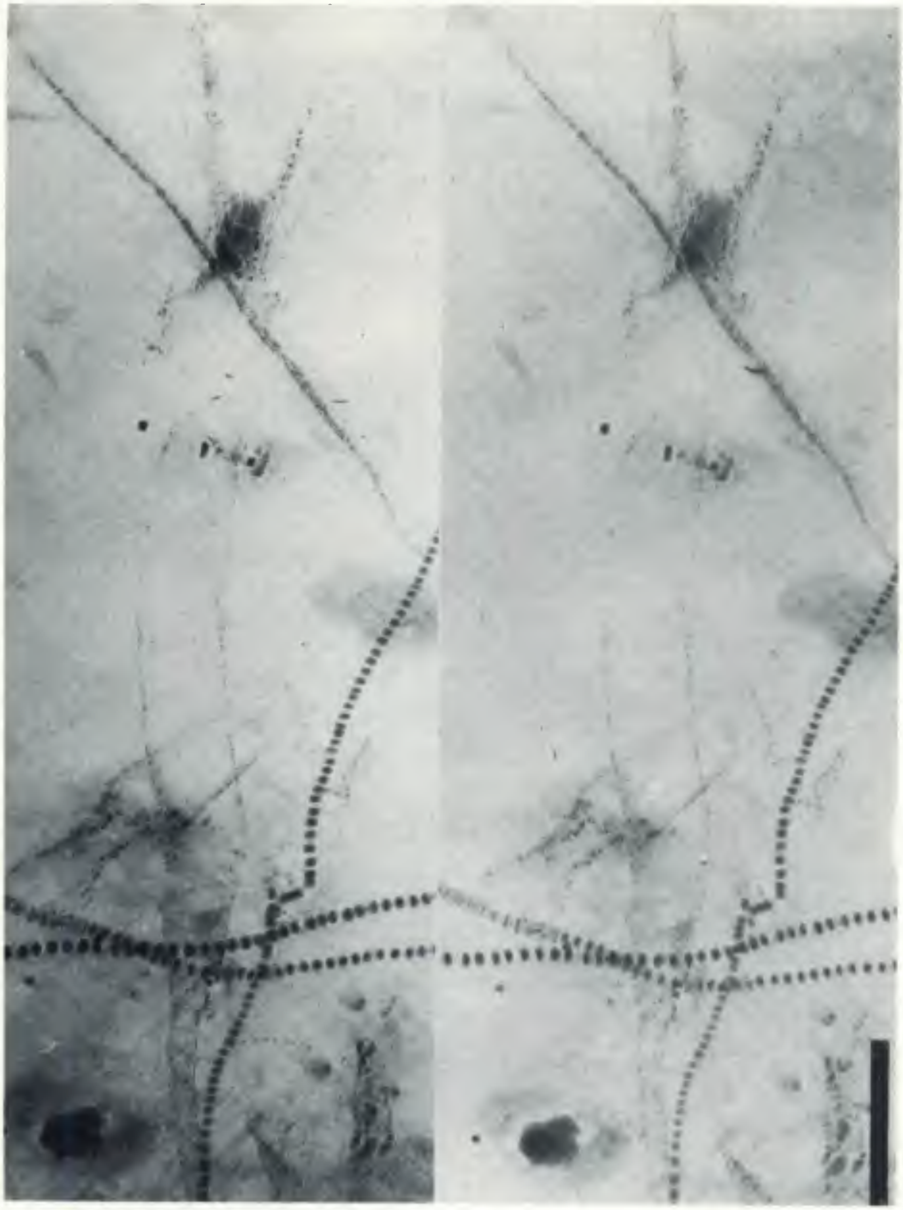

Fig. 2. Radiograph WS 515 of two specimens of *Sphenothallus* sp. (WS 515a and b) associated with stalked crinoids (bar = 10 mm). Collections of Bavarian State Museum, Munich No BSP 1986 I 5.

The genus *Sphenothallus*

Sphenothallus HALL was described originally from Middle Ordovician black shales of New York as a plant. Today it is generally accepted as a "worm tube", but it is a neglected fossil, seldom discussed in the literature. In recent years the two most comprehensive papers on the fossil have been based on Upper Carboniferous material from northwestern Europe (SCHMIDT & TEICHMÜLLER 1956, 1958). They demonstrated that the genus has an elongate tube which probably had some limited flexibility during life, being strengthened and thickened on two opposing points of the circumference. More recently, MASON & YOCHELSON (1985) pointed out its scattered, but widespread distribution through the Devonian, Mississippian, and Pennsylvanian in the United States. They have offered new proof that during life it was attached by a basal disk to the substrate.

