AN ATTEMPT TO THE CORRELATION OF THE BRACHIOPOD BIOZONES IN THE LIASSIC DEPOSITS OF THE NORTHERN APUSENI MOUNTAINS (ROMANIA)

de

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INTRODUCTION

The Liassic Brachiopoda from the Northern Apuseni Mountains had been reported since the beginings of our century, by Palfy (1912) from the nearings of Moneasa. Later, many other authors brought their contributions to the study of this group: Preda I. (1962, 1967), Iordan Magdalena (in Mantea & coll., 1982), Codrea V. (1985), Georgescu D. M. (1988, 1989).

Many other research workers contributed also for collecting a very rich brachiopod material; thus, the author was able to examine over a thousand specimens for the present paper.

Using brachiopods as marker fossils is already a common method in the geological practice for the Jurassic deposits. But recent studies, and mainly those of P. Tchoumatchenco showed the incontestable biostratigraphic value of the brachiopods for the Liassic deposits of Bulgaria.

In the Someşul Cald Graben, the particular biostratigraphic value of the brachiopods had been established by Iordan Magdalena (in Mantea & coll., 1982) who used the brachiopod assemblages for dating By this, brachiopod assemblages had been established for the identified biozones. The importance of the fact is greater as the author tried to correlate this biozones with the ammonite ones and also the lithology.

Into this study, a generalization of these assemblages is done for the Northern Apuseni Mountains zone. Where the material possesed permited us, we used the serial grinding techniques for a more acurate generic and specific atribution of our specimens. Using this method, a series of previous mistakes into the systematics of the group are proved. There were sectioned over thirty specimens, only a small part of them being figured now.

A. GENERAL STRATIGRAPHY

The Liassic deposits start with the Detrital Formation (Hettangian — Lower Sinemurian). Because the complete missing of brachiopods we don't stop to much on it.

The Calcareous Formation which overlies the Detrital Formation it is considered to be of Upper Sinemurian — Pliensbachian age. Within this formation two stratigraphical entities could be distinguished on both lithological and paleontological basis: the first is represented by Upper Sinemurian — Carixian deposits and the second of the Domerian ones. The brachiopods occur in both these entities, but associated with ammonites only at the Domerian level; This fact permits a more adequate correlation of the deposits.

The Marly Formation (Toarcian), as the Detrital Formation hadn't offered brachiopod specimens. It is to note the fact that Preda I. (1967) reported *Spiriferina alpina* OPPEL from this formation at Roşia. Doubtfull shell fragments had been collected by the author at Vadu Crişului, but until we shall identify a clear assemblage of this age, further material is to be collected in the future.

As we can see the brachiopods occur only in the Calcareous Formation (Upper Sinemurian — Pliensbachian) and doubtfully in the Toarcian Marly Formation. They are associated with ammonites at the Domerian level, but mainly with the belemnites, pelecypods and gastropods. The last three fossil groups are less known against a very rich and well preserved material.

B. THE FEATURES OF THE BRACHIOPOD „POPULATIONS"

This problem has many aspects, as it follows. First, they can be very clear stratigraphically localized, this fact indicating this group as very important in biostratigraphy. Less favourable is the reduced number of available specimens at the most levels containing brachiopods. Thus, the "populations" represented by more than twenty specimens are very rare.

The brachiopods occur in Upper Sinemurian — Carixian associated with pelecypods *(Liogryphea, Aequipecten,* etc.), belemnites *(Paxilloteuthis)* and gastropods. But at the Domerian level they are associated also with the ammonites and numerous belemnites. Most of the situations the brachiopods are the main group within the fossil assemblages. The great majority of the fossiliferous outcrops offered a brachiopod fauna constituted of the four main groups known at this level: Rhynchonellids, Spiriferinids, Terebratulids and Zeillerids.

C. DETAILED BIOSTRATIGRAPHY

There are two major tectonic units in the Northern Apuseni Mountains: the Bihor Autochton and the Finiş Nappe.

1. **The Bihor Autochton.** Within this tectonic unit, D. Patrulius (1976) proposed several brachiopod assemblages for the Calcareous Formation. Thus, within the Upper Sinemurian — Carixian limestones, three brachiopod assemblages are distinguished as it follows: the species *Tetrarhynchia aequicostata* (JEKELIUS) and *Piarorhynchia juvensis* (QUENSTEDT) characterize the base of this strata. The assemblage with *Tetrarhynchia tetrahedra* (SOWERBY), *T. argotinensis* (RADOVANOVIC) and

Lobothyris subpunctata (DAVIDSON) characterize the medium part, as *Tetrarhynchia argotinensis* (RADOVANOVIC), *Spiriferina tumida* (BUCH), *Lobothyris punctata* (SOWERBY) and *Cincta numismalis* (LAMARCK) occur at the top of the deposits. The Domerian deposits contain — in the opinion of this author — species as *Homoeorhynchia acuta* (SOWERBY), *Tetrarhynchia argotinensis* (RADOVANOVIC), *Spiriferina tumida* (BUCH), *Spiriferina aff. rostrata* (SCHLOTHEIM) and *Cincta numismalis* (LAMARCK). By this, D. Patrulius made a very important step in using brachiopods as marker fossils for the Liassic deposits in this zone.

At Vadu Crişului from the grey limestone with silliceous accidents, with a thickness of about twenty meters, the author collected *Tetrarhynchia subconcinna* (DAVIDSON) and *Cincta cf. numismalis* (LAMARCK); these species indicate the presence of subconcinna-zone. Towards the upper part of the Domerian deposits, there was collected *Homoeorhynchia acuta* (SOWERBY), the index species for the acuta-zone. Here, this species is associated with *Pleuroceras solare* (PHILLIPS). Between these two bradriopod biozones, there is a column of about twelve meters which can represent the cornuta-zone, unproved from paleontological point of view.

At Şuncuiuş (Şuncuiuş — Recea — Bălanca) the Liassic deposits start with the Detrital Formation (Hettangian — Lower Sinemurian) overlied by yellowish limestones with silliceous accidents, very rich in brachiopods. Georgescu D. M. (1988, 1989) reported: *Slovenirhynchia slovenica* SIBLIK, *Tetrarhynchia tetrahedra* (SOWERBY), *T. subconcinna* (DAVIDSON), *T. argotinensis* (RADOVANOVIC), *Gibbirhynchia curviceps* (QUENSTEDT), *Cuneirhynchia serbiensis* SUCIC PROTIC, *Liospiriferina rostrata* (SCHLOTHEIM), *Pirotothyris fortis* SUCIC PROTIC, *Zeilleria waterhousi* (DAVIDSON), *Z. sarthacensis* (d'ORBIGNY), *Cincta numismalis* (LAMARCK). This assemblage proves the presence of *subconcinna, curviceps* and *numismalis*-zone (? the upper part).

At Bratca the brachiopods are very rare. On the Drăgoi Valley, from the limestone with silliceous accidents the author collected *Lobothyris subpunctata* (DAVIDSON). Towards the upper part, over a level with *Gryphea,* there had been collected *Cincta numismalis* (LAMARCK); the two species indicate the presence of *numismalis*-zone. In her Doctor Thesis, Popa Elena (1977) reported *Zeilleria subnumismalis* (DAVIDSON) on Boiului Valley from the Domerian limestones. Thus, it is to note the presence of subnumismalis-zone.

