New Spirillinidae (Foraminifera) from the Dogger of Lókút (Transdanubian Central Range, Hungary)

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Abstract
From thin sections of Middle Jurassic pebbles in the Late Bajocian megabreccia near Lókút (Transdanubian Central Range, Hungary) biloculine Spirillinina with thickenings of either the umbilical or the umbilical and spiral sides of the test are described. Most of the fauna is new: Hungarillina n. gen. (H. lokutiense n. gen., n. sp., H. media n. gen., n. sp., H. pedunculata n. gen., n. sp.), Radiospirillina n. gen. (Radiospirillina umbonata n. gen., n. sp.), Spirilliconus n. gen. (S. corinnae n. gen., n. sp.). These forms strongly resemble species of the Involutinina in morphology but can be clearly separated by the monocrystalline deuteroloculus walls and the hyalino-radial plugs.

The optical characteristics and the influence of diagenesis on the optical behavior of the foraminiferal test walls are presented. The microfacies and the faunal associations indicate an open marine, circalittoral, and relatively deep depositional environment.

Key words
Foraminifera, Spirillinina, Dogger, Bakony Mts., Hungary, Hungarillina n. gen., Radiospirillina n. gen., Spirilliconus n. gen.

Zusammenfassung

Das kristalloptische Verhalten sowie der Einfluß diagenetischer Prozesse auf das optische Verhalten der Foraminiferengehäuse werden dargestellt. Die Mikrofacies und die Faunenvergesellschaftung deuten auf einen offenmarinen, circalittoralen und relativ tiefen Ablagerungsraum hin.

Schlüsselworte
Foraminifera, Spirillinina, Dogger, Bakony Gebirge, Ungarn, Hungarillina n. gen., Radiospirillina n. gen., Spirilliconus n. gen.

Résumé

Mots clés
Foraminifera, Spirillinina, Dogger, Montagne de Bakony, Hongrie, Hungarillina n. gen., Radiospirillina n. gen., Spirilliconus n. gen.

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I. INTRODUCTION

In 1989 BLAU described *Aulotortus (?) bakonyensis* BLAU, an involutinid foraminifer, from Middle Jurassic brachiopodal limestone pebbles in a megabreccia near Lókút (Figs. 1, 2) in the Bakony Mts. (Transdanubian Central Range, Hungary). The author pointed out, that *Aulotortus (?) bakonyensis* is in association with spirillinids - the latter ones being the subject for a forthcoming paper. Now, a decade later, we present the first part of the spirillinid fauna.

During our work it became evident, that several questions concerning the observations of pluriloculine spirillinids either in thin sections or on isolated specimens are unresolved and cannot be answered yet. Therefore our work is restricted (1) to the biloculine spirillinids and (2) among these to forms bearing umbilical and/or spiral masses covering the deuteroloculus.

II. GEOLOGICAL SETTING

The uppermost Triassic and partially the Lower Liassic in the Bakony Mts. (Transdanubian Central Range) is represented by thick carbonate platform sediments (Dachstein and Dachstein-type limestone, Kardosrét limestone; e.g. GALACZ, 1984; KAZMER, 1986; HAAS, 1988). These carbonate platforms started to drown either in the Late Trias (Rhaetian) or in the Early Lias. The timing of the collapse is equivalent to the breakdown of the Late Triassic carbonate platforms in the Austroalpine and the Southern Alpine areas (e.g. AUBOIN, 1963; WIEDENMAYER, 1963; KALIN & TRUMPY, 1977; WINTERER & BOSELLINI, 1981; BLAU & SCHMIDT, 1988; BÖHM et al., 1995) induced by the thinning of the continental crust due to the Ligurian rifting as summarized in SCHMIDT et al., 1991.

Consequently, the Jurassic sequences of the Bakony Mts. were affected by the same processes. This can be demonstrated at several localities in the Transdanubian Central Range, e.g. Tata (FÜLÖP, 1976) and Sümeg (HAAS et al., 1985).