The Hunsrück specimens

To date, five samples of *Sphenothallus* sp. have been observed by radiographs in the slates. Only part of one of the tube is exposed on a slate surface. Two are on one piece and the others are on separate pieces. In the past, some flattened tubes may have been discarded because they were thought to be poorly preserved psilophytes.

The first individual (WS 11295, Fig. 1) noted is also the smallest, the tube length being about 2 cm. The early, narrow part of the tube shows strong pyritization. Details of the apex are not known; the light areas between the dark-appearing pyrite are irregular and should not be interpreted as any sort of septation or segmentation. Otherwise, strong pyritization is confined to the edges of the fossil throughout most of the tube length. When the tube of *Sphenothallus* is compressed, almost invariably the two thickened zones are lateral rather than central. We suggest that this individual and the others were compressed in the conventional manner; heavier pyritization may be associated with the greater amount of organic matter in the thickened zones of the tube.

The tube is slightly sinuous in the plane of the radiograph. This small individual expands at a uniform rate, being about three times the width – when flattened – at the aperture as at the apical end. Near the aperture the amount of pyritization again increases to form a nearly complete plug across the tube. Extending from the tube are two long, narrow pyritic streaks. We interpret these as tentacles arising from the plug-like structure at the opening of the tube. They are about one-third the length of the tube and are separated by an angle of about $80° \pm$. No other details of the plug-like mass, presumed to be the head mass, or other features of the anatomy can be resolved. It is possible that a second small specimen is also present, its aperture being near the apex of the specimen described above. However, it is not as obvious in the radiograph and cannot be identified with certainty.

Two larger specimens are definitely present on one slab (WS 515) and lie across each other in the radiograph, the aperture of the lower one being near the mid-point of the second (Fig. 2).

Both are slighty sinuous and about six cm long. The early part of each tube is comparable to WS 11295 in expanding uniformly, but after a rapid expansion, the width remains virtually constant for most of the length. This is similar to the growth pattern seen in many specimens (MASON & YOCHELSON 1985) for in all but the earliest growth stages it is difficult to see significant expansion of tube width during great elongation.

On the lower specimen, most of the details of the tube are obscure, but in the apertural area, pyritization is stronger. Extending from the tube opening is a mass, about half of the flattened diameter. On one side an elongate projection, interpreted as a tentacle, is present, and to the other side there is a suggestion that a similar projection may have been present.

Fig. 3. Radiograph of apertural area of WS 515a (bar = 10 mm).

Fig. 4. Radiograph of WS 11538 (bar = 10 mm). Collection of G. Brassel, Flensburg.

The largest specimen is also the most striking (Fig. 3); extending from the aperture is the spool-shaped body mass, protruding several mm above the rim of the opening. Within this mass, light and dark areas can be seen, but no interpretation may be made. At the front of the body mass two lateral tentacles project, diverging slightly as they extend outward.

The internal structure of WS 515a and WS 515b appears to indicate that the two marginal tentacles were held up by a sleeve of supportive tissue. This is similar in manner to the supportive structure of the tentacular crown of a living sabellid annelid (Kennedy & Kryvi 1980), and suggests strongly that *Sphenothallus* was a sedentary tube-dwelling organism capable of extending a tentacular crown for feeding. No details of the tentacles can be seen and the only other point to add is that the supportive structure was approximately bobbin-shaped.