Undoubtlly, the richest brachiopod assemblage had been collected from Roşia. On the Cuţilor and Lazuri Valleys, the Calcareous Formation is represented by two complexe. The first one, at the base is constituted of black limestones, and sometimes reddish limestones, ussually sandy. This complex contains *Slovenirhynchia cf. maninensis* SIBLIK, *Tetrarhynchia subconcinna* (DAVIDSON), *Gibbirhynchia curviceps* (QUENSTEDT), *Cuneirhynchia dalmasi* (DUMORTIER), *Spiriferina alpina* OPPEL, *Lobothyris punctata* (SOWERBY), *L. subpunctata* (DAVIDSON), *L. ovatissima* (QUENSTEDT), *Zeilleria mariae* (d'ORBIGNY), *Z. vicinalis* (SCHLOTHEIM), *Plesiothyris reissi* sp.nov. This assemblage, collected from deposits of Upper Sinemurian — Carixian age indicates the presence of subconcinna and curviceps-zone. At the Gorunaş hill, at this level it is known a „population" of *Zeilleria cf. cornuta* (SOWERBY). The second complex

is constituted mainly of reddish limestones and it is considered of Domerian age; its age has been established using the ammonites *Amaltheus margaritatus* (MONTFORT) and *Pleuroceras solare* (PHILLIPS). At the base of this complex it is known a very interesting brachiopod assemblage: *Slovenirhynchia maninensis* SIBLIK, *S. jurcsaki* sp.nov., *Cuneirhynchia dalmasi* (DUMORTIER), *Spiriferina alpina falloti* CORROY, *S. tumida* (BUCH), *Lobothyris punctata* (SOWERBY), *L. subpunctata* (DAVIDSON), *L. edwardsi* (DAVIDSON), *L. cf. andleri* (OPPEL), *Telothyris ariegensis* (SUCIC-PROTIC), *Pyraenaica ? huzai* sp.nov., *Zeilleria cornuta* (SOWERBY), *Z. quadrifida* (LAMARCK). It is the only place in Romania where occurs *Zeilleria cornuta* (SOWERBY), index species of the cornuta-zone. At the upper part of the Domerian deposits associated with *Amaltheus margaritatum* (MONTFORT) and *Pleuroceras solare* (PHILLIPS) it is recorded *Homoeorhynchia acuta* (SOWERBY), thus being proved the presence of acuta-zone. This is the only species occuring at this level. The Toarcian Marly Formation overlies the Domerian deposits. From this one, Preda I. (1967) reported *Spiriferina alpina* OPPEL. We note that the specimen considered by the previous author couldn't be identified by the present one in the collections from the laboratories of Geology and Paleontology from the University of Bucharest. Unfortunatelly, Preda I., didn't indicate the place where his material is deposited.

The region of Someşul Cald Graben is very important for the establishing the brachiopod biozones for the Liassic deposits of the Northern Apuseni Mountains. Iordan Magdalena (in Mantea & coll., 1982) disscussed the problem on four geological sections.

In the Onceasa zone, at the base of the Liassic deposits there is the Detrital Formation. The Upper Sinemurian — Carixian deposits with a thickness of almost twenty meters, are constituted by an alternance of sandstones and limestones. At the Upper part, reddish and grey spathic limestones contains *Tetrarhynchia subconcinna* (DAVIDSON), *Gibbirhynchia cf. curviceps* (QUENSTEDT), *Lobothyris aff. punctata* (SOWERBY). This assemblage prove the presence of subconcinna-zone. The deposits of Domerian age are represented by sandy limestones or limestones with silliceous accidents. They contain *Homoeorhynchia maninensis* SIBLIK, *Spiriferina tumida* (BUCH), *S. alpina falloti* CORROY, *Liospiriferina rostrata* (SCHLOTHEIM). This assemblage was considered by dr. Iordan M. as representing the cornuta-zone. As all the cited species has a wide stratigraphic range we consider here there is no index species. The thickness of the Domerian deposits is about ten meters. These deposits are followed by the Toarcian black marls. There is no indication for the presence of the acuta-zone.

Another interesting section is on Pîrîul Ars. Over the Detrital Formation there are deposits of Upper Sinemurian — Carixiian age, with a thickness of about fourty meters. At the base, grey spathic limestones contain *Lobothyris subpunctata* (DAVIDSON). Over a level of quartzitic sandstones it follows a thick bank of grey spathic limestones with *Spiriferina hartmani* ZIETEN, *S. alpina* OPPEL, *Lobothyris edwardsi* (DAVIDSON), *Cincta numismalis* (LAMARCK). These species, and mainly the last oneprove the presence of numismalis-zone. The domerian deposits are represented by blackish-grey crinoidal limestones with *Slovenirhynchia*

jurcsaki sp.nov., *Lobothyris punctata* (SOWERBY), *L. edwardsi* (DAVIDSON); the assemblage indicates the presence of *jurcsaki* zone. At the upper part of the section it is known *Homoeorhynchia acuta* (SOWERBY) together with *Pleuroceras solare* (PHILLIPS), and which indicate the presence of the acuta-zone.

At the Someşul Cald Springs there is probably the most complete section in the Someşul Cald Graben. From grey and reddish spathic limestones of Upper Sinemurian — Carixian age there are known *Spiriferina hartmani* ZIETEN, *S. alpina* OPPEL, *Lobothyris subpunctata* (DAVIDSON), *L. cf. edwardsi* (DAVIDSON), *Zeilleria indentata* (SOWERBY), *Cincta numismalis* (LAMARCK), assemblage that proves the presence of the *numismalis*-zone. Over these deposits there are black limestones with silliceous accidents of Domerian age. From their lower part it is known an assemblage with *Spiriferina alpina* OPPEL, *S. haueri* (CORROY), *S. tumida* CORROY, *Zeilleria sarthacensis* (d'ORBIGNY) and *Z. subnumismalis* (DAVIDSON). This assemblage is typical for the subnumismalis-zone.

2. **The Finis Nappe.** Very few things are known about the brachiopods of the Finiş Nappe. Patrulius D. (1976) reported *Tetrarhynchia argotinensis* (RADOVANOVIC) in reddish limestones containing belemnites and pelecypods. Recently, Huza R. R. collected from the Gryphea limestone (Upper Sinemurian — Pliensbachian) several larger terebratuloids. The relativelly bad preserved specimens permited to the author the identification of the species *Lobothyris cf. subpunctata* (DAVIDSON). This terebratuloid assemblage will be the object of a detailed study in the near future.

D. BRACHIOPOD DISTRIBUTION IN THE NORTHERN APUSENI MOUNTAINS

The brachiopods, facies depending fossils, had a discontinous distribution in a sedimentary area as that which existed during the Liassic time in the Northern Apuseni Mountains zone. This thing make very difficult the biostratigraphy using the reprezentants of this group. In the following pages we'll try to present a short view of the brachiopod biozones and the horizontal and vertical changes of them.

