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BIVALVE NATURE OF HUENE'S DINOSAUR *SUCCINODON*

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The revision of Lower Paleocene fossils identified as *Succinodon putzeri* by Huene (1941) showed that they represent remains of boring bivalves of the suborder Pholadina. The structure of tubes and the marine origin of rocks in which they occur make possible to assign them to *Kuphus* Guettard 1770.

K e y w o r d s: Teredinidae, Bivalvia, Montian.

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INTRODUCTION

The studies covered the material gathered in the course of field works conducted by Pożaryska within the frame of the research projects of the Museum of the Earth, Warsaw, in 1948—1950. The field studies were aimed at collecting paleontological material in Upper Cretaceous and Paleogene rocks cropping out in the gorge of the Vistula River through the Mid-Polish Uplands (fig. 1). The material gathered comes from Nasiłów near Bochotnica and comprises also nests of numerous tube-like shells, resembling tubes of bivalves of the *Teredo* group (pl. 4: 5, 6). Such tubes found in the same strata and locality during the W.W. II by German military geologist Putzer (1942) have been determined by von Huene (1941) as remains of a titanosaurid dinosaur. Huene (1941) erected for these remains a new genus and species *Succinodon putzeri*. Putzer published a paper in which he described the Uppermost Cretaceous section of the Middle Vistula gorge and made comparisons with the coeval rocks in north-western Germany (1942). The list of fossils from Vistula region Putzer supplemented by *Succinodon putzeri*, which, after him, would be the first Late Senonian dinosaur found in glauconitic marls in the vicinities of Bochotnica near Kazimierz upon Vistula River. After Putzer (1942),

these reptilians lived in neighbouring land area, which would also markedly change previous paleogeographic reconstructions. The analysis of "reptilian" remains found by Putzer carried out by Huene made it possible to identify imprints of jaw, i.e. premaxilla or dentary as well as contained teeth and tooth bases (Huene, 1941: 87). It seems both purposeful and indispensable to correct that scientific error even after 40 years, especially as *Succinodon putzeri* Huene is still being cited in specialistic works (e.g. by Steel 1970: 77). In the works, the genus *Succinodon* Huene was usually assigned to the subfamily Titanosaurinae Nopsca 1928, family Camarasauridae Cope, 1877. It should be also noted that rocks bearing those fossils were erroneously dated by Putzer (1942: 361) as the Campanian, whereas no rocks of that age crop out in the vicinities of Bochotnica village, wherefrom "*Succinodon putzeri*" was reported. The senior author made several unsuccessful attempts to get access to the material gathered by Putzer and housed in Tübingen (FRG), where Huene was working at that time, but it appeared that the material has been lost. The attempts to obtain to the material subsequently made by Dr. G. Alberti under inspiration of the senior author and Prof. E. Voigt (Geologisch-Paläontologishes Institut der Universität, Hamburg), also appeared unsuccessful. However, sketch drawings of the assumed reptilian remains, given by Huene (1941), make possible to state unequivocally that these were remains of boring organisms of the *Teredo* group identical as those described below (fig. 2). The material collected by the senior author, since 1979 has been studied by the junior author and the results are presented below.

Warm thanks are due to Professors E. Voigt and G. Alberti for their help in search for the Putzer-Huene's collection. Photos were made by Mrs. Elżbieta Wyrzykowska, Mr. Sławomir Woźniak and the drawings in the text by Ms. Elżbieta Gutkowska (Institute of Paleobiology, Polish Academy of Sciences, Warsaw). The material is housed at the Institute of Paleobiology, Polish Academy of Sciences, Warsaw, (abbreviated ZPAL).

