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# *MONSPELIENSINA* AND *SPIROLOXOSTOMA*, PALEOGEOGRAPHICALLY SIGNIFICANT FORAMINIFERAL GENERA FROM THE "*RZEHAKIA* (*ONCOPHORA*) BEDS" (UPPER OTTNANGIAN, MIOCENE) IN THE SOUTH SLOVAK BASIN (CENTRAL PARATETHYS)

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Holcová, K. (1996): *Monspeliensina* and *Spiroloxostoma*, paleogeographically significant foraminiferal genera from the "*Rzehakia* (*Oncophora*) Beds" (Upper Ottnangian, Miocene) in the South Slovak Basin (Central Paratethys). - Acta Mus. Nat. Pragae, Ser. B, Hist. Nat., 52(1996)(1-4): 101-110. Praha.
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Abstract. Detailed morphology (using the SEM and light microscope), paleoecology (based on quantitative data) and spatial distribution were studied in the benthonic-foraminiferal genera *Spiroloxostoma* and *Monspeliensina*.

The genus *Spiroloxostoma* (formerly described from the South Slovak Basin as endemic genus *Vsevolodia* KANTOROVÁ) was transported in suspension from the unknown bathyal area to the South Slovak Basin. During the Lower Badenian, the genus penetrated from the unknown source area into the E part of the Pannonian Basin in Romania.

The genus *Monspeliensina* is firstly reported from the Pannonian realm. The shallow and probably brackish-water genus had to immigrate from the Bavarian-Upper Austrian Molasse to the South Slovak Basin during the Ottnangian.

■ benthonic foraminifers, *Monspeliensina*, *Spiroloxostoma*, paleoecology, paleogeography, Upper Ottnangian, South Slovak Basin

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## Introduction

The "*Rzehakia* (*Oncophora*) Beds" represent important Upper Ottnangian (Lower Miocene, Papp et al.1973) Paratethys horizon stretching from Switzerland in the West to the Aral Sea in the East (Kvaliashvili 1962, Čtyroký 1968). The beds were named after the frequently occurring bivalve *Rzehakia* KOROBKOV (formerly *Oncophora* RZEHAK). Generally, the "*Rzehakia* Beds" were deposited in shallow brackish seas or large brachyhaline to oligohaline lagoons. In the southern part of the Paratethys, these brackish basins were periodically connected with the open Lower Miocene sea. Isolation of brackish basins led to the development of endemic forms of fauna.

Specific development of the "*Rzehakia* (*Oncophora*) Beds" was described from the the South Slovak Basin (Vass et al.1979, 1992). The "*Rzehakia* (*Oncophora*) Beds" (represented here by the lithostratigraphical unit called Medokýš Mb., Vass et al. 1983) are composed of massive or laminated fine-grained sandstone. The laminated sandstone contains laminae or thin beds of claystone, siltstone or coarse-grained sandstone. The massive sandstone is intensively bioturbated. The South-Slovak "*Rzehakia* (*Oncophora*) Beds" differ from the other developments mainly by a very abundant occurrence of foraminiferal tests (practically in every sample). They contain abundant (foraminiferal number about 800), small, thin-walled foraminifers. Benthonic foraminiferal assemblages are dominated by lower neritic to bathyal species, e.g. *Globocassidulina*, *Cassidulina*, *Cibicidoides*, *Trifarina*, *Bolivina*, *Uvigerina*, etc. Planktonic foraminifers are represented by *Globigerina* ex gr. *praebulloides* BLOW, *Cassigerinella boudecensis* POK. and small microperforate pentacamerate species. Larger, shallow-water foraminifers (*Ammonia*, *Haynesina*, *Elphidium*, *Lobatula*, *Hanzawaia*, etc.) occur in some horizons.

Based on the presence of *Uvigerina graciliformis* PAPP et TURN., the South-Slovak "*Rzehakia* (*Oncophora*) Beds" have been clasified as Karpatian sediments (Kantorová et al.1968, Vass et al.1979, 1983, 1992). According to new observations (Cicha, personal communication), *Uvigerina graciliformis* may occur also in the Upper Ottnangian. The "*Rzehakia* (*Oncophora*) Beds" in the South Slovak Basin are assumed to be isochronous with the "*Rzehakia* (*Oncophora*) Beds" from other areas of the Paratethys. Therefore, an Upper Ottnangian age is proposed also for the South Slovak "*Rzehakia (Oncophora)* Beds".

For the "*Rzehakia* Beds"-time interval, Kantorová et al. (1968) assumed transport of all foraminiferal tests by storm waves from an unknown open sea to a brackish basin in the area of the present-day South Slovak Basin. The author's study (Holcová 1996) revealed two types of foraminiferal assemblages:

(1) Oryctocenoses consisting of size-sorted, small foraminiferal tests probably transported in suspended load by storm waves. Such oryctocenoses prevail in the analyzed area.

(2) Indigenous assemblages represented by larger, size-unsorted tests occurring in the SE part of the analyzed area. Indigenous assemblages are euryhaline to stenohaline which demonstrates the direct connection with the open sea. The lack of open-marine Lower Ottnangian sediments in the neighbouring areas may be explained by denudations of these sediments, but mainly by subsequent tectonic activity.