1. **Subconcinna, Curviceps and Numismalis-zone.** This biozon is "taxon range" zone for all the index species, and correspond to the Upper Sinemurian (*obtusum, oxynotum* and *raricostatum zones*) and the Lower and Middle Carixian (*jamesoni* and *ibex* zons). The three index species occurs together in the Şuncuiuş zone. Only at Roşia *T. subconcinna* (DAVIDSON) is associated with *G. curviceps* (QUENSTEDT), but in the rest of the sections is present only one of the three species. Revet & Tchoumatchenco (1973) reported all the three species in the *dunrobinensis*-zone. A very interesting assemblage was met by the present author at Munteanu (Southern Banat), where together with *Tetrarhynchia dunrobinensis* (ROLLIER) there are present all the three index-species of this zone for the Northern Apuseni Mountains, Having these in mind, we have all the reasons to consider this zons as the equivalent of the

dunrobinensis zone in Bulgary. The general features of the main brachiopod groups are the following:

RHYNCHONELLIDA: T. subconcinna (DAVIDSON) and *Gibbirhynchia curviceps* (QUENSTEDT) are represented by a relative large number of specimens — this is another reason for considering them as index-

NORTHERN APUSENI MOUNTAINS							Type biozones (Bulgary) -after Tchoum.-	LIASIC STAGES
Vadu Crişului	Suncuiuş	Bratca	Roşia	Onceasa	Pîrîul Ars	Somesul Cald Springs		
NO BRACHIOPODS							cynocephala	TOARCIAN
acuta		?	acuta	?	acuta	acuta	acuta	DOMERIAN
?		subnum.	cormuta	?	jurcsaki	subnum.	cormuta	
subconcinna	subcon., curv. & mumis.	numismalis	subconcinna & curviceps	subconcinna	numismalis	numismalis	dunrobinensis	CARIXIAN
								SINEMURIAN
NO BRACHIOPODS							walcotti	HETTANGIAN

Fig. 1: The brachiopod biozones in the Northern Apuseni Mountains area.

species. The others (species) appear only locally, as minor constituents of the assemblages.

SPIRIFERINIDA: Not too numerous, they are dominated by *Liospiriferina rostrata* (SCHLOTHEIM) and *Spiriferina alpina* OPPEL.

TEREBRATULIDINA: The group it is numerical dominated by *Lobothyris punctata* (SOWERBY) and *L. subpunctata* (DAVIDSON). *L. ovatissima* (QUENSTEDT), *Pirotothyris fortis* SUCIC-PROTIC, *Squamiplana pyroidea* SUCIC-PROTIC and *S. gemmellaroi* (FUCINI) are developed locally.

TEREBRATELLIDINA: Represented by many species attributed to three genera; Excepting *Cincta numismalis* (LAMARCK) the others species are represented locally by a small number of specimens.

2. **Jurcsacki, Cornuta and Subnumismalis-zone.** As the previous one, this is a "taxon range zona" faor all three index species. It corresponds to the Upper Carixian (*davoei* zone) and the Lower Domerian (*stockesi* zone). *Zeilleria cornuta* (SOWERBY) index species for the equivalent zone in Bulgary occurs at Roşia, this place being the single one in our country where this species had be been recorded. *Zeilleria subnumismalis* (DAVIDSON) and *Slovenirhynchia jurcsaki* sp.nov. are rare, but the twoo occur at the same level in the Southern Banat (Romania). The brachiopod

faunas of this level are poor in specimens — excepting *Z. cornuta* (SOWERBY). The changes of the major brachiopod groups are:

RHYNCHONELLIDA: Three species only are known in this zone: *Slovenirhynchia maninensis* SIBLIK, *S. jurcsaki* sp.nov. and *Cuneirhyn-*

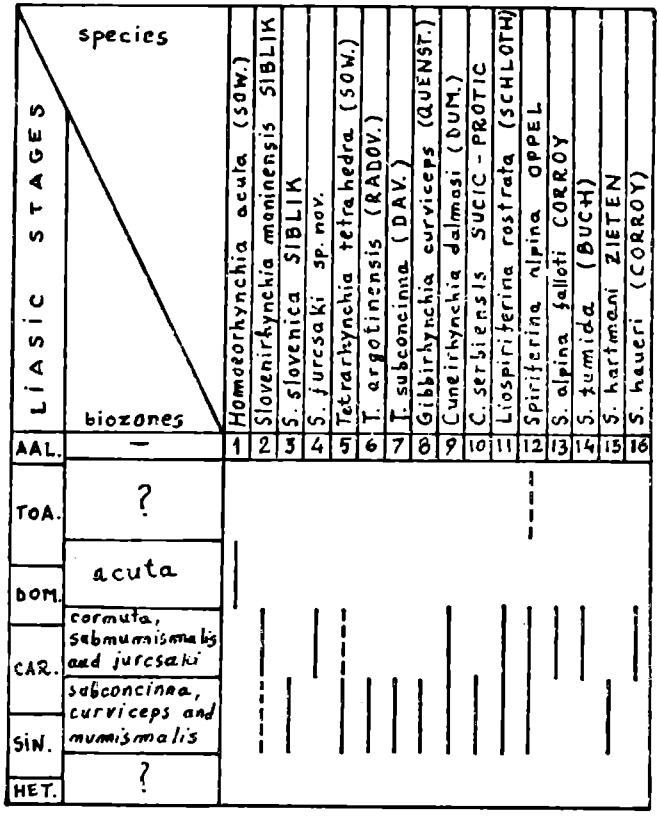

Fig. 2: The stratigraphic distribution of the Rhynchonellids and Spiriferinids in the studied area.

chia dalmasi (DUMORTIER). Into the previous zone, only the first one had been met. We must note a numerical decreasing of the „populations".

SPIRIFERINIDA: A diversification in what concerns the number of species it is to be noted.

TEREBRATULIDINA: Lobothyris punctata (SOWERBY) and *L. subpunctata* (DAVIDSON) are present also in this zone, being the most numerous representants of the group. But there are present also *L. edwardsi* (DAVIDSON), *Telothyris ariegensis* (SUCIC-PROTIC) and *Pyraenaica ? huzai* sp.nov.

TEREBRATELLIDINA: The completely changed fauna is constituted only of species or genus *Zeilleria. Zeilleria cornuta* (SOWERBY) and *Z. subnumismalis* are the most important.

3. **Acuta-zone.** This is a "taxon range zona" with *Homoeorhynchia acuta* (SOWERBY), and corresponds to the Middle and Upper Domerian

(*margaritatus* and *spinatum* zones) and Lowermost Toarcian (*tenuicostatum* zone). This zone is partly present only, the upper part probably missing. The brachiopod fauna recorded from this zone is undoubtelly the poorest one in the liassic deposits of the Northern Apuseni Mountains.

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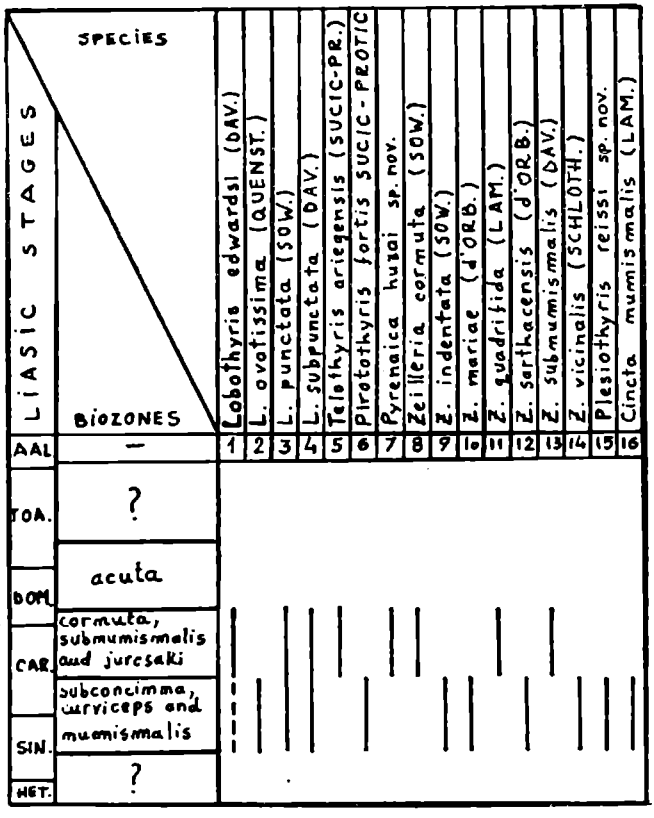

Fig. 3: The stratigraphic distribution of the Terebratulidina in the Liassic deposits of the Northern Apuseni Mountains.