BIO — AND LITHOSTRATIGRAPHY OF THE STRATA

The studied calcareous tubes were found in marly, glauconite-rich sandstones of early Paleocene age, characterized by the wealth of phosphatic nodules and redeposited Upper Cretaceous fossils. The materials were gathered in the quarry at Nasiłów near Bochotnica, Puławy region. In Bochotnica quarry (fig. 1*B*) there are also known the rocks of the same age and the same geological setting as in Nasiłów quarry on the other side of Vistula (fig. 1*A*). In the quarry at Nasiłów there are exploited Paleocene limestones and gaizes and Upper Maastrichtian limestones and opokas (opoka = compact calcareous sedimentary rock, containing a dozen

or so percent of silica: Pożaryska 1952). Glauconitic sandstone separates the two series and it corresponds to the contact of Cretaceous and Tertiary rocks with a stratigraphical hiatus. The section begins with white opokas, overlain by hard limestone layer about 0.5 m thick. Both opokas and limestone yield macro- and microfauna typical of the Upper Maastrichtian (Pożaryska 1952, 1967). These rocks are assigned to the *Belemnitella kasimiroviensis* Zone. According to a more detailed foraminifer zonation, the so-called *Pseudotextularia* Zone, corresponding to the uppermost Maastrichtian, after generally accepted European division, is missing here.

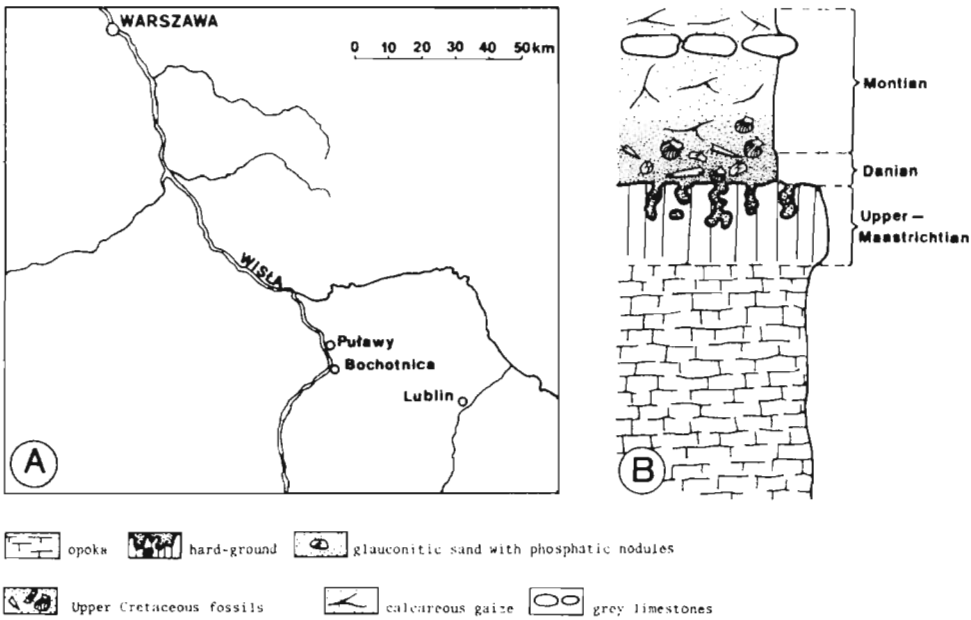

Fig. 1. *A* Location of quarries discussed; range of Early Paleocene deposits in the Mid-Polish Uplands, after Pożaryska 1967. *B* Geological profile in Bochotnica quarry.

Top surface of the hard limestone layer occurring at the top of series of Cretaceous opokas, is markedly uneven, cut by numerous channels of organic (*Thalassinoides*, teredinid tubes) and inorganic origin. The channels are infilled with sandy-glauconitic deposits, and the latter appears to be of early Paleocene age. It may be assigned to the *Globigerina daubjergensis* Zone, Middle Danian. This layer pass upwards into marly gaize, intercalated by layers of gray-coloured limestone nodules (called "siwak" in Polish). Rich foraminifer microfauna (Pożaryska 1965) and calcareous nannoplankton (Gaździcka 1975, 1978) evidence Montian age of the series.

DESCRIPTION

Suborder **Pholadina** Adams et Adams, 1858
Superfamily **Pholadacea** Lamarck, 1809
Family **Teredinidae** Rafinesque, 1815
Subfamily **Kuphinae** Tryon, 1862
Genus ?*Kuphus* Guettard, 1770
Kuphus sp.
(pl. 3 : 1—7; pl. 4 : 1—7)

Material. — Numerous calcareous tubes and their moulds, in places crowded in the rock. ZPAL Mo. XV/ 1—25.