The aim of this work is the presentation of two interesting foraminiferal genera occuring in the "*Rzehakia* (*Oncophora*) Beds" in the South Slovak Basin:

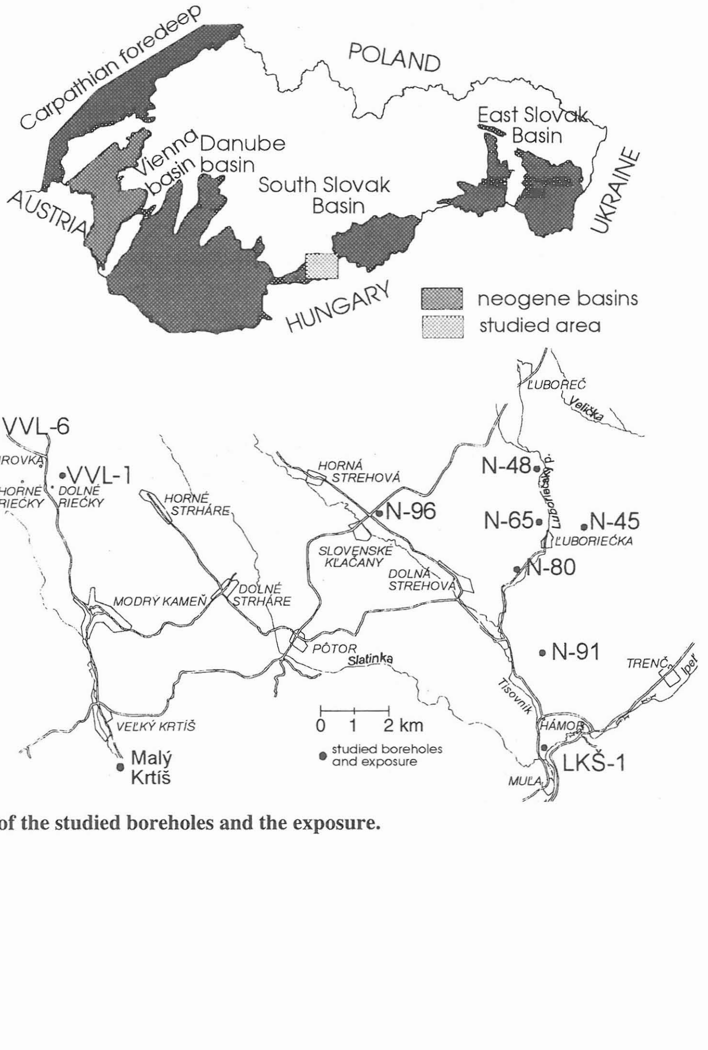

**Fig. 1. Locations of the studied boreholes and the exposure.**

(1) *Spiroloxostoma* formerly described from the "*Rzehakia* (*Oncophora*) Beds" as a new endemic genus *Vsevolodia* KANTOROVÁ 1975.

(2) *Monspeliensina* found for the first time in the area studied.

## Materials and methods

The analyzed material comes from the "*Rzehakia* (*Oncophora*) Beds" in the Ipeľská kotlina and the Lučenecká kotlina Basins (part of the South Slovak Basin). 78 samples from seven boreholes and one exposure were studied (fig.1). Foraminifera were removed from the 63 µm (240-mesh) sieve fraction. Well preserved specimens were chosen for study in the SEM. After taking SEM-micrographs of whole specimens, tests were broken and their internal structures were observed. Internal structures were also studied using a light microscope.

Foraminiferal assemblages were paleoecologicaly interpreted on the basis of ecological requirements of species occurring in samples (Boltovskoy and Wright 1976, Murray 1973, 1991, etc.). Taphonomical analysis (for details see Holcová 1996) preceded these paleoecological interpretations. Quantitative data (percentage of *Monspeliensina* and *Spiroloxostoma* in assemblages, diversity of benthonic foraminiferal assemblages) were calculated for at least 300 specimens of benthonic foraminifers from every sample.

### Genus *Spiroloxostoma* CONATO, 1964

Type species: *Spiroloxostoma croarae* CONATO, 1964

1964 *Spiroloxostoma* CONATO, Conato, p. 284, text-figs 5, 6, pl. 1, figs 6, 7
1975 *Vsevolodia* KANTOROVÁ, Kantorová, pp. 87-89, pls 55-58, type species: *Vsevolodia czechoviczi* KANTOROVÁ, 1975

Remarks: Small tests of *Spiroloxostoma czechoviczi* were described from suspension-transported orytocenoses dominated by juveniles. In such a case, tests called *Vsevolodia* may represent only juveniles of some well-know genus. However, small *Spiroloxostoma* from other localities (Romania, Italy) were described from size-unsorted, very probable indigenous assemblages. Therefore, *Spiroloxostoma* is considered to be a new genus with small tests.

### *Spiroloxostoma czechoviczi* (KANTOROVÁ, 1975)

Pl. 1, figs 1-6, 8, 9; pl. 2, figs 1-8; pl. 3, figs 1-12

1975 *Vsevolodia czechoviczi* KANTOROVÁ, Kantorová, pp. 89-90, pls 55-58 (holotype VK-1)

Description: A detailed description was published by Kantorová (1975). The species was described from the Ipeľská kotlina Basin, therefore, no morphological differences were observed between my analyzed specimens (also from Ipeľská kotlina Basin) and material of Kantorová. The following additional data on the morphology of this species were obtained:

(1) Continuation of toothplate inside the chamber differs in early and later stages of tests (plate 2, figs 1, 2, 4, 6).

(2) In agreement with the observation of Loeblich and Tappan (1988) (holotype of *Spiroloxostoma croarae*), only the biserial arrangement of tests was observed for species *Spiroloxostoma czechoviczi*. Kantorová (1975) described the initial triserial stage.

(3) Using data primarily from the light-microscope study, two morphotypes of *S. czechoviczi* were distinguished: The first morphotype is represented by specimens with more lobate outline of test, distinctly depressed sutures, more twisted biserial arrangement of chambers, thin wall, and large proloculus (pl. 1, figs 1, 3, 5, 9, pl. 3, figs 7-12). The tests of the second morphotype are narrower, the outline is only slightly lobate, arrangement of chambers biserial, final stage of test is twisted only slightly, tests have 2-3 chambers more than tests of the first morphotype and the wall and septa of final stage of tests are thick (visible in the light microscope). In the majority of tests, the proloculus is small. In addition the largest proloculi are smaller than those of the first morphotype (pl. 1, figs 2, 4, 8, pl. 3, figs 1-6).

The morphothypes may represent macrospheric (the first morphotype) and microspheric (the second morphotype) specimens. A clear interpretation of the morphotypes is impossible owing to the variable size of proloculi of the second morphotype (probable microspheric specimens).

Test morphology of the second morhotype is identical with that of *Spiroloxostoma czechoviczi* plicata (KANTOROVÁ, 1975). It is very probable that different ornamentation of this subspecies is caused only by diagenetic recrystallization.