The area of Lókút was mapped by several authors and a geological map eventually compiled by KONDA (1970), who attributed a red brachiopod bearing limestone resting on Rhaetian Dachsteinkalk (artificial ravine at Fenyveskut S of Lókút, no. 8 on KONDA’s map; see Fig. 2a in the present paper) to the Pliensbachian. It is noteworthy, that KONDA (1970) already saw a hiatus between the Dachsteinkalk and the deposition of the red limestone facies. GALACZ (1988) reinvestigated this section and found it to represent a polymict megabreccia with components of Dachsteinkalk, Sinemurian brachiopodal limestone, Pliensbachian brachiopodal-ammonitic limestone, Toarcian ammonitic limestone, Cretaceous, Blancan (Tithonian-Lower Cretaceous), Radiolites, Red Bostitra lat. with magabreccias (U. Bajoc.), Cherty Bostitra lat. (Toarcian-Bathonian), Glauconitic crinoidal lat. (Toarcian), Grey and red cherty lat. (Pliensbachian), <Heitzov> lat. (Sinemurian-Pliensbachian), Crinoidi/brachiopodal lat. (Sinem.-Pliensb.), Neptunian dykes (Lias), Dachstein lat. (Rhaetian), Hauptdolomit (Norian).
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and Middle Bajocian brachiopodal-ammonitic limestone. These pebbles swim in a matrix of Late Bajocian Bositra limestone (GALACZ, 1988: fig. 5; see also Fig. 2b in the present paper).

For the interpretation of the tectonic regime it is interesting that the formation of the Fenyveskút megabreccia took place in the Dogger. The Ligurian rifting produced tilted block tectonics and corresponding sedimentologic environments in the Southern Alpine and the Upper Austroalpine areas that can be dated to the Late Trias/Early Lias. Later on (Dogger) a transpressive regime formed pull apart basins and push up ridges with corresponding sediments in the Austroalpine area (SCHMIDT et al., 1991: 226). Therefore the Fenyveskút megabreccia is not necessarily a product of the synrift phase but can also indicate strike-slip movements in the Dogger of the Bakony Mts.

III. MATERIAL

During a field trip led by M. KAZMÉR and A. GALACZ in 1986, one of the present authors (J.B.) collected material from the mentioned pebbles. Samples of the Early Lias yielded rich involutinid faunas published in BLAU & HAAS (1991, sample number 1576). Samples of bricked micritic limestone pebbles could be dated due to brachiopods (cf. Linguithyris sp., det. A. GALACZ) as Dogger in age. Spirillinid foraminifers of these samples are the subject of the present study. Samples have been taken from several pebbles numbered individually, and a series of thin sections was produced from each of the samples. The thin section numbers of the figured specimens are documented in the plate captions, the numbers refer to the sample number, the respective suffix indicates specific thin sections.

The thin sections are deposited in the collection of J. BLAU which is housed at the Institut für Angewandte Geowissenschaften, Justus-Liebig-University, Gießen.

IV. TAXONOMIC PROBLEMS

In this chapter we characterize the thin sections microfacially, discuss the wall diagenesis of some foraminifers and selected other microfossils and describe the optical characters of the spirillinids and the resulting problems.

Microfacies, faunal associations and depositional environment

In thin section the limestones appear pinkish, microfacially they represent mudstones to wackestones with abundant small foraminifers, various other microfossils and fine grained bioclasts (see below). Apart from Globochaeta, photosynthetic algae are absent. According to SKOMPSKI (1982), Globochaeta is most similar to the recent green algae family Chlorosphaeraceae, the genera comprised in the family «live either free, without any relation to a substrate, or epi- and endophytically» (SKOMPSKI, 1982: 52). The occurrence of Globochaeta therefore gives no hint for the depositional depth, but clearly indicates an open marine environment.