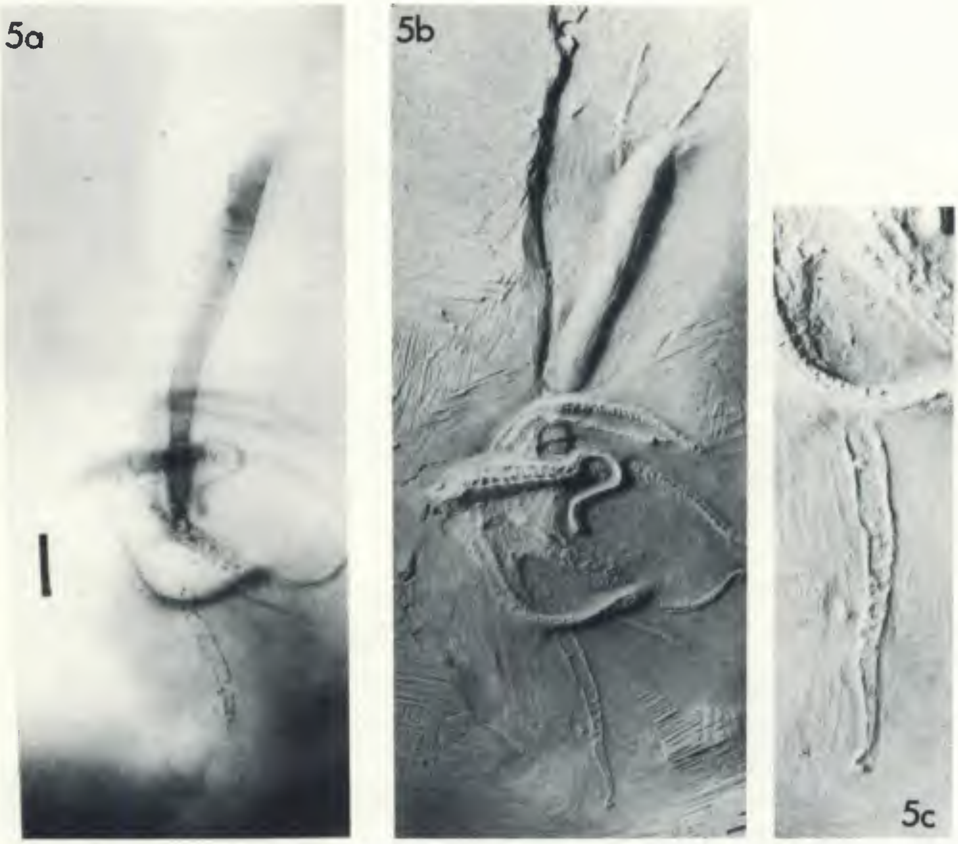

Fig. 5. a: Stereoradiograph of WS 12735 (bar = 10 mm). Collection of Dr. WILL, Rockenhausen. b: Surface photograph of the specimen. c: Detail of Fig. 5b.

Another specimen, WS 11538, may have been preserved withdrawn inside the tube; the body-mass plug is present about one-third of the distance down the tube. Presumably the organism was capable of retraction, as well as extending out of the tube. No tentacles have been observed in this relatively large specimen, but they may be obscured by the body mass. The specimen does not contribute enough other data to warrant illustration.

The individual WS 12735 is interesting in showing the early stages of the tube more clearly than the others (Fig. 5a, b, c). The individual is difficult to interpret for the smaller part of the tube is partially exposed and provides a weaker radiograph than the upper half. Tentacles appear to present protruding from the aperture, but are not strongly pyritized. Near the center of the tube, the arms of a starfish cross it, making the connection between the aperture and apical part of the tube difficult to observe at first. In addition to the pyritized area of the body mass, fine grains of pyrite line the tube from about halfway down its length and continue toward the apical area. The lower part of the body near the apex is more strongly pyritized than that above. However, examination of this area under higher magnification shows that it is not septate.

Discussion

The literature on Devonian "worm tubes" is so scattered and so full of misidentifications that we prefer not to assign our material to any previously named species. At least some of the Devonian species currently placed in the molluscan genus *Hyolithes* may be based on specimens of *Sphenothallus.* Because none of the Hunsrück specimens shows any particularly diagnostic features, it does not seem useful to introduce another specific name into the literature.

In spite of the limited details seen on the radiographs, what can be observed is informative. The presence of paired tentacles would seem to prove beyond question that *Sphenothallus* was indeed wormlike. The present material is simply not adequate to either assign this genus to a recent worm group or erect an extinct group for it. In spite of this, one may further generalize that other enigmatic tubes which paleontologists have assigned to this part of the animal kingdom are probably correctly identified as "worm tubes". We see no evidence of segmentation that would link *Sphenothallus* to the Annelida, but the evidence is unsufficient to state categorically that this genus is not segmented and therefore unrelated at the phylum level.

In the present-day fauna, all serpulid worms which build tubes construct them of calcium carbonate. No modern phosphatic worm tubes are known. This may reflect a difference at the ordinal level or higher. Until more is known of fossil worm tubes, we prefer to leave open all taxonomic categories above the generic level.

List of *Sphenothallus* specimens

WS No	Collection	Text-fig.	Remarks
515	Bavarian State Coll. Munich, BSP 1986 I 5	Fig. 2, 3	publ. as unknown fossil by Kutscher 1922
11295	Stürmer, Erlangen	Fig. 1	
11538	Brassel, Flensburg	Fig. 4	
12735	Will, Rockenhausen	Fig. 5a, b, c	

Literature

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Mason, Ch. & Yochelson, E. L. (1985): Some tubular fossils *(Sphenothallus:* »Vermes«) in the middle and late Paleozoic of the United States. – J. Paleont., **59**: 85–95.

Schmidt, W. & Teichmüller, M. (1956): Die Enträtselung eines bislang unbekannten Fossils im deutschen Oberkarbon, *Spenothallus stubblefieldi* n. sp., und die Art seines Auftretens. – Geol. Jb., **71**: 243–298.

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