Description. — Long, cylindrical tubes, circular in cross section, S-shaped, straight or slightly arcuate (pl. 3 : 3,5, 6*a*—*b*; pl. 4 : 7). Tube surface covered with numerous concentric lines varying in thickness (pl. 3 : 6 *b*). Tube walls are relatively thick. Longitudinal and transverse sections display their lamellar structure. Growth lamellae are parallel to one another and differentiated into the wide and dark and the narrow, light-coloured ones (pl. 3 : 1, 2, 4, 5). Beneath calcareous shell, there are transverse septa (pl. 3 : 4, 5; pl. 4 : 1—6; fig. 2 *g*). A single septum has a form of a shallow bowl, with ovate opening in the center, through which siphon was passing (fig. 1 *g*). The opening is surrounded by a very short collar prolongation, formed by bending of the septum downwards (pl. 4 : 1*a*, 3*a*, 4*b*). The septum is the thickest in the mid-height, in place of its maximum curvature, thinning out at tube walls and near central opening (pl. 4 : 1 *a*—c). Septa are built of homogeneous middle layer and their lower and upper surfaces are covered with very thin, mat, calcareous film (pl. 4 : 4, 5). The latter strongly react with HCL, whereas the middle layer does not react at all. Convex surface of the septum displays growth lines of white layer.

Dimensions:

tubes	septa
Length of tubes ca 100 mm	Intervals of septa 3 mm
Ø of tubes up to 15 mm	Longer Ø of opening 4.5 mm
Density of lines 4—6 per 1 mm	Shorter Ø of opening 3.0 mm
Walls thickness 0.5—1.3 mm	Maximum thickness of septum 0.3—0.5 mm
	Minimum thickness of septum 0.1 mm
	Ø of septum 7.5 mm

Remarks. — Calcareous tubes from Nasiłów appear similar to that of *Turnus dubius* Stanton, described from the "Lower Conglomerate" (Cretaceous) of Rio Tarde Canyon in Patagonia both in proportion of length to diameter, horizontal bowl-like septa, spaced at about the same intervals and concentric ornamentation (Stanton 1901 : 27, pl. 6 : 5—6). However, any closer affinities are precluded by the presence of shell with accessory plate (protoplax) in the latter (see Stanton 1901 : 28) Minute strongly reduced shell and the lack of acessory plates are characteristic of *Teredo*. In the case of fossil *Teredo* shell, the specific criteria mainly include length, cross-section and ornamentation of tubes and even the nature of deposit in which these bivalves occur (Turner 1969). Calcareous tubes from Nasiłów also resemble moulds of tubes from the Upper Cretaceous of eastern Madagascar, assigned to *Teredo* sp. by Cottreau (1922 : 51, pl. 6 : 8,8*a*). The lack of other skeletal elements except tubes, precluded any specific identification but it did not exclude their affiliation with boring bivalves of *Teredo* type, presumably living in mud at the sea floor (Cottreau 1922).

As it was stated above, bivalves with calcarcous tubes from Nasiłów also lived in deposits of markedly shallowed sea basin. According to the published data representatives of Pholadacea are known in various environments from typical marine to brackish even freshwater, from Jurassic to Recent, (?Carboniferous). They are adapted to boring channels in relatively hard substratum: stiff clays, wood, peat, soft and brittle rocks as well as corals and shells (Turner 1969). From the *Nummulite* Marls of south-eastern France, Gitton (1978 : 102, pl. 15 : 16, 20) reported two species: *Teredo* sp. A and *Teredo* sp. B., the tubes of which were always found in different substrata. *Teredo* sp. A was found in plant remains, and *Teredo* sp. B — in sea floor deposits. The tubes of these species differ markedly: *Teredo* sp. A is characterized by short, thin-walled tubes, rarely attaining 8 mm in diameter, and *Teredo* sp. B — by long, thick-walled tubes usually about 100 mm long and up to 15 mm in diameter (Gitton 1978), similar as the tubes from Nasiłów. Gitton assigned both species to the subfamily Teredininae Rafinesque, 1815. However, taking into account the character of the tubes from Nasiłów and mode of life of those bivalves it appears that these specimens as well as those described as *Teredo* sp. B by Gitton would be better accomodated in the subfamily Kuphinae Tryon, 1862. Bivalves of that family are very rarely encountered in wood, being common in more or less hard sea-floor deposits (Turner 1969; Cox *et al.* 1969), especially in marly limestones e.g pallets, tubes and shells of *Teredo* cf. *norvegica* Spengler, described from the Helvetian of the Husteckaja seria behind Carpathian area (USSR) by Korobkov (1954: 220). To the genus *Kuphus* Guettard are assigned as its junior synonyms some genera: *Septaria* Lamarck, *Cloisonnaria* Adams, *Furcella* Lamarck, *Cyphus* Fischer, characterized by similar features as tubes from Nasiłów (Moll 1942; Turner 1969), and being included previously to so called *Teredo norvegica* group (Moll 1942). In the description of *Teredo norvegica* Spengler is given that distal part of its tubes were opened outwards and closed by septa with ovate opening in the center. Every of these septa was serving for some time as a place for attachment of pallets (Franc 1960), the small calcareous structures closing the end of tube when siphons are retracted.