In order to facilitate the discussion concerning the foraminifers’ wall and the diagenetic processes, the different encountered taxa are summarized in groups defined by short characteristics:

1) Two chambered (proloculus + deuteroloculus) foraminifers with monocristalline deuteroloculus wall and hyaline-radiate umbilical or spiral and umbilical masses (plugs):
   - Hungarillina n. gen.
   - Radiospirillina n. gen.
   - Spirilliconus n. gen.

2) Triplanar or trochospiral foraminifers with a monocristalline test without umbilical or spiral and umbilical masses:
   - «Spirillina» EHRENBERG (auct). This group includes tests with a streptospiral embryonic stage resembling Glomospirella in morphology.
   - Tethysiella BLAU

3) Foraminifers with pluriloculine test and a monocristalline wall:
   - Paalzowella CUSHMAN
   - Trispirina DANICH

4) Foraminifers with pluriloculine test and a hyaline-radiate wall:
   - Lenticulina div. sp.
   - Nodosaria div. sp.
   - Nodosariidae

5) Original aragonitic wall, sparicalcite due to diageneisis:
   - Turrispirillina CUSHMAN
   - Aulotortus (? ) bakonyensis BLAU
   - Epistominids
   - Protoglobigerinids
   - Microgastropods
   - Ammonites

6) Various other microfossils:
   - Rhyncholites
   - Aptychi
   - Ostracods
   - Crinoids
   - Globochaeta
   - Brachiopods
   - Ferruginous microstromatolites
   - Bositra «filaments».

This microfossil association has been found in almost each of the investigated samples. None of the respective
thin sections shows signs of reworking, therefore we suppose all associations as autochtonous. Some of the fossils are nektonic (ammonites, aptychi, rhyncholites), other are believed to be planktonic (protoplanticerids, Globochaeae, Bositra «filaments»), and at least most of the foraminiferal fauna and the brachiopods are benthic faunal elements.

**Interpretation**

At the present stage of our knowledge, these fossil associations indicate a calm, open sea milieu, relatively deep (circalittoral), and far away (or even protected) from any continental or shallow marine carbonate platform detritus influx. The depositional depth was below the euphotic zone and above the Aragonite Compensation Depth (ACD). Although we have no information about the microfacies of the Pliensbachian and Toarcian pebbles of the Fenyvesküt Breccia, the Sinemurian and Dogger pebbles indicate more or less the same depositional depth. This implies, that brecciation and transport of the pebbles took place in relatively deep water and rules out the formation of the Fenyvesküt Breccia as a result of a «transgressive» event. We agree with the (small scale) model for the depositional environment of GALACZ (1988: fig. 6), which leaves open the question of the overregional tectonic regime.

**Optical characteristics and the influence of diagenesis on the foraminiferal test walls**

In our material the microfossil groups described above (1-6) own clearly distinguishable optical characters of the test walls when viewed in normal and polarized (crossed nics) light.

A) The monocrystalline wall (groups 1 to 3) is translucent, «dense», yellowish, with sharp contours. Very small black grains can be often observed in this wall. Sometimes they are more or less aligned and seem to follow internal layers of the wall (pl. 1, fig. 12; pl. 2, figs. 8, 9). The monocrystalline wall is relatively resistant against diagenetic processes. The worst preserved tests sometimes show few sharp and indented edges of the wall. These can be explained as epitaxial (syntactical) overgrowths.

B) The hyaline-radiate umbilical and/or spiral masses (plugs) of the genera in group 1 are formed by relatively thick ascicular calcite crystals. These are well visible under crossed nicols. The ultrastructure is coarser than in the wall of the Nodosariidae.

C) The hyaline-radiate calcitic wall of Nodosariidae (group 4) appears typically silky, very finely radiate showing a sharp black cross under crossed nicols. From a light optical point of view, this wall very rarely becomes altered by diagenesis.

D) Aragonitic foraminiferal testwalls (group 5) are always altered by diagenesis in our samples (see BLAU, 1989). The walls are recrystallized to a sparry calcite mosaic which appears white greyish with blurred contours in translucent light. The walls of the associated ammonites and microgastropods follow the same scheme of alteration.