Unfortunatelly, many deposits from the Northern Apuseni Mountains are completely lacking the brachiopods. Thus, the Detrital Formation (Hettangian — Lower Sinemurian) seems to correspond to the walcotti-zone. Recently, the author identified a subzone of this zone on the basis of a rich material from the Haghimaş Mountains (Eastern Carpathians) puted very kindly at his disposal by Dr. Preda I. (University of Bucharest). It is the subzone with *Rhaetina gregaria* (SUESS) and it is placed in the Lower Hettangian.

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The Marly Formation (Toarcian) is also completely lacking the brachiopods. Recently, the author identified at Munteana (Southern Banat) an assemblage with *Telothyris arnaudi* ALMERAS & MOULAN, which

indicates the presence of the Toarcian stage. The material had been offered to the author by Dr. Iordan Magdalena (Geological Institute of Bucharest).

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For different sections on a relativelly large area, the same beds may present different index species for the same biozone. This is because to the discontinuities in the repartition of the syncronous brachiopod populations.

The situation, considered for a longer period of time gives a complex view on the brachiopod distribution in rocks. The existence of the faunal provinces is proved (e.g. NW European, mediteraneean) but within each province there are a few bassins where the brachiopods have their own stratigraphic range, which may or not be different from the adjacent ones. These facts determined us to consider the regionality of the brachiopod faunas as one of the most important factors to take in account in using the brachiopods in biostratigraphy.

E. PALEONTOLOGICAL PART

Phylum: *Brachiopoda* Dumeril, 1806
Class: *Articulata* Huxley, 1869
Order: *Rhynchonellida* Kuhn, 1949
Family: *Rhynchonellidae* Gray, 1848
Subfamily: *Rhynchonellinae* Gray, 1848
Genus: *Homoeorhynchia* Buckman, 1918

Homoeorynchia acuta (SOWERBY), 1816

Rhynchonella acuta (SOWERBY) — Davidson, 1852, p. 76, pl. XIV, f. 8—9; Quenstedt, 1871, p. 64, pl. 37, f. 150—153; Haas & Petri, 1882, pl. 3, f. 23.

Homoeorhynchia acuta (SOWERBY) — Ager, 1956, p. 29, pl. 3, f. 1—4, text-fig. 17—19; Mantea & coll., 1982, pl. VII, f. 3—4; Almeras & Elmi, 1983, pl. 2, f. 9—12.

MATERIAL: One bad preserved specimen from Vadu Crişului (acuta-zone), two slightly deformed specimens from Roşia (L.P.B. III b. 0203). The specimens from Pîrîul Ars section and Someşul Cald Springs are deposited at the Geological Institute of Bucharest.

DIMENSIONS: *. For one of the specimens from Roşia: L_p=16.1 mm; W=18.7 mm; t=12.2 mm; W/L_p=1.161; t/L_p=0.758.

REMARKS: Very rare species in the studied area.

STRATIGRAPHIC RANGE: *acuta*-zone; Middle and Upper Domerian to Lowermost Toarcian.

* L_p=Length of the pedicle valve; L_b=length of the brachial valve; W=width; t=thickness.

Genus: *Slovenirhynchia* Siblik, 1967

Slovenirhynchia jurcsaki sp. nov.

(Pl. 1, figs. 1—3; Fig. 4)

Homoeorhynchia sp. — Preda, 1967, p. 50, pl. 2, f. 8.

Homoeorhynchia slovenica (SIBLIK) — Mantea & coll., 1982, pl. 7, f. 5.

HOLOTYPE: Specimen L.P.B. III b. 0204.

DIMENSIONS OF THE HOLOTYPE: L_p=11.0 mm; W=13.2 mm; t=7.6 mm; W/L_p=1.200; t/L_p=0.691.

DERIVATIO NOMINIS: Species dedicated to Jurcsak T. (Museum from Oradea) for his studies concerning vertebrate faunas from Romania.

STRATUM TYPICUM: The reddish limestones of Domerian age from Roşia (cornuta-zone).

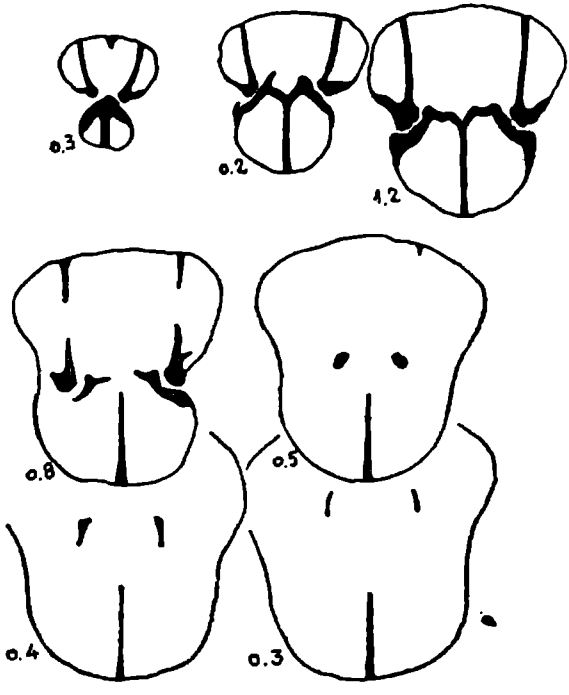

Fig. 4: Seven serial transveres sections through a specimen of Slovenirhynchia jurcsaki sp. nov. from cornuta-zone, at Roşia. L_p=12.1 mm.

MATERIAL: Apart of holotype, other five specimens: three at the University of Bucharest (L.P.B. III b. 0205) and two at the Museum from Oradea (C.M.B.N. 15.301/20). Two other specimens, one of them figured (Mantea, he & coll., 1982) are deposited at the Geological Institute from Bucharest. Other two specimens from Munteana (Southern Banat) from

the Domerian limestones. Other ten bad preserved specimens were not inventaried.

DIMENSIONS:	L_p	W	t	W/L_p	t/L_p
LPB ... 0204	11.0	13.2	7.6	1.200	0.691
LPB ... 0205	12.6	14,5	7.6	1.151	0.603
	13.2	14.1	9.7	1.068	0.735
	12.2	14.1	7.3	1.155	0.598
CMBN/15.301/20	10.8	12.6	6.9	1.167	0.639
	12.1	13.7	7.9	1.132	0.652

DESCRIPTION: External features — Shells of small size with a transversally elongate outline. The maximum width is attained approximatelly at the middle of the length. In lateral view the shells have a subcynocephalous aspect. The lateral commissures are subvertical, slightly indented anteriorly. The frontal commissure is uniplicate. The small, narrow beak is suberect to erect. Foramen small, submesothyrid; the beak ridges are slightly pronounced. The shell surface presents well developed costae, slightly rounded, developed on the first two thirds of the valves length. In the posterior zone there is a well pronounced smooth stage. On the brachial valve there are two (rarely three) median costae and two (1+1) on the lateral slopes; on the pedicle one there is one strong median and four (2+2) on the lateral slopes. The frontal commissure presented two (rarely three) costae on fold and one (rarely two) on sinus.