DISCUSSION

The description and figures given by Huene clearly show that we are dealing here with misidentification of tubes of teredinid bivalves as "reptilian teeth and their bases placed in "jaws". The specimens from Huene's fig. 1*a*, reprinted in this paper in fig. 2*a*, fully corespond to our specimen on fig. 2*a'*. The tube is characterized by similarly elongate outline as well as subcircular section in its upper part and flattened due to squeezing in the lower part. The fragment interpreteted by Huene as "jaw" with "tooth bases" (this paper fig. 2*a*—*f*) may be compared with a block displaying a number of tubes adjoining one another (pl. 4: 6; fig. 2*d'*). Dimensions of "teeth" reported by Huene, closely correspond to those measured on the studied *Teredo*-like tubes figured here. Moreover, ring-like constrictions, interpreted here as places where septa are developed, are similar in the Huene's and our specimens) pl. 3: 5; pl. 4: 3*b*, 5, 7). The layers of tube walls, were presumably misidentified as dentine and enamel respectively, the inner of which is mat (fig. 2*b*, upper cross section) and the outer is smooth and glossy.

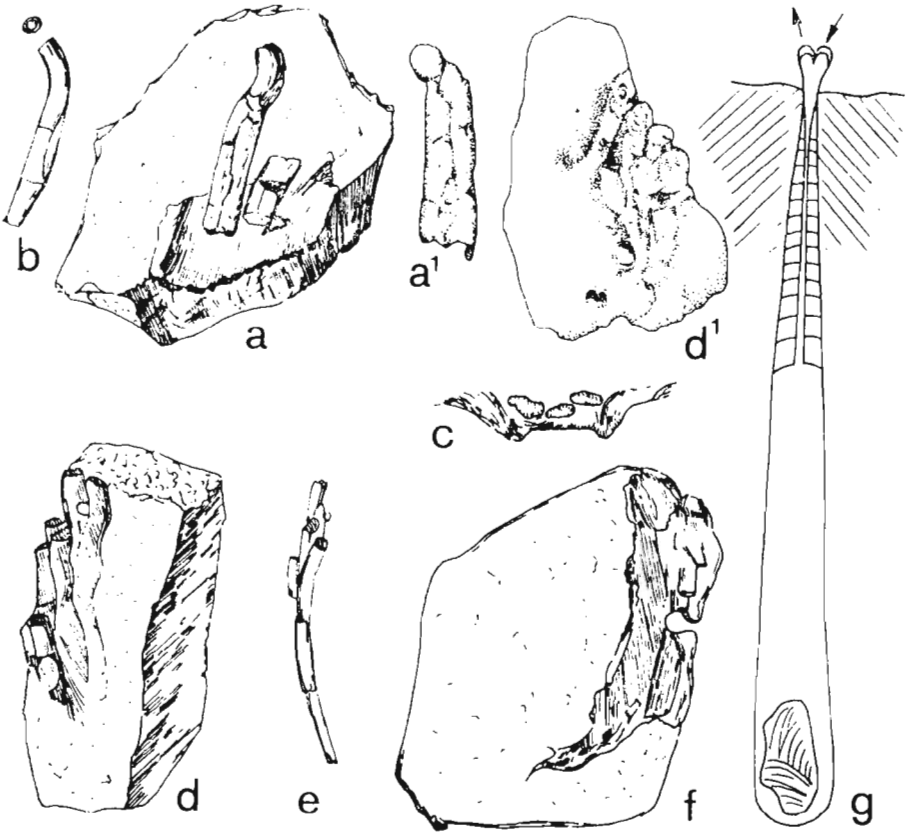

Fig. 2. *a*—*f* "Jaws" and "teeth" fragments, after Huene (1941: fig. 1), *a'* and *d'* tubes of *Kuphus* sp. from Nasiłów described in this paper: *a* fragment of a "jaw with tooth", *a'* fragment of a tube in side view, *b* side view and two cross sections of a "tooth", *c* three "tooth bases" in side view, *d* and *e* fragment of a "jaw" with numerous "tooth bases" side views, *d'* fragment of rock with tubes, *f* another fragment of "jaw" figured in *2d*, *g* reconstruction of a bivalve *Kuphus* sp. in life position in its tube, with septa and siphons marked (original).

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MAŁŻOWY CHARAKTER RZEKOMEGO DINOZAURA *SUCCINODON* HUENE, 1941

Streszczenie