E) The wall structures of each of the microfossils of group 6 differ in their composition from the above mentioned groups.

**Test wall observations under polarized light**

DIENI & MASSARI (1965), HOHENEGGER & PILLER (1977) and BELLEMO (1980) presented different observations on spirillinids under polarized light and interpretations on the wall ultrastructure. Because the tests of Spirillina are very flat and hyaline, light microscopical observations under crossed nicols are generally based on isolated specimens (immersed or not in water or oil) and not on oriented sections. Of course the recent species have empty tests (or full of cytoplasm), therefore one might forget that the fossil individuals are in the most cases full of diageneric calcite which largely participates then to the figures visible under crossed nicols. This fundamental point of the test wall analysis has not been evocated well enough in the literature. Following our observations (WERNLI, 1971), the figures of fossil isolated tests under crossed nicols are strongly modified by the nature and the crystallography of the diageneric infilling of the tube. Therefore ultrastructural interpretations based on the figures under crossed nicols must be made very carefully. However, it is demonstrated that in many cases the diageneric infilling of the void of the test has been grown epitaxial (syntactical). In this case the figures produced under crossed nicols are similar to those of the unaltered test or even intensified. Nevertheless, the diageneric infilling may also be radial, microgranular or of any other type. In this cases the figures produced by crossed nicols become modified in respect to those of unaltered tests and it is very difficult to discriminate the effects due to the wall ultrastructure from those due to the infilling of the tube. Only more refined analysis of fossil empty shells and/or oriented sections can resolve the problem.

**V. SYSTEMATICS**

The suprageneric classification of the foraminifera dealt herein follows LOEBLICH & TAPPAN (1988).
Family Spirillinidae Reuss & Fritsch, 1861
Genus Hungarillina n. gen.

Type species: Hungarillina lokutiense n. gen., n. sp.

Derivatio nominis: Artificial word composed of Hungary and Spirillina.

Diagnosis: Hungarillina n. gen. is a biloculine spirillinid with a globular proloculus and an undivided tube-like deuteroleocus. The deuteroleocus is middle to high trochospiral. The wall of the deuteroleocus tube is of monocrystalline calcite. The umbilicus is either completely or partially filled by a mass (columella, plug) of test material composed of hyaline-radiate calcite crystals.


Following LOEBLICH & TAPPAN (1988) the other known non septate trochospiral genera of the Spirillinidae (with monocrystalline wall) differ from Hungarillina n. gen. by the following characters: Conicospirillina CUSHMAN has no umbilical mass. The last whorls of the tube are more or less involute on the umbilicus.

Mychostomina BERTHELIN has a trochospiral tube with particular structures on the umbilical side.

Turrispirillina CUSHMAN (included by us in the Involutinina because its wall is probably originally aragonitic - a reinvestigation of the type material is necessary to clarify the nature of the test) has a deuteroleocus tube with evolute whorls on the spiral side and an empty umbilicus.

Tethysiella BLAU (= Praepatellina BLAU, junior homonym) has a very high trochospiral deuteroleocus tube and an empty umbilicus.

Spirotrocholina AZBEL has a trochospiral deuteroleocus tube with quadrangular transverse section, and nodosities (short «tubules») on the spiral side. The umbilicus is occupied by a straight axial columnella which is connected with the umbilical wall by a helicoidal lamella. This structure forms a spiral canal. The tube wall is made of monocrystalline calcite.

The genus is based on Spirotrocholina incerta (Svetovostokova-Khabarova) of the Russian Oxfordian. However, in the original description AZBEL (1986) includes Spirotrocholina grandulata (CORDEY) in the genus. The latter one belongs to Trocholina (Involutinina) because its test is composed of aragonite.

Probably there are phylectic relationships between Hungarillina n. gen. and Spirotrocholina: Hungarillina pedunculata n. gen., n. sp. shows a pillar-like columnella but is free and not connected with the internal (= umbilical) flanks of the deuteroleocus tube.