Internal features — Long, subparallel dental lamellae; at the posterior part there is present a short, strange and well developed ventral septum. On the brachial valve there have been not observed the cardinal process. The hinge-plates appear after a very well developed septalium. The teeth are strong, slightly crenulated. Crus of radulifer type, triangular in cross section. Dorsal septum very long and sharp bladelike (L_{ds}= 55% L_b).

REMARKS: *Slovenirhynchia jurcski* sp. nov. differs of *S. maninensis* SIBLIK IN having flattened shells and rounded costae. Of. *S. slovenica* SIBLIK it differs in having less inflated shells, in transversally elongate outline and more rounded costae.

STRATIGRAFIC RANGE: Upper Carixian (?) to Lower Domerian.

Subfamily: *Tetrarhynchiinae* Ager, 1965

Genus: *Tetrarhynchia* Buckman, 1918

Tetrarhynchia subconcinna (DAVIDSON), 1852

Rhynchonella subconcinna — Davidson, 1852, p. 90, pl. XVII, f. 17; Davidson, 1878, p. 206.

Tetrarhynchia subconcinna (DAVIDSON) — Ager, 1956, p. 10, pl. I, f. 5—7, Text — fig. 9; Răileanu & Iordan, 1964, p. 8, pl. 1, f. 3; Preda, 1967, pl. I, f. 5.

Tetrarhynchi dunrobinensis (ROLLIER) — Preda, 1967, p. 48, pl. I, f. 6.

Mediteranirhynchia (sp. nov.?) — Georgescu, 1988, p. 628, pl. 2, f. 9—12.

MATERIAL: About ten specimens from Roșia (subconcinna & curviceps zone), L.P.B. III b. 0206. Other two specimens (C.M.B.N. 15.301/3) from Șuncuiuș. The specimens from the Onceasa region are deposited at the Geological Institute from Bucharest.

DIMENSIONS: For a specimen from Roșia: L_p=17,4 mm; W=18.6 mm; t=15,3 mm; W/L_p=1 069; t/L_p=0,879. For a specimen from Șuncuiuș: L_p=15,5 mm; W=14,5 mm; t=9,7 mm; W/L_p=0,935; t/L_p=0,625.

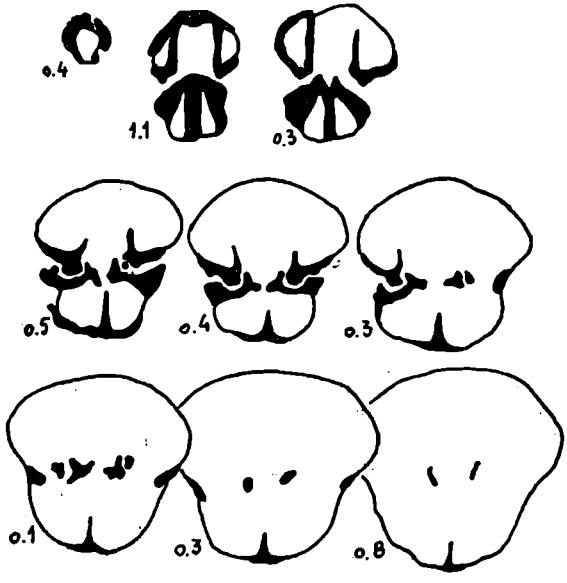

Fig. 5: Nine serial transverse sections through a specimen of Gibbirhynchia curviceps (QUENSTEDT) from the subconcinna & curviceps-zone, from Roșia. L_p=18.9 mm.

STRATIGRAPHIC RANGE: subconcinna, curviceps & numismalis-zone; Upper Sinemurian to Lower and Middle Carixian.

Genus: *Gibbirhynchia* Buckman, 1918
(Text — fig. 5))

Gibbirhynchia curviceps (QUENSTEDT), 1858

Terebratula curviceps — Quenstedt, 1858, p. 57, pl. 37, f. 118.

Gibbirhynchia curviceps (Quenstedt) — Ager, 1962, p. 96, pl. 8, f. 4; Răileanu & Iordan, 1964, p. 9, pl. 1, f. 7; Preda, 1967, p. 49, pl. 2, f.1; Georgescu, 1968, p. 630, pl. 1, f. 5—8;

Tetrarhynchia tetrahedra (SOWERBY) — Preda, 1967, p. 47, pl. 1, f. 1—3.

Tetrarhynchia austriaca (QUENSTEDT) — Preda, 1967, p. 48, pl. 1, f. 4.

Tetrarhynchia sp. 1 — Preda, 1967, p. 48, pl. 1, f. 8.

MATERIAL: About twenty specimens from Roșia (*subconcinna* & *curviceps* zone), L.P.B. III b. 0207. Other ten from Șuncuiuș (C.M.B.N. 15.301/6) (*subconcinna, curviceps* and *numismalis* zone).

DIMENSIONS: For the sectioned specimen from Roșia: L_p=12,5 mm; W=11,7 mm; t=11,1 mm; W/L_p=0,936; t/L_p=0,888. For a specimen from Șuncuiuș; L_p=14,0 mm; W=14,5 mm; t=13,1 mm; W/L_p=1.036; t/L_p= =0,936.

STRATIGRAPHIC RANGE: Upper Sinemurian — Lower and Middle Carixian.

Genus: *Cuneirhynchia* Buckman, 1918

Cuneirhynchia dalmasi (DUMORTIER), 1869

Cuneirhynchia dalmasi (DUMORTIER) — Ager, 1962, p. 126, pl. IX, f. 4—5, text — figs. 77—80; Ager, 1965, p. H612, f. 494—2 = Dumortier's figuration; Preda, 1967, p. 49, pl. I, f. 10; Almeras & Elmi, 1983, pl. 3, f. 7, 8 = Refiguration of the Holotype.

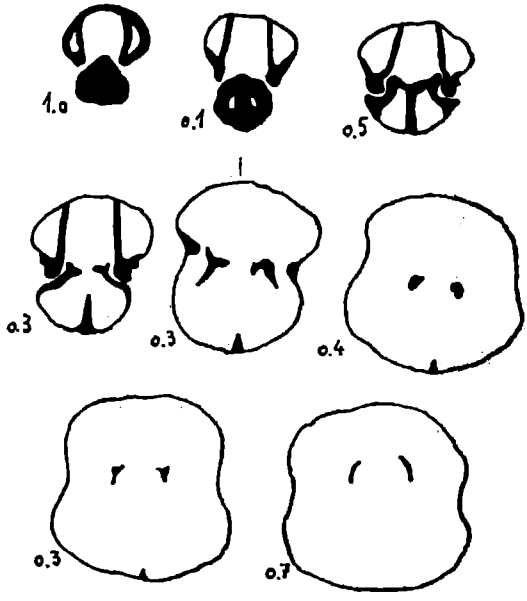

Fig. 6: Eight serial transverse sections through a specimen of Cuneirhynchia dalmasi (DUMORTIER) from the subconcinna & curviceps-zone from Roșia. L_p=12.4 mm.