Badania dolnopaleoceńskich skamieniałości z piaskowców glaukonitowych okolic Puław (fig. 1) identyfikowanych jako szczęki i zęby dinozaura *Succinodon* Huene, 1941 (fig. 2), wykazały, że są to szczątki borujących małżów z podrzędu Pholadina (pls. 3, 4). Budowa rurek tych małżów, występujących w morskich osadach, pozwoliła określić ich przypuszczalną przynależność do rodzaju *Kuphus* Guettard, 1770.

EXPLANATION OF PLATES 1 AND 2

Plate 3

Kuphus sp., Nasiłów, Montian

1. Transvers section of tube, ZPAL Mo.XV/12; note the course of light and dark growth lamellae, ×30.
2. Longitudinal section of tube, ZPAL Mo.XV/13; note parallel arrangement of growth lamellae, ×30.
3. Arcuate tube with uneven, rough surface, ZPAL Mo.XV/2 ×1.5.
4. Fragment of tube in upper (*a*) and side (*b*) views, ZPAL Mo.XV/17; note contact of septum and tube wall in *b*; ×5 and ×10, respectively.
5. Fragment of tube with preserved septa, ZPAL Mo.XV/14; contact of septa and tube wall, ×5.
6. Tube with long straight section, ZPAL Mo.XV/1: *a* twisted terminal part, *b* club-like swelling in twisted part of the tube and well developed ornamentation, ×2.
7. Tube squeezed, except for its upper part, ZPAL Mo.XV/4, ×1.5.

Plate 4

Kuphus sp., Nasiłów, Montian

1. Fragment of isolated septum, ZPAL Mo.XV/15: *a* concave inner side, *b* convex outer side, *c* outer margin, ×10.
2. Apertural part of tube displaying fragments of three septa, ZPAL Mo.XV/8, ×5.
3. Fragment of tube, ZPAL Mo.XV/10: *a* septum with central ovate opening seen from above, *b* the same specimen in side view, ×5.
4. Internal mould of tube, ZPAL Mo.XV/9: *a* side view of specimen with 4 bowl-like septa, *b* septum with central opening, seen from below, ×5.
5. Numerous imprints of tubes, randomly arranged in rock, ZPAL Mo.XV/20, septa preserved in one of the specimens, ×1.
6. Numerous tubes and their moulds displaying a marked orientation, ZPAL Mo.XV/21, ×1.
7. S-shaped mould of tube, ZPAL Mo.XV/16; note constructions and swellings, ×1.5.


1


3


2


4a


5

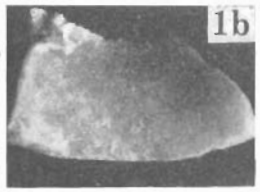

6a


6b


7


4b


1a


1b


1c


2


3a


4a


4b


3b


7


6