The Patellinidae RHUMBLER are either partly or entirely pluriloculine. Other homeomorphic genera described in the literature have an aragonitic wall recrystalized to calcispar and therefore belong to the Involutinina. In particular Ichnusella DIENI & MASSARI originally described with a calcitic monocrystalline tube is now considered (PILLER, 1983; LOEBLICH & TAPPAN, 1988) as junior synonym of Trocholina.

Discussion: OESTERLE (1968: 772) figured a thin section of an isolated specimen from the type series of Trocholina nodulosa SEIBOLD & SEIBOLD. This shows exactly the same crystallography of the deuteroleocus and the umbilical plug as our specimens. OESTERLE therefore placed the species in Ichnusella DIENI & MASSARI. As discussed above, Ichnusella is considered as a junior synonym of Trocholina. We include Trocholina nodulosa SEIBOLD & SEIBOLD in Hungarillina n. gen.

Hungarillina lokutiense n. gen., n. sp.

Pl. I, figs. 1-17

Derivatio nominis: The name is derived from the finding locality Lókút.

Holotype: The specimen to Pl. I, figs. 4, 5.

Locus typicus: Fenyveskút, Bakony Mts., Hungary.

Stratum typicum: Pebbles of brickred limestones from the Fenyveskút Breccia, Dogger in age.

Material: About 50 randomly oriented specimens in thin section.

Differential diagnosis: Hungarillina lokutiense n. gen., n. sp. differs by its high spired conical test and the completely filled umbilicus from all other known species of the genus.

Description: The test is high conical and bell-shaped. The tubular deuteroleocus is enrolled high trochospiral, in axial sections the tube is ovate in the first whorls and becomes more flattened in the last ones. In the adult stage the deuteroleocus tube measures about 50 microns in width and 20 microns in height. The height/diameter ratio of the test varies between 0.8 and 1.1, the mean value is 1.0.

The umbilicus of the test is occupied completely by a plug consisting of dense hyaline-radiate calcite crystals. The umbilical side is flat or slightly convex. The deuteroleocus wall consists of hyaline compact monocrystalline calcite with well defined contours. Regularly very small dark grains which are aligned more or less in the median position of the wall can be observed. These perhaps indicate a double layered wall (e.g. Pl. I, figs. 8, 12, 16). Because the thickness of the deuteroleocus wall is the same between the whors as well as in the external flanks of the test, the deuteroleocus seems to be a hemitube. No pores have been observed in this wall. This is most probably an effect of the diag­n­esis because all modern Spirillinitids have pores.
Hungarillina media n. gen., n. sp.

Pl. II, figs. 1, 2

Derivatio nominis: From medium (Latin): middle.

Holotypus: The specimen to Pl. II, fig. 1 (normal light), 2 (crossed nicols).


Stratum typicum: Pebbles of brickred limestones from the Fenyveskút Breccia, Dogger in age.

Material: 1 specimen in thin section.

Differential diagnosis: Hungarillina media n. gen., n. sp. differs by its medium high spired test and the partly filled umbilicus from all other known species of the genus.

Description: The test is middle high, the deuteroloculus tube is enrolled trochospirally with about 6 whorls increasing regularly in diameter. The transverse section of the tube is hemicircular in the juvenil part and becomes more compressed and arched later. The umbilicus is filled by a mass of calcitic, radial crystals. The umbilical plug is bound to the initial 4-5 deuteroloculus whorls, while the last 1-2 whorls are free and separated from the plug leaving the umbilicus widely open. The umilical plug is projected slightly to exterior. On the spiral side the suture between the whorls is flush in the juvenile stage to slightly depressed in the adult stage.

The deuteroloculus wall is calcitic, hyaline, monocristalline, the umilical plug is radiate and composed of rather coarse ascicular crystals. This becomes evident under crossed nicols: The tube wall extincts at different angle from the rest of the test. Often the extinction of the diagenetic infilling of the tube is syntaxial.