### ***Spiroloxostoma*** cf. ***savenae*** CONATO, 1964

Pl. 1, fig. 7

1964 *Spiroloxostoma savenae* CONATO, Conato, pp. 285-286, text-fig. 6, pl. 1, fig. 7

Three specimens of *Spiroloxostoma* with fine granulated tests were found. These specimens differ from the diagnosis of *S. savenae* by smaller number of chambers. The taxonomical position of this *Spiroloxostoma* as a separate species may be questionable. It is possible that morphotype without distinct ornamentation could be only an ecophenotype of distinctly ornamented species. The specimen from pl. 1, fig. 6 may represent a transitional form from typical *S. czechoviczi* to "*S. savenae*".

## Paleocology of the genus *Spiroloxostoma*

The genus has been reported in an indigenous position in the Lower Badenian of Romania (Popescu, personal communication) and in the Lower Pliocene of North Apennines (Conato 1964). Bathyal paleodepths were interpeted for the both localities. This paleoecological interpretation is impossible to automaticaly use for Ottnangian *Spiroloxostoma* as well, because a shift of paleoecological requirements was observed for some species during the Neogene (van der Zwaan 1983, Kurihara and Kennett 1988, in the area studied Šutovská 1991).

In order to interpret the paleoecology of the genus *Spiroloxostoma* from the South Slovakia "*Rzehakia* Beds", oryctocenoses with *Spiroloxostoma* were analyzed. *Spiroloxostoma* occurs only in suspension-transported oryctocenoses. Generally, these oryctocenoses are transported from deeper parts of the basin to near-shore facies. In Recent seas, the occurrence of suspension-transported bathyal species was observed e.g. in estuarine deposits (Wang and Murray 1983). A model of a mixing of indigenous euryhaline assemblages (dominated by *Ammonia*, *Haynesina*,

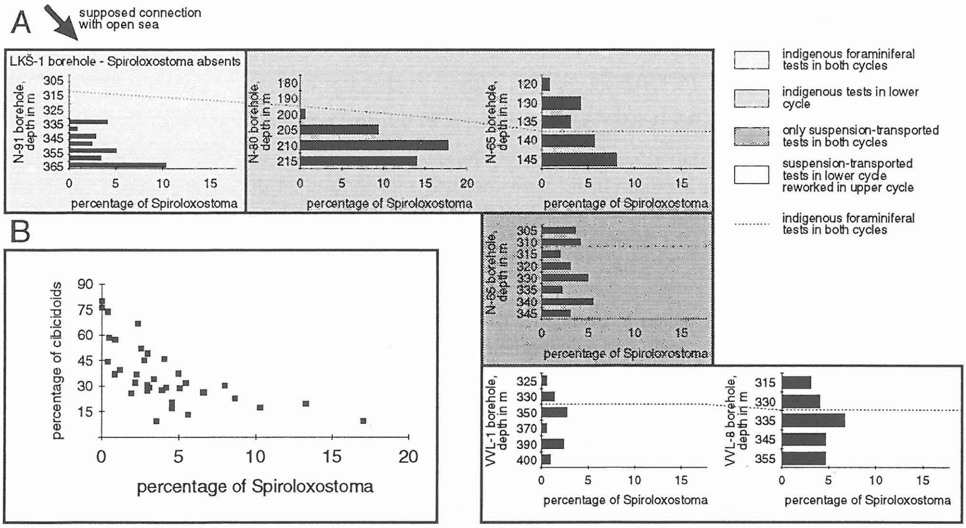

**Fig. 2. A - Percentage of *Spiroloxostoma* in suspension-transported foraminiferal assemblages from analyzed boreholes. B - Comparison of percentages of *Spiroloxostoma* and cibicidoids in suspension-transported assemblages from analyzed samples.**

*Monspeliensina*) with suspension-transported lower neritic to bathyal assemblages was accepted for the South Slovakia "*Rzehakia* (*Oncophora*) Beds" (Holcová, 1996).

In order to interpret the paleoecology of source area of *Spiroloxostoma*, its distribution in different types of suspension-transported oryctocenoses was analyzed. Paleoecological interpretation of these types of oryctocenoses was based on taxa with well-known paleoecological requirements.

Suspension-transported assemblages represent only a part of original assemblages.Their composition depends on species composition of assemblages in the source area as well as on the transport mechanism of foraminiferal tests. Therefore, the distribution of *Spiroloxostoma* was studied only in three well distinguishable types of suspension-transported oryctocenose. These oryctocenoses were composed of foraminifers with similar paleoecological requirements, which may characterize the paleoenvironment of the source area:

(1) *Spiroloxostoma* does not occur (or occurs very rarely: 1-3 specimens) in shallow-water, probable hyposaline assemblages dominated by *Ammonia*.

(2) Assemblages composed mostly of cibicidoids (lower neritic assemblages) contain at the most 10 % of *Spiroloxostoma*. Generally, an increasing percentage of cibicidoids in oryctocenose is accompanied by a decreasing percentage of *Spiroloxostoma* and vice versa (fig. 2).

(3) *Spiroloxostoma* is most common in oryctocenoses dominated by *Cassidullina*, *Globocassidulina*, *Islandiella*, *Trifarina*, *Uvigerina* and *Caucasina*. Upper bathyal paleoodepth was interpreted for these assemblages. Therefore, it is very probable that *Spiroloxostoma* was also a bathyal genus in the Ottnangian.

Two cycles of sea-level changes of the 5th order were distinguished for the "*Rzehakia* (*Oncophora*) Beds" in the South Slovak Basin (Holcová in prep.). *Spiroloxostoma* prevails in the lower cycle (fig. 2) in which the interpreted paleodepth was deeper than in the upper cycle. It may confirm the interpetation of a bathyal life habitat of *Spiroloxostoma*, too.

The genus is most abundant in in oryctocenoses dominated by suspension-transported foraminifers located in area near to an assumed connection with the open sea (fig. 2). However, *Spiroloxostoma* does not occur in oryctocenoses dominated by indigenous foraminifers (LKŠ-1 borehole, upper part of N-91 borehole) situated closest to the proposed connection with the open sea. This may be due to the character of the transport mechanism.