MATERIAL: Three specimens from Roșia, the sectioned one being collected from the *subconcinna, curviceps* and *numismalis* zone and two from the *cornuta* zone. One specimen is deposited in Bucharest, L.P.B. III b. 0208 and one at Oradea: C.M.B.N. 15.301/21.

DIMENSIONS: For the sectioned specimen: L_p=12,3 mm; W=12,1 mm; t=7,8 mm; W/L_p=0,984; t/L_p=0,634.

STRATIGRAPHIC RANGE: Upper Sinemurian to Lower Domerian.

Order: *Terebratulida* Waafen, 1883.
Suborder: *Terebratulidina* Waagen, 1883
Superfeamily: *Terebratulacea* Gray, 1840
Family: *Terebratulidae* Gray, 1840
Subfamily: *Lobothyrinae* Makridin, 1955
Genus: *Lobothyris* Buckman, 1917

Lobothyris punctata (SOWERBY), 1812

Terebratula punctata SOWERBY — Davidson, 1852, p. 45, pl 6, f. 1—6; Deslongchamps 1863, p. 160, pl. 40, f. 1—5.

Lobothyris punctata (SOWERBY) — Tuluweit, 1965, p. 60, pl. 7, f. 2, Abb. 1; Muir-Wood, 1965, p. H784, f. 642—6, 643—2, 644—2; Delance, 1969, p. 28, pl. B, f. 2; Almeras & Moulan, 1982, p. 89, pl. f. 1—8, text — figs. 30—35

MATERIAL: A doubtfull specimen was collected at Şuncuiuş (subconcinna, curviceps and numismalis zone), C.M.B.N. 15.301/12. At Roşia were collected five specimens from the subconcinna & curviceps zone, L.P.B. III b. 0209, and two from the cornuta-zone.

DIMENSIONS: For a specimen from subconcinna, curviceps and numismalis zone: L_p=24,9 mm; L_b=22,7 mm; W=22,8 mm; t=13,6 mm; L_b/L_p=0,912; W/L_p=0,916; t/L_p=0,546.

STRATIGRAPHIC RANGE: Upper Sinemurian to Lower Domerian.

Lobothyris subpunctata (DAVIDSON), 1852

Terebratula subpunctata — Davidson, 1852, p. 46, pl. 6, f 6—10.

Lobothyris subpunctata (DAVIDSON) — Tuluweit, 1965, p. 62, pl. 7, f. 11, Abb. 1; Delance, 1969, p. 29, pl. B, f. 1, 3, 4; Mantea & coll.,1982, pl. VIII, f. 3; Almeras & Moulan, 1982, p. 111, pl. 7, f. 1—13, pl.8, f. 1—5, text — figs. 38—42.

MATERIAL: One poorly preserved specimen from Bratca. Twelve well preserved specimens from Upper Sinemurian — Lower Domerian from Roşia C.M.B.N. 15.301/22 and L.P.B. III b. 0210. The specimens collected from Onceasa area, Pîriul Ars and Someşul Cald Springs are deposited at The Geological Institute from Bucharest.

DIMENSIONS: For a specimen from Roşia: L_p=31,3 mm; L_b=27,1 mm; W=22,2 mm; t=19,7 mm; L_b/L_p=0,866; W/L_p=0,709; t/L_p=0,629.

STRATIGRAPHIC RANGE: Upper Sinemurian to Lower Domerian.

Genus: *Telothyris* Almeras & Moulan, 1982

Telothyris ariegensis (SUCUC-PROTIC), 1971

Zeilleria numismalis (LAMARCK) — Preda, 1967, p. 64, pl. 7, f. 5.

Pyraenaica ariegensis sp. nov. — Sucic-Protic, 1971, p. 24, pl. 9, f. 1—5, pl. 28, f. 1, pl. 38, f. 7.

MATERIAL: Eight well preserved specimens, one of them transversally sectioned. Five specimens, L.P.B. III b. 0211, and the other three, C.M.B.N. 15.301/23.

DIMENSIONS: For the greatest specimen: L_p=24,0 mm; L_b=22,3 mm; W=23,1 mm; t=7,9 mm; L_b/L_p=0,929; W/L_p0,962; t/L_p=0,329.

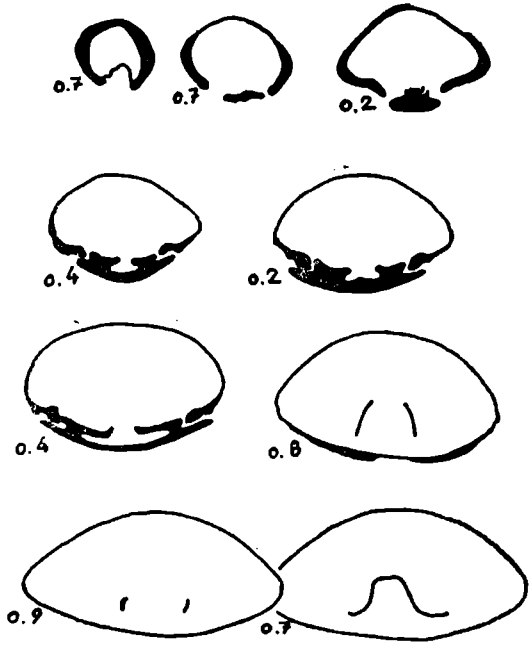

Fig. 7: Nine serial transverse sections throught a specimen of Telothyris ariegensis (SUCIC-PROTIC) from the cornuta-zone from Roșia. L_p=14.3 mm.

STRATIGRAPHIC RANGE: cornuta-zone; Upper Carixian to Lower Domerian.

Genus: *Pyraenaica* (?) Sucic-Protic, 1971

Pyraenaica (?) huzai sp. nov.

Zeilleria sarthacensis (d'ORBIGNY) — Preda, 1967, p. 55, pl. 7, f. 10.

HOLOTYPE: Specimen L.P.B. III b. 0212 (a).

DIMENSIONS OF THE HOLOTYPE: L_p=20,1 mm; L_b=18,5 mm; W=14,9 mm; t=8,4 mm; L_b/L_p=0,920; W/L_p=0,741; t/L_p=0,418.

DERIVATIO NOMINIS: Species dedicated to my friend Huza R. R. (Museum from Oradea).

STRATUM TYPICUM: The Domerian reddish limestones from Roșia (cornuta zone).

MATERIAL: Other two well preserved specimens L.P.B. III b. 0212 (b), and five bad preserved and not inventaried.

DIMENSIONS:	L_p	W	t	W/L_p	t/L_p
0212 (a)	20,1	14,9	8,4	0.741	0.418
0212 (b)	14,3	10,8	5,4	0.755	0.378
	21,7	16,0	9,3	0.737	0.428

DESCRIPTION: External features — Shells of small size, slightly antero posteriorly elongated. Valves biconvex, the pedicle being more inflated than the brachial one, the later being flattened. The commissures are straight. The small and suberect beak is narrow. Foramen big, submeso-