Hungarillina pedunculata n. gen., n. sp.

Pl. II, fig. 4

Derivatio nominis: From pedunculus (Latin): peduncle.

Holotypus: The specimen to Pl. II, fig. 4.


Stratum typicum: Pebbles of brickred limestones from the Fenyveskút Breccia, Dogger in age.

Material: 1 specimen in thin section.

Differential diagnosis: Hungarillina pedunculata n. gen., n. sp. differs by its convex to hemispherical test and a peduncle in the umbilicus which is connected only with the juvenile part of the test from all other known species of the genus.

Description: This species of Hungarillina n. gen. resembles a low bell with its clapper in morphology. The height/diameter ratio of the test is about 0.4-0.5. The deuteroloculus is middle to low trochospiral, the spiral side of the test is convex to hemispherical. In axial sections the deuteroloculus hemitube is hemicircular with flush to slightly depressed sutures on spiral and umbilical sides.

The umbilical cavity is widely opened, concave, and bears in its center an axial peduncle. This claviform appendix is connected to the test at the proloculus and the juvenil whorls.

The deuteroloculus wall structure is calcitic hyaline, monocristalline and the structure of the peduncle radiate. Viewed under crossed nicols the extinction of the deuteroloculus wall is not strictly complete for all the whorls but wanders gradually from one whorl to the next. This phenomenon is well known in some Spirillina (Dieni & Massari, 1964, Wernli, 1971) and due to a slowly change of the orientation of the principal optic axis during ontogenesis.

Subaxial sections of this species which are not cutting the peduncle could be confused with those of Conicospirillina.

Radiospirillina n. gen.

Type species: Radiospirillina umbonata n. gen., n. sp.

Derivatio nominis: Combination from Latin «radius» and Spirillina, the name was choosen in order to describe the radial thickenings on both sides of the test.

Diagnosis: The genus comprises bilocular planispiral spirillinids with thickenings composed of hyaline radiate calcite on both sides of the test.

Description: The lenticular more or less umbonate tests have a proloculus followed by a tubular planispiral monocristalline deuteroloculus. Both sides of the test are axially thickenened by masses of hyaline radial calcite. These plugs can be restricted either to the initial whorls of the spire or cover the entire sides.

The crystallographic features of Radiospirillina are clearly evident in axial sections viewed under crossed nicols: The deuteroloculus wall totally extincts indicating a monocristalline wall, while the lateral radiate plugs show a black cross.

The detailed architecture of the embryonic stage is not clear. The first whorls of the deuteroloculus could be entirely planispiral or streptospiral. In fact this juvenarium seems to show polarization figures different from that of the rest of the test (Pl. II, fig. 7).
Comparisons: *Pachyspirillina* RUGGIERI & GIUNTA (1965: 408) differs from the new genus by irregularly thickened, pustulous and nodulous spiral and umbilical sides (RUGGIERI & GIUNTA, 1965). We can interpret from the original figures of RUGGIERI & GIUANTA (1965: pl. II, figs. 2, 4, 6) that the «lateral thickening» of the test could probably be due to subaxial, centered but oblique sections.

**Remarks:** *Radiospirillina* n. gen. actually includes *R. umbonata* n. gen., n. sp. and *R. involutinoides* (RUGGIERI & GIUNTA), the latter one originally assigned with «?» to *Pachyspirillina*. It is remarkable that the new genus perfectly resembles the genus *Involutina* (SCHLUMBERGER) in morphology. Perfectly equatorial sections of *Radiospirillina* n. gen. are undistinguishable from those of *Spirillina*.

*Radiospirillina umbonata* n. gen., n. sp.