## Distribution of the genus *Spiroloxostoma*

The genus was found in three areas and three different stratigraphical levels.

The first occurrence of the genus *Spiroloxostoma* is reported from the Upper Ottnangian of the South Slovak Basin (Kantorová 1975). Tests were transported as suspended load from an unknown source area probably situated in the northern or central part of the Pannonian Basin. There is no reference about the occurrence of the genus in the Karpatian. The tests of *Spiroloxostoma* are small (the majority of them are smaller than 200 µm), therefore, they may be considered to be juveniles of some uvigerinas or related genera. Reworked tests of *Spiroloxostoma* are common in the Lower Badenian sediments of the South Slovak Basin.

During the widespread Lower Badenian transgression, the genus probably penetrated into the eastern part of the Pannonian Basin. *Spiroloxostoma* was found here in the Upper Lagenids Zone of the Bega Basin (Popescu, personal communication). Penetration into the Mediterranean area probably started in the Badenian, because the shallow water environment interpreted for the western part of the Pannonian Basin in the Sarmatian (Papp et al. 1973) was unsuitable for survival of this bathyal genus in the mentioned area. However, no evidence of penetration of *Spiroloxostoma* into the Mediterranean area has been found. The occurrence of Spiroloxostoma in this area was described by Conato (1964): *Spiroloxostoma croarae* CONATO, *S. savenae* CONATO. On the basis of SEM-micrographs, more significant morphological changes of the genus may have occurred during the period between the Ottnangian and the Badenian. *Spiroloxostoma* from Romania (described as Spiroloxostoma czechoviczi) is more similar to *Spiroloxostoma croarae* CONATO than to *S. czechoviczi* KANTOROVÁ. It could be a new species.

### Genus *Monspeliensina* GLAÇON et LYS, 1968

Type species: *Monspeliensina vulpesi* GLAÇON et LYS, 1968

1968 *Monspeliensina* GLAÇON et LYS, Glacon and Lys, pp. 2302-2304
1969 *Taxyella* ANGLADA et MAGNÉ, Anglada and Magné, p. 367, type species: *Taxyella fontcaudensis*, ANGLADA et MAGNÉ, 1969

### ***Monspeliensina vulpesi*** GLAÇON et LYS, 1968

Fig. 3, pl. 4, figs 1-14, pl. 5, figs 1-6

1958 *Epistomaria* cf. *cubana* PALMER, Lys and Bourdon, p. 211, fig. 3
1968 *Monspeliensina vulpesi* GLAÇON et LYS, Glaçon and Lys, p. 2305, pl. 1, fig 1-3, 5, 7, 9, pl. 2, figs 1-4, 7
1969 *Taxyella fontcaudensis* ANGLADA et MAGNÉ, Anglada and Magné, p. 368, pl. 1, figs 1, 4

Description: Detailed descriptions were given by Glaçon and Lys (1968) and Anglada and Magné (1969). Specimens from the Ipeľská kotlina Basin are very similar to these descriptions, however, only 9-10 chambers in the last whorls occur in the analyzed material.

The structure of bifurgated internal partitions forming chamberlets were studied from broken specimens in the SEM (pl. 4, fig. 9, pl. 5, figs 4-6, text-fig. 3).

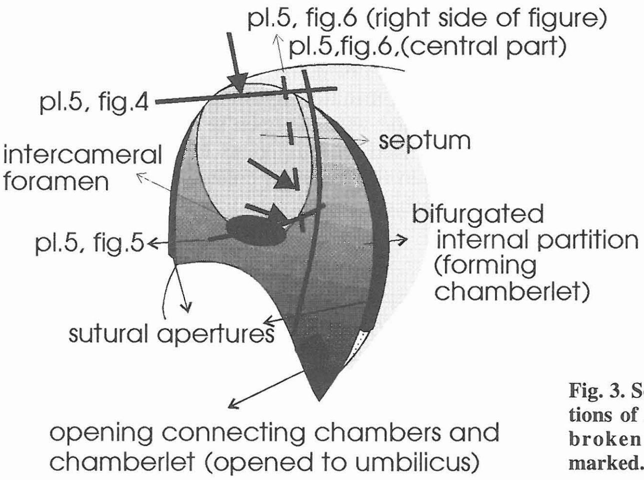

**Fig. 3. Scheme of bifurgated internal partitions of *Monspeliensina*. Rough sections of broken tests from pl. 5, figs 4-6 are marked.**

The following intraspecific variability was observed:

(1) Differences in the quantity of shell material produced thin-walled morphotypes with lobate outline, larger sutural apertures and an unfilled umbilicus which continuously transform to thick-walled morphotypes with umbilicus and sutural apertures (especially on the spiral side of tests) filled by shell material and straight outline of tests (umbilical view: pl. 1, figs 1-2-3-5, spiral view: pl. 1, figs 6-7-8).

(2) Tests of earlier ontogenetic stages differ by the lower number of chambers in the last whorl (pl. 4, figs 10-12). Sutural apertures were not found on the smallest juvenile specimens (pl. 4, fig. 13).

Paleoecology of the genus *Monspeliensina*

The following paleoenvironment was interpreted for the genus:

(1) Type level of the genus is represented by the brackish-water facies of the Upper Aquitanian in the lower Rhone Valley. *Monspeliensina* associates with *Elphidium*, *Epistomaria* and *Ammonia* (Glaçon and Lys 1968, Anglada and Magné 1969).

(2) In the Ottnangian of Upper Austria, the genus was transported to the normal marine sediments (Ch.Rupp, personal communication).

(3) In the Karpatian sediments of the Korneuburg basin near Vienna, *Monspeliensina* associates with *Ammonia parkinsonia* and *Aubignyna perlucida* in probable brackish facies (Rögl, in prep.).

(4) In the "*Rzehakia* (*Oncophora*) Beds" of the South Slovak Basin, *Monspeliensina* is abundant (10-45 %) in indigenous assemblages (fig. 4). The genus is associated mainly with *Ammonia parkinsonia-tepida*, *Elphidium* div. sp., *Haynesina* sp. The assemblage represents a shallow-water and very likely brackish paleoenvironment. Sediments, overlying rocks with *Monspeliensina*, contain only small *Ammonia* (?continuos decreasing of salinity). *Monspeliensina* occurs only in the lower, deeper cycle of sea level changes (see above).

Based on these observations as well as the life habitat of *Monspeliensina* interpreted for other areas, it is supposed, that *Monspeliensina* lived in a shallow-water and very likely brackish paleoenvironment. However, the genus was not able to survive in a hyposaline environment suitable for survival of monospecific assemblages of the small *Ammonia*.

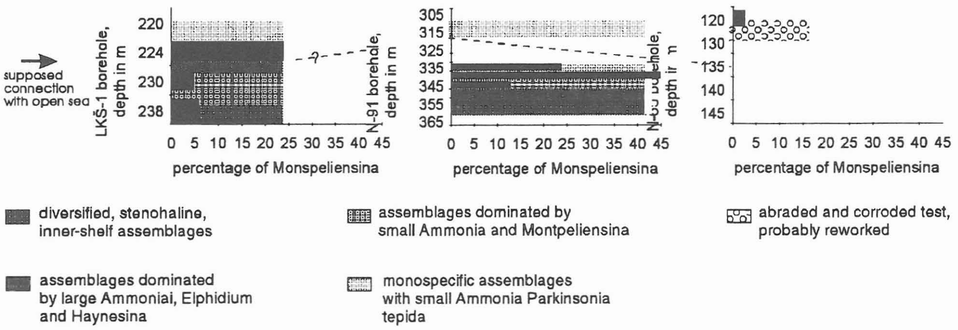

**Fig. 4. Percentage of *Monspeliensina* in indigenous foraminiferal assemblages.**

Distribution and paleogeography of the genus *Monspeliensina*

*Monspeliensina* was found in four areas and stratigraphic levels:

(1) in the Upper Aquitanian of the Rhone Basin (Lys and Bourdon 1958, Glaçon and Lys 1968, Anglada and Magné 1969), (2) in the Lower Ottnangian of Upper Austria (Rupp, personal communication), (3) in the Upper Ottnangian of the South Slovak Basin, (4) in the Karpatian of the Korneuburg Basin (Rögl, in prep.).

It is hypothesized that the genus immigrated from the Rhone Basin to the Bavarian-Austrian Molasse during the Upper Eggenburgian and the Lower Ottnangian when these two basins were connected as proposed by Rögl and Steininger (1983) (Rupp, personal communication).

*Monspeliensina* had to immigrate from the Alpine Foredeep Basin to the Carpathian Backland Basin during the short-time interval between the Lower and the Upper Ottnangian. The presence of *Monspeliensina* may be evidence of a good connection between these two basins, also proposed by Rögl and Steininger (1983).

## Conclusions

The genera *Monspeliensina* and *Spiroloxostoma* were studied from the "*Rzehakia* (*Oncophora*) Beds" in the South Slovak Basin.

The genus *Spiroloxostoma* is represented by two species: abundant *S. czechoviczi* (KANTOROVÁ) and very rare *S.* cf. *savenae* CONATO. Two morphotypes of *S. czechoviczi* were distinguished. These morphotypes may represent microspheric and macrospheric specimens.

The genus represents a suspension-transported part of oryctocenoses. Bathyal paleodepth was interpreted for the source area of suspension-transported species including *Spiroloxostoma*. It is hypothesized that the genus immigrated to the E part of the Pannonian Basin (SW Romania) during the Lower Badenian. During the Badenian, this bathyal genus had to penetrate into the Mediterranean realm.

In the material studied from the South Slovak Basin, the genus *Monspeliensina* is represented by the species *M. vulpesi* GLAÇON et LYS. Intraspecific variability was observed in the amount of shell material. The genus is common to abundant in the majority of the indigenous assemblages. It is proposed that *Monspeliensina* required shallow-water and probably a slightly hyposaline paleoenvironment. The genus penetrated into the South Slovak Basin during the Ottnangian from the Alpine Foredeep Basin in Upper Austria.

## Acknowledgments

The author thanks Dr. Ch. Rupp (Geologische Bundesanstalt, Wien) and Dr. G. Popescu (Geological Survey of Romania) for kindly providing unpublished data on the occurence of *Monspeliensina* and *Spiroloxostoma*. I am also grateful to H. Kvačková (National Museum, Prague) for making the SEM-micrographs. Light-microscope photographs were taken in the microscope Zeiss Amplival in the Department of Mycology, the National Museum, Prague.

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## EXPLANATIONS OF THE PLATES

### PLATE 1

*Spiroloxostoma czechoviczi* (KANTOROVÁ, 1975)

1. N-91 borehole, 365 m, (?) macrospheric specimen.
2. N-80 borehole, 215 m, (?) microspheric specimen.
3. N-80 borehole, 215 m.
4. N-96 borehole, 345 m.
5. N-96 borehole, 330 m.
6. N-65 borehole, 140 m.
8. N-91 borehole, 365 m, (?) microspheric specimen.
9. N-91 borehole, 365 m, (?) macrospheric specimen.

*Spiroloxostoma* cf. *savenae* CONATO, 1964

7. N-65 borehole, 140 m.

1-7. SEM-micrographs, 8,9 - light-microscope photographs, scale bar for all photographs in the left bottom corner.

### PLATE 2

*Spiroloxostoma czechoviczi* (KANTOROVÁ, 1975)

1. continuation of toothplate inside the chamber (t), final part of test, N-91 borehole, 365 m, 800 ×.
2. continuation of toothplate inside the chamber (t), final part of test, N-96 borehole, 340 m, 1500 ×.
3. internal structure of initial part of test, N-91 borehole, 365 m, 1500 × (specimen from fig. 1).
4. (?) continuation of toothplate inside the chamber (?t), middle part of test, N-91 borehole, 355 m, 1500 ×.
5. aperture without lip in juvenile specimen, N-91 borehole, 365 m, 500 ×.
6. continuation of (?) toothplate inside the chamber (?t), juvenile part of test, N-80 borehole, 210 m.
7. detail of aperture with lip, N-91 borehole, 365 m, 1 500 ×.
8. detail of aperture with lip, N-80 borehole, 210 m, 1 500 ×.

## PLATE 3

*Spiroloxostoma czechoviczi* (KANTOROVÁ, 1975)

1-6. (?) microsperic specimens. 1 - side view, broader side of test, N-91 borehole, 365 m; 2 - side view, narrower side of test, N-80 borehole, 210 m; 3 - side view, N-96 borehole, 145 m, 150 ×; 4 - side view, N-96 borehole, 145 m, 150 ×; 5 - side view, N-8O borehole, 215 m; 6 - detail of initail stage of test, specimen from fig. 2, N-80 borehole, 210 m, 2000 ×.

7-12. (?) macrospheric specimens. 7 - side view, broader side of test, N-91 borehole, 360 m; 8 - side view, narrower part of test, N-91 borehole, 365 m; 9 - side view, N-96 borehole, 145 m; 10 - side view, N-80 borehole, 215 m, 150 ×; 11 - side view, N-91 borehole, 365 m 150 ×; 12 - side view, N-80 borehole, 210 m.

1, 2, 6-8 SEM-micrographs, 3-5, 9-12 - light-microscope photographs; scale bar for photographs 1, 2, 5, 7-9 and 12 at the bottom of plate.

## PLATE 4

*Monspeliensina vulpesi* GLAÇON et LYS, 1968

1- 5. umbilical view. 1 - LKŠ-1 borehole, 224 m; 2, 3 - N-91 borehole, 335 m; 4 - N-91 bore hole, 340 m; 5 - LKŠ-1 borehole, 230 m.

6- 8. spiral view. 6, 8 - N-91 borehole, 340 m; 7 - LKŠ-1 borehole, 238 m.

9-14. apertural view. 9 - N-91 borehole, 335 m (f-intercameral foramen, c-chamberlet lumen, o-opening connecting chambers and chamberlet); 14 - N-91 borehole, 345m

10-13. juvenile specimens. 1O - umbilical view, N-91 borehole, 335 m; 11 - umbilical view, N-91 borehole, 345 m; 12 - spiral view, N-91 borehole, 335 m; 13 - spiral view, LKŠ-1 borehole, 224 m, 250 ×;

SEM-micrographs; scale bar for photographs 1-12 and 14 in the left bottom corner.

## PLATE 5

*Monspeliensina vulpesi* GLAÇON et LYS, 1968

1. umbilical view: chamberlet lumen (c) is visible, N-91 borehole, 335 m, 180 ×.
2. spiral view, N-91 borehole, 34O m, 80 ×.
3. sutural aperture (a) in the penultimate whorl of the spiral side of test, LKŠ-1 borehole, 238 m, 3000 × (specimen from pl. 4, fig. 7).
4. broken specimen, lateral view, N-91 borehole, 34O m, f-intercameral foramen, a-sutural apertures.
5. broken specimen, N-91 borehole, 335 m, a-chamberlet lumen, f-base of intercameral foramen, p-bifurgating internal partition, c-chamberlet lumen.
6. broken specimen, LKŠ-1 borehole, 230 m, c-chamberlet lumen, a-sutural aperture, o-opening connecting chamber and chamberlet lumen, p-bifurgating internal partitions.

1, 2 light-microscope photographs, 3-6 SEM-micrographs; scale bar for photographs 4-6 on the left side of plate.


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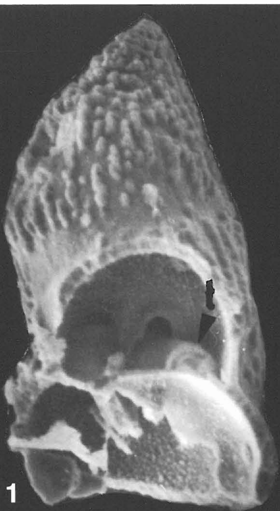
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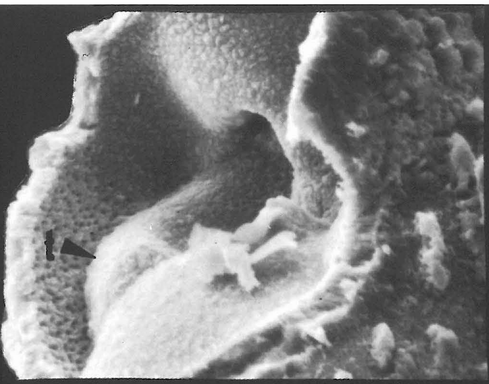
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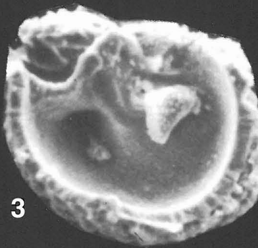
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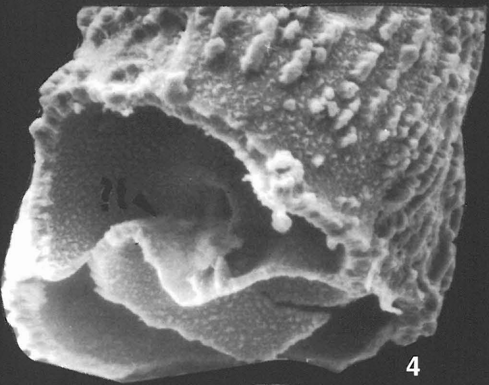
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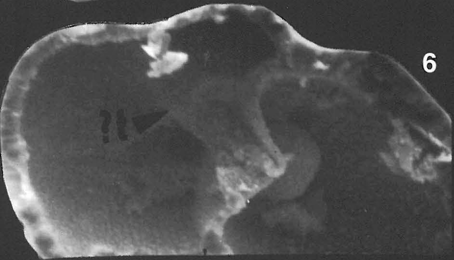