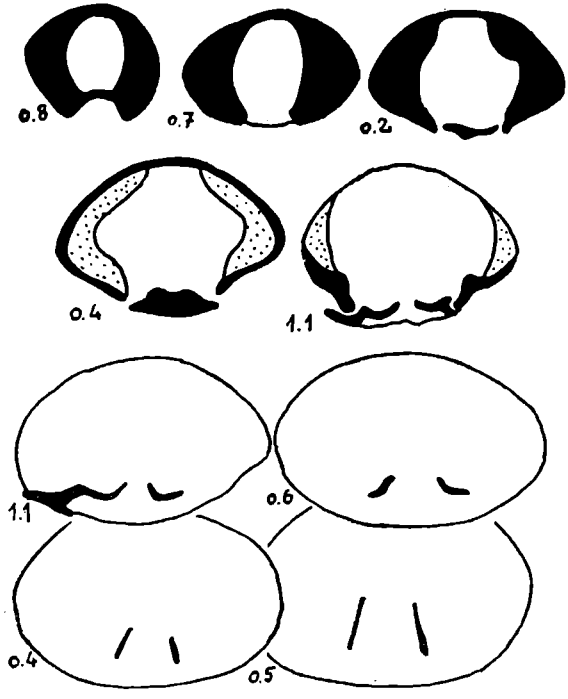

Fig. 8: Nine serial transverse sections through a specimen of Pyraenaica (?) huzai sp. nov. from the cornuta-zone from Roşia. L_p=21.7 mm.

thyrid, the beak ridges being weak. Well exposed symphytium. Internal features — Low arched and thin pedicle collar on the pedicle valve. The brachial valve starts with the low and bilobed cardinal process. The hinge plates are well demarcated from the relativelly high and arched crural bases; the inner socket ridge is weak. The teeth are rectangular, and the sockets are large, rounded. The crural processes are long, straight and ventrally vergent. No euseptoidum. The distal parts of the brachidium are missing.

REMARKS: Against a very poor material, we erected this new species on the basis of the very particular features of the specimens at our disposal.

STRATIGRAPHIC RANGE: cornuta-zone; Upper Carixian — Lower Domerian.

Suborder: *Terebratellida* Muir Wood, 1955
Superfamily: *Zeilleriacea* Rollier, 1915.
Family: *Zeilleridae* Rollier, 1915
Genus: *Zeilleria* Bayle, 1878

Zeilleria cornuta (SOWERBY), 1818

Terebratula cornuta (SOWERBY) — Davidson, 1852, p. 29, pl. 3, f. 11—18 Deslongchamps, 1863, p. 95, pl. 17, 18, 19.
Zeilleria cornuta (SOWERBY) — Douville, 1879, p. 275, f. 17; Preda, 1967, p. 55, pl. 8, f. 7.

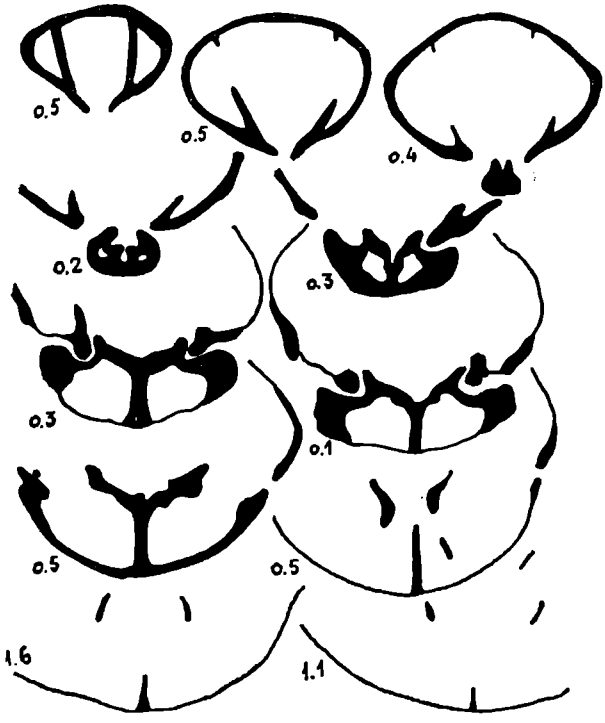

Fig. 9: Eleven serial transverse sections through a specimen of Zeilleria cornuta (SOWERBY) from the cornuta-zone from Roşia. L_p=16.0 mm.

Zeilleria indentata (SOWERBY) — Preda, 1967, p. 55, pl. 8, f. 9.
Zeilleria subcornuta (SOWERBY) — Preda, 1967, p. 55, pl. 8, f. 8.

MATERIAL: About 60 specimens, one of them being transversally sectioned Thirty specimens — L.P.B. III b. 0213, and the other C.M.B.N. 15.301/24. The material had been collected from Roşia, cornuta-zone.

DIMENSIONS: For a specimen: L_p=15.6 mm; W=12.1 mm; t=7.2 mm; W/L_p=0.776 mm; t/L_p=0.461 mm.

STRATIGRAPHIC RANGE: cornuta-zone; Upper Carixian to Lower Domerian.

Zeilleria quadrifida (LAMARCK), 1819

Terebratula quadrifida LAMARCK — Quenstedt, 1871, p. 309, pl. 45, f. 125.
Zeilleria quadrifida (LAMARCK) — Muir Wood, 1965, p. H821,

f. 700—3; Siblik, 1966, p. 140, pl. 1, f. 2; Delance, 1974, p. 177, pl. 3, f. 1—15.

Zeilleria cornuta (SOWERBY) — Muir Wood, 1965, p. H821, f. 700—3 a—e.

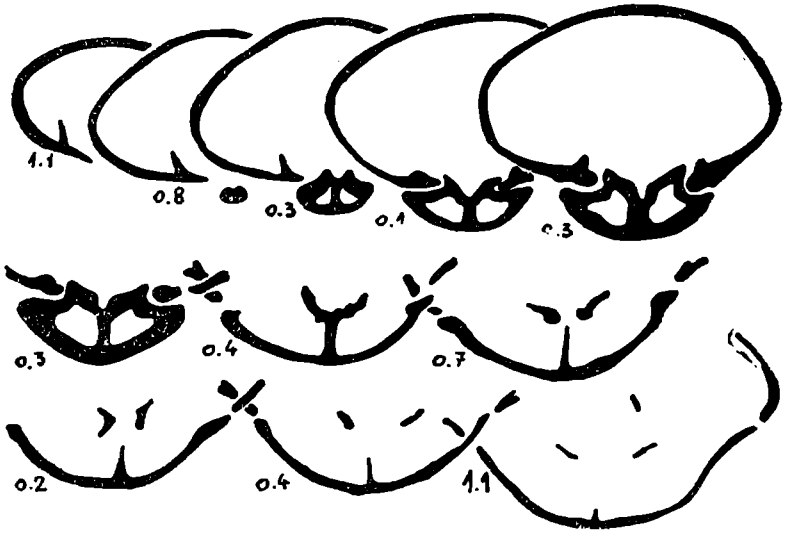

Fig. 10: Eleven serial transverse sections through a bicorne specimen of Zeilleria quadrifida (LAMARCK) from cornuta-zone from Roşia. L_p=15.3 mm.

MATERIAL: Eight specimens, all of them being reported to the „bicorn" morpha of the species. L.P.B. III b. 0214.

DIMENSIONS: For a specimen: L_p=15.7 mm; W=11.1 mm; T=8.7 mm; W/L_p=0.707; t/L_p=0.554.

STRATIGRAPHIC RANGE: cornuta-zone; Upper Carixian to Lower Domerian.

Zeilleria subnumismalis (DAVIDSON), 1852

Terebratula numismalis var. *subnumismalis* — Davidson, 1852, p. 38 pl. V, f. 10.

Zeilleria subnumismalis (DAVIDSON) — Siblik, 1966, p. 140, pl. 2, f. 6; Delance, 1974, p. 202, pl. 3, f. 16—17; Mantea & coll., 1982, pl. 9, f. 3.

MATERIAL: Two specimens, both into the collection of the Geological Institute from Bucharest,

STRATIGRAPHIC RANGE: subnumismalis-zone; Upper Carixian--Lower Domerian.

GENUS: *Plesiothyris* Douville, 1879

Plesiothyris reissi sp. nov.

HOLOTYPE: Specimen L.P.B. III b. 0215.

DIMENSIONS OF THE HOLOTYPE: L_p=17.2 mm; L_b=14.9 mm; W=12.1 mm; t=8.1 mm; L_b/L_p=0.866; W/L_p=0.703; t/L_p=0.471.

DERIVATIO NOMINIS: Species dedicated to Dr. Reiss Z. (The Hebrew University of Jerusalem) for his studies in the field of micropaleontology.

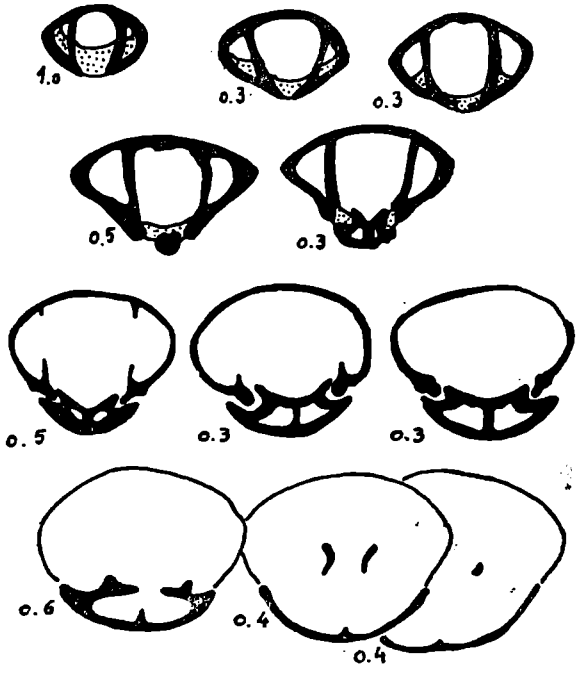

Fig. 11: Eleven serial transverse sections through a specimen of Plesiothyris reissi sp. nov. from the subconcinna & curviceps zone from Roşia. L_p=15.4 mm.

STRATUM TYPICUM: The black limestones (Upper Sinemurian to Lower and Middle Carixian from Roşia.

MATERIAL: Other six specimens, L.P.B. III b. 0216, more orr less well preserved.

DIMENSIONS: For other three specimens:

L_p	W	t	W/L_p	t/L_p
16.6	11.4	7.9	0.686	0.475
14.7	10.2	7.2	0.693	0.489
12.1	8.7	6.6	0.719	0.545

DESCRIPTION: External features — Shells of small size, with pentagonal rounded outline. Valves biconvex, the pedicle one being more inflated than the brachial one. The lateral commissures are slightly arched and the frontal commissure in low uniplicate. The beak is narrow and erect; the beak ridges are long, angular. The circular foramen is submesothyrid. On the shell surface, there are extremelly rare growth lines.

Internal features — As for the Genus.

REMARKS: Our species differs from *Plesiothyris verneuilli* (DESL.) by by the elongation of the shell, the uniplicate frontal commissure and

the less folded valves. Of *P. beli* SUCIC—PROTIC differs in the elongate outline, the features of the frontal commissure, and in the frontal commissure, and in the more proeminent beak.

STRATIGRAPHIC RANGE: subconcinna and curviceps zone; Upper Sinemurian to Lower and Middle Carixian.

GENUS: *Cincta* Quenstedt, 1868

Cincta numismalis (LAMARCK), 1819

Cincta numismalis (LAMARCK) — Muir Wood, 1965, p. H824 f. 703—3; Tuluweit, 1965, p. 94, pl. 10, f. 7; Mantea & coll., 1982, pl. IX, f. 2; Georgescu, 1989, pl. 3, f. 7—10, text-fig. 8.

Zeilleria (Cincta) numismalis (LAMARCK) — Delance, 1974, p. 239, pl. 5, f. 3—22.

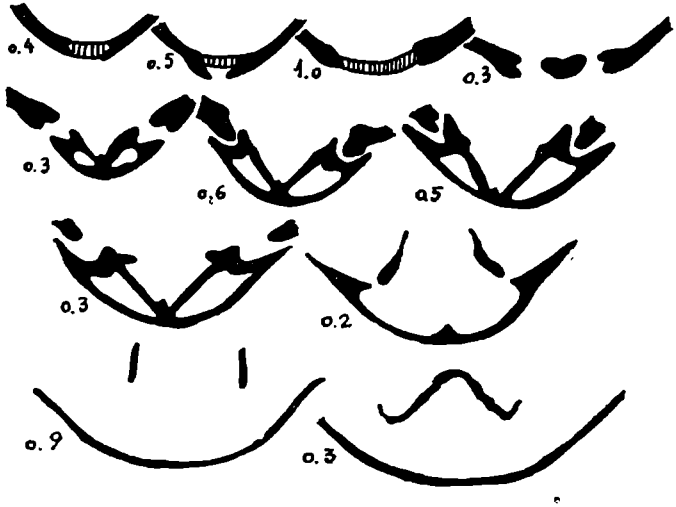

Fig. 12: Eleven serial transverse sections through a specimen of Rhaetina gregaria (SUESS) from the Lowermost Liass, (?) gregaria-subzone, (?) walcotti-zone from Haghimaş Mountains (Eastern Carpathians). L_p=13.7 mm.

MATERIAL: Fifteen very well preserved specimens (C.M.B.N. 15.301/17) from Suncuiuş. One specimen from Bratca, several others from Pîrîul Ars and Someşul Cald Springs.

STRATIGRAPHIC RANGE: sunconcinna, curviceps and numismalis zone, Upper Sinemurian to Lower and Middle Carixian.

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O ÎNCERCARE DE CORELARE A BIOZONELOR DE BRACHIOPODE DIN DEPOZITELE LIASSICE DIN MUNȚII APUSENI DE NORD (ROMÂNIA)

(Rezumat)

În condițiile în care cea mai mare parte a depozitelor Liasice din România au furnizat faune de brachiopode neasociate cu amoniți, în prezenta lucrare se face o încercare de a corela biozonele de brachiopode pe o arie mai largă, respectiv regiunea Munților Apuseni de Nord. Se arată că distribuția speciilor în bazinul de sedimentare constituie factorul determinant în stabilirea speciilor index pentru aceste biozone, pe diverse profile. Astfel, pentru intervalul Sinemurian superior — Carixian inferior și mediu se stabilesc ca specii index Tetrarhynchia subconcinna (DAVIDSON), Gibbirhynchia curviceps (QUENSTEDT) și Cincta numismalis (LAMARCK). Pentru intervalul Carixian superior — Domerian inferior specii index sînt considerate Zeilleria cornuta (SOWERBY), Z. subnumismalis (DAVIDSON), Slovenirhynchia jurcsaki sp. nov. Pentru Domerian mediu și superior și baza Toarcianului, Homoeorhynchia acuta (SOWERBY) constituie specia index. Acestea, în condițiile în care depozitele atribuite Hettangian — Sinemurianului inferior și Toarcianului nu conțin brachiopode.

Totodată sînt descrise trei specii noi: Slovenirhynchia jurcsaki sp. nov., Pyraenaica (?) huzai sp. nov. și Plesiothyris reissi sp. nov.