Pl. II, figs. 3, 5-8

**Derivatio nominis:** From umbo (Lat.): small shield, bump.

**Holotype:** The specimen to Pl. II, figs. 7 (normal light) and 8 (crossed nicols).

**Locus typicus:** Fényveskút S’ of Lókút, Bakony Mts., Hungary.

**Stratum typicum:** Pebbles of brickred limestones from the Fényveskút Breccia, Dogger in age.

**Material:** 40 specimens in thin section.

**Differential diagnosis:** *Radiospirillina* covered completely on both sides of the test by hyalino-radial test material.

**Description:** The test is lenticular (biconvex) and composed of a planispiral deuteroloculus tube with monocrystalline wall. In axial section the tube can be slightly arched. It increases regularly in size. Both sides of the test are covered by thick masses of hyaline-radiate calcite forming lateral (axial, umbonal) plugs. These lateral plugs cover all whorls of the tube. The lightoptical features are already mentioned in the generic description.

*Radiospirillina involutinoides* (RUGGIERI & GIUNTA)

Pl. II, figs. 9, 10, 15.

1965. *Pachyspirillina* (?) involutinoides n. sp.- RUGGIERI & GIUNTA, p. 409, pl. 2, figs. 20-22, text-figs. 4i, n. q.

**Material:** 2 specimens in thin section.

**Differential diagnosis:** *Radiospirillina* covered in the juvenile part of the test by umbilical masses on both sides.

**Description:** The species *involutinoides* RUGGIERI & GIUNTA was originally attributed with doubt to the genus *Pachyspirillina* by RUGGIERI & GIUNTA and is here placed in *Radiospirillina* n. gen. In fact this species exhibits two biconvex hyaline-radiate plugs on the juvenile part of the test and corresponds therefore well to *Radiospirillina*. The last 2-4 whorls remain uncovered.

**Remarks:** Probable phyletic relations between *Spirilliconus* n. gen. and *Radiospirillinas* n. gen. are demonstrated by some specimens of the latter genus which show a very slightly trochospiral coiling of the deuteroloculus tube (Pl. II, fig. 7).

*Spirilliconus* n. gen.

**Type species:** *Spirilliconus corinnae* n. gen., n. sp.

**Derivatio nominis:** Combination from Latin conus and *Spirillina*, the name was chosen in order to describe the conical enrolled deuteroloculus tube.

**Diagnosis:** Biloculine spirillinid with trochspirally coiled deuteroloculus tube, deuteroloculus wall monocrystalline. The Spiral and umbilical sides are covered either partially or completely by inequal plugs of hyaline radiate calcite.

*Spirilliconus corinnae* n. gen., n. sp.

Pl. II, figs. 11-14


**Derivatio nominis:** Dedicated to Corinne Charvet, Muséum d’histoire naturelle de Genève.

**Holotype:** The specimen to Pl. II, figs. 11 (normal light) and 13 (crossed nicols).

**Locus typicus:** Fényveskút S’ of Lókút, Bakony Mts., Hungary.

**Stratum typicum:** Pebbles of brickred limestones from the Fényveskút Breccia, Dogger in age.

**Material:** 30 specimens in thin section.

**Differential diagnosis:** At the moment, the genus is monospecific.

**Description:** The test is composed of a trochospiral deuteroloculus tube with monocrystalline wall. The juvenile part (5-6 whorls) is only slightly trochospiral and covered on the spiral and umbilical sides by plugs of hyaline-radiate calcite. The adult stage (1-2 whorls) is high trochospiral and remains uncovered. In axial sections, the deuteroloculus hemitube, is hemi-circular, slightly arched, and the suture is visible. Under crossed nicols the tube wall extincts totally indicating a monocrystalline structure while the spiral and umbilical lateral plugs show a black cross typical for radiate calcite crystals. The wall seems to be imperforate, but pores might be filled with syntaxial cement during diagenesis. The largest diameter of the test is about 340 microns, and the height/diameter ratio of the cone is around 0.3.