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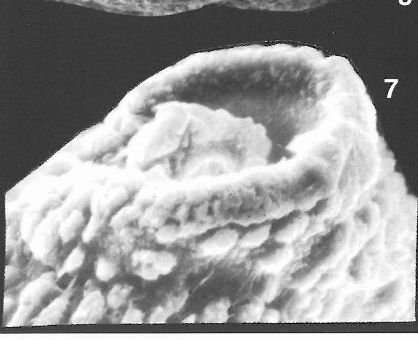
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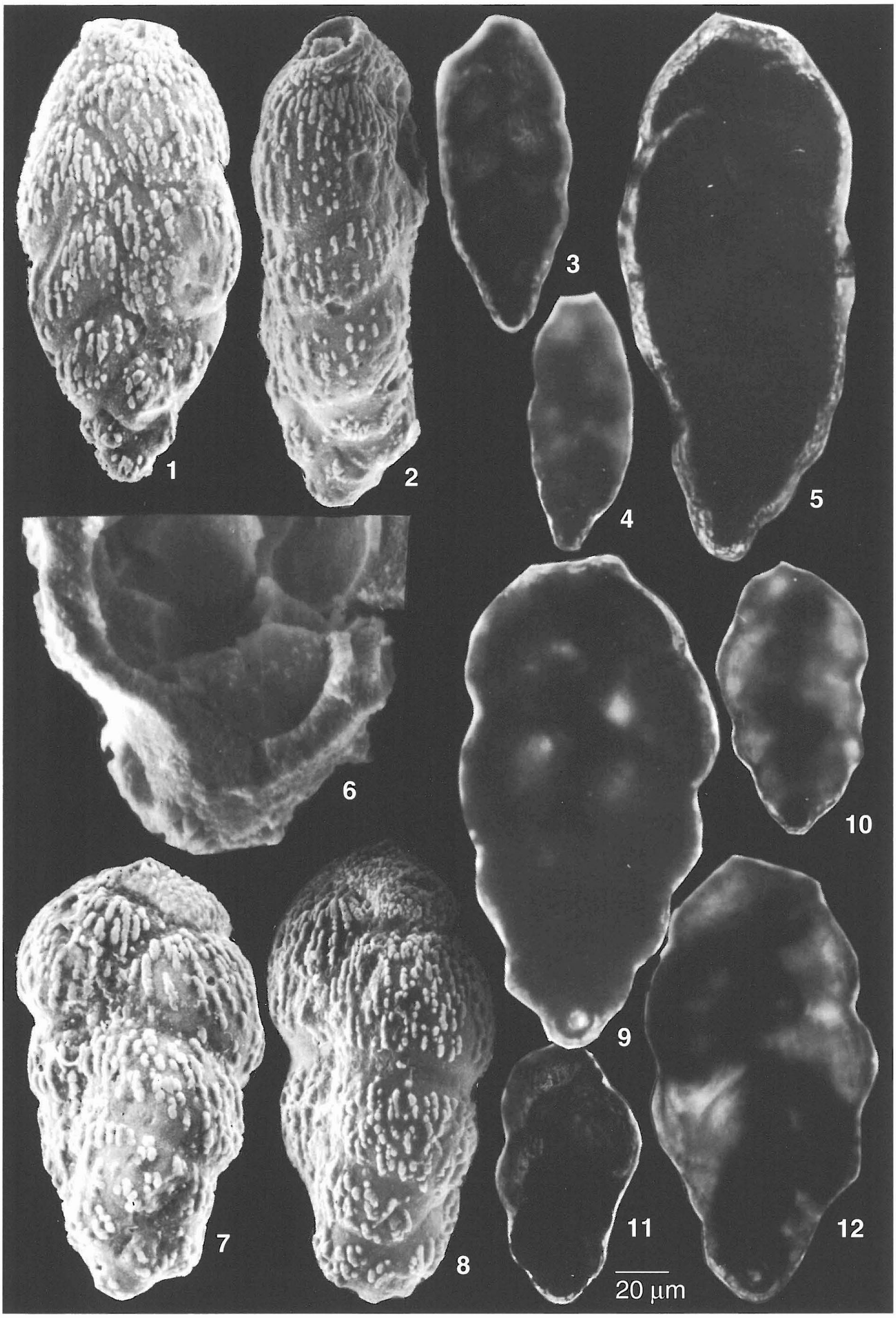
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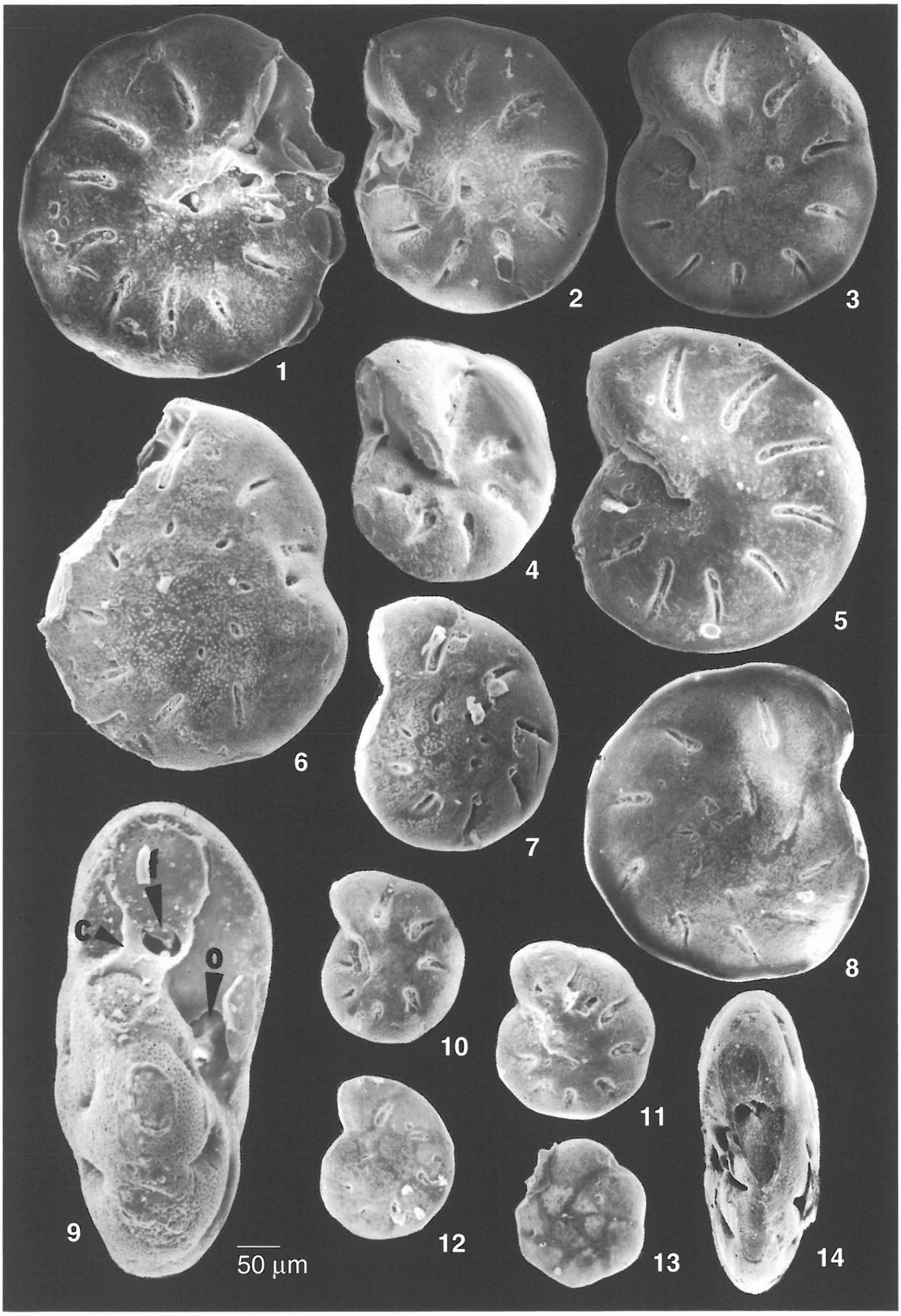
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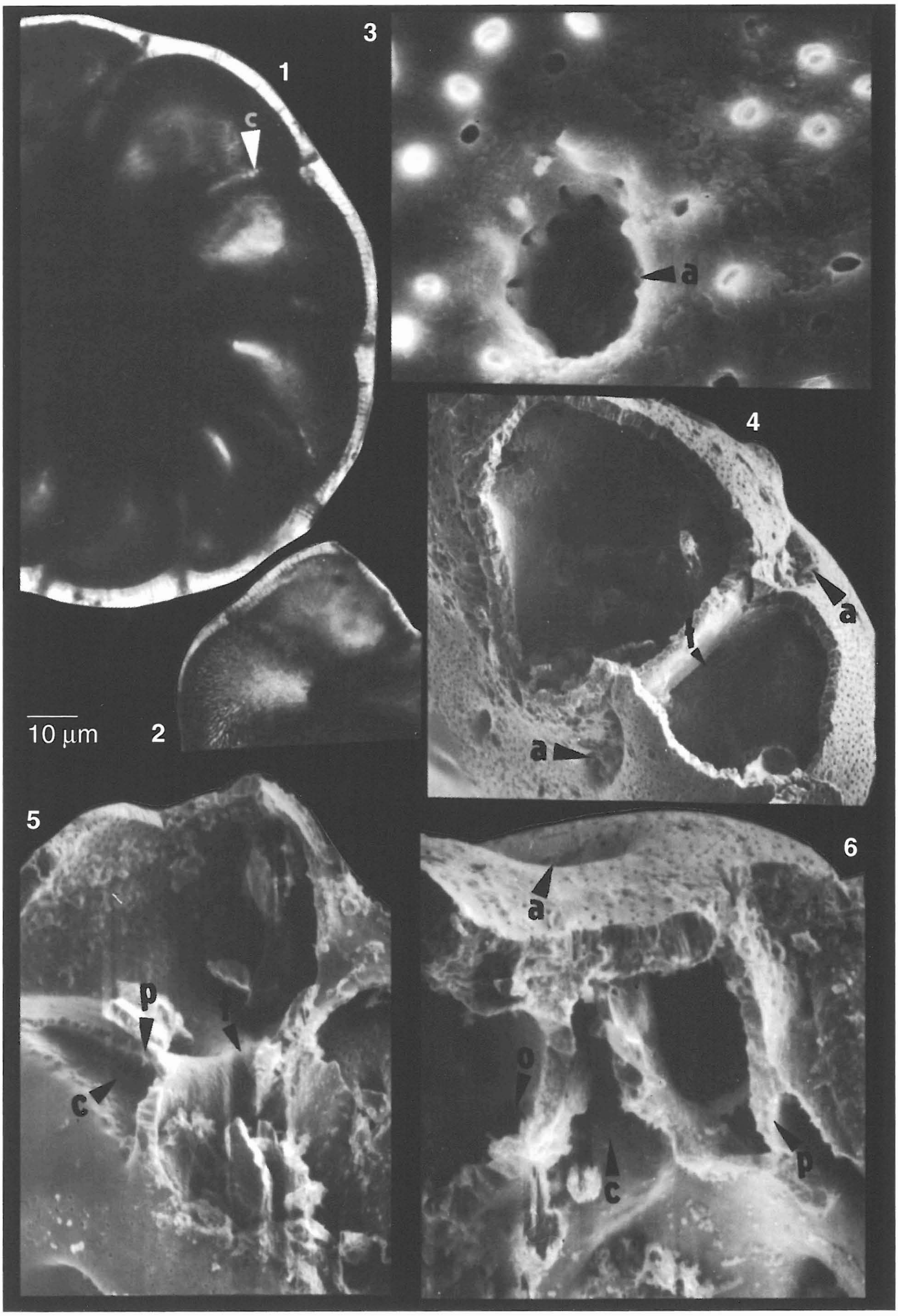
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