**Remarks:** Despite the different test composition *Spirilliconus corinnae* n. gen., n. sp. resembles strongly *Piriniella blindi* BLAU in overall morphology. In the latter species, the juvenile part of the test is also slightly
trochospiral and covered by test material on both sides. In the umbilical mass of the species develops a canal system (see BLAU, 1987; pl. 3, fig. 1). The adult stage of *Piriniella blindi* BLAU remains uncovered and forms a higher spire.

Comparisons of *Spirilliconus corinnae* n. gen., n. sp. with isolated tests described from washable rocks are difficult because of the lack of information about their wall composition.

CONCLUSIONS

Middle Jurassic pebbles in the Late Bajocian megabrec­cia near Lőkút (Transdanubian Central Range, Hungary) yield a rich spirilllinid (Foraminifera) fauna. Among these the biloculine Spirillinina with plugs either on the umbilical or on both sides of the deuterolocus spire are described.

In overall morphology, these forms strongly resemble genera of the *Involutinina* HOHENEGGER & PILLER (1975), e.g. *Trocholina* and *Involutina*. Nevertheless, in thin sections the spirilllinids are clearly separable by light optical methods: The deuterolocus wall always is monocrystalline while the test thickenings (plugs) are hyaline-radiate. This is documented by several figures in the present paper. On the other hand, if not exceptional­ly well preserved, the original aragonitic involutinids are normally recrystallized and in thin section the test appears as a mosaic of sparry calcite.

Other yet undescribed biloculine spirilllinids of the Hungarian samples again are homeomorphous with Textulariina like *Glomospirella* or *Involutinina* like *Turrispirillina lavanta* BLAU. These forms as well as the multiloculine spirilllinids are hardly to determine at the moment, because few information in terms of orient­ed sections and crystallographic features are available in the literature. This is truely a task for the future.

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Plate I

Because the deuterolocus tube and the radial columella have different extinction angles in polarized light, all sections are illustrated under variable crossed nicols angles in order to show better the internal structures of the tests. N. L.: Normal light, P. L.: Polarized light. All sections are axial or subaxial if not indicated. Enlargement for all figures: approximately 200x.

*Hungarillina lokutiense* n. gen., n. sp.

- Fig. 1: sample 1577-6, N. L., slightly irregular individual.
- Fig. 2: sample 1574, N. L., oblique section.
- Fig. 3, 6: sample 1574, 3: N. L., 6: P. L., holotypus.
- Fig. 4, 5: sample 1577-6, 4: N. L., 5: P. L., oblique section.
- Fig. 7, 8: sample 1577-5, 7: P. L., 8: N. L., altered individual.
- Fig. 9: sample 1577-4, semi P. L., oblique tangential section.
- Fig. 10, 11: sample 1577, 10: P. L., 11: N. L.
- Fig. 12, 13: sample 1577-4, 12: N. L., 13: P. L.
- Fig. 14, 15: sample 1577-2, 14: N. L., 15: P. L.
- Fig. 16: sample 1577, N. L., transverse section.
REFERENCES


Plate II

Because the deuterolocus tube and the plugs have different extinction angles in polarized light, all sections are illustrated under variable crossed nicks angles in order to show better the internal structures of the tests. N. L.: Normal light, P. L.: Polarized light. All sections are axial or subaxial if not otherwise indicated. Enlargement: see captions.

Figs. 1, 2: *Hungarillina media* n. gen., n. sp., holotypus, sample 1577a, 1: N. L., 2: P. L. 250x.


Fig. 4: *Hungarillina pedunculat* n. gen., n. sp., holotypus, sample 1577a, N. L., approx. 270x.

Figs. 9, 10, 15: *Radiospirillina involutinoides* (RUGGIERI & GIUNTA), sample 1577-5, 9, 10: N. L., 15: P. L., approx. 200x.


REUSS, A.E. & A. FRITSCH (1861) - Verzeichnis von 100 Gypsmodellen von Foraminiferen, welche unter der Leitung des Prof. Dr. A. REUSS und Dr. A. FRITSCH gearbeitet wurden. Prag (Karl Seyfried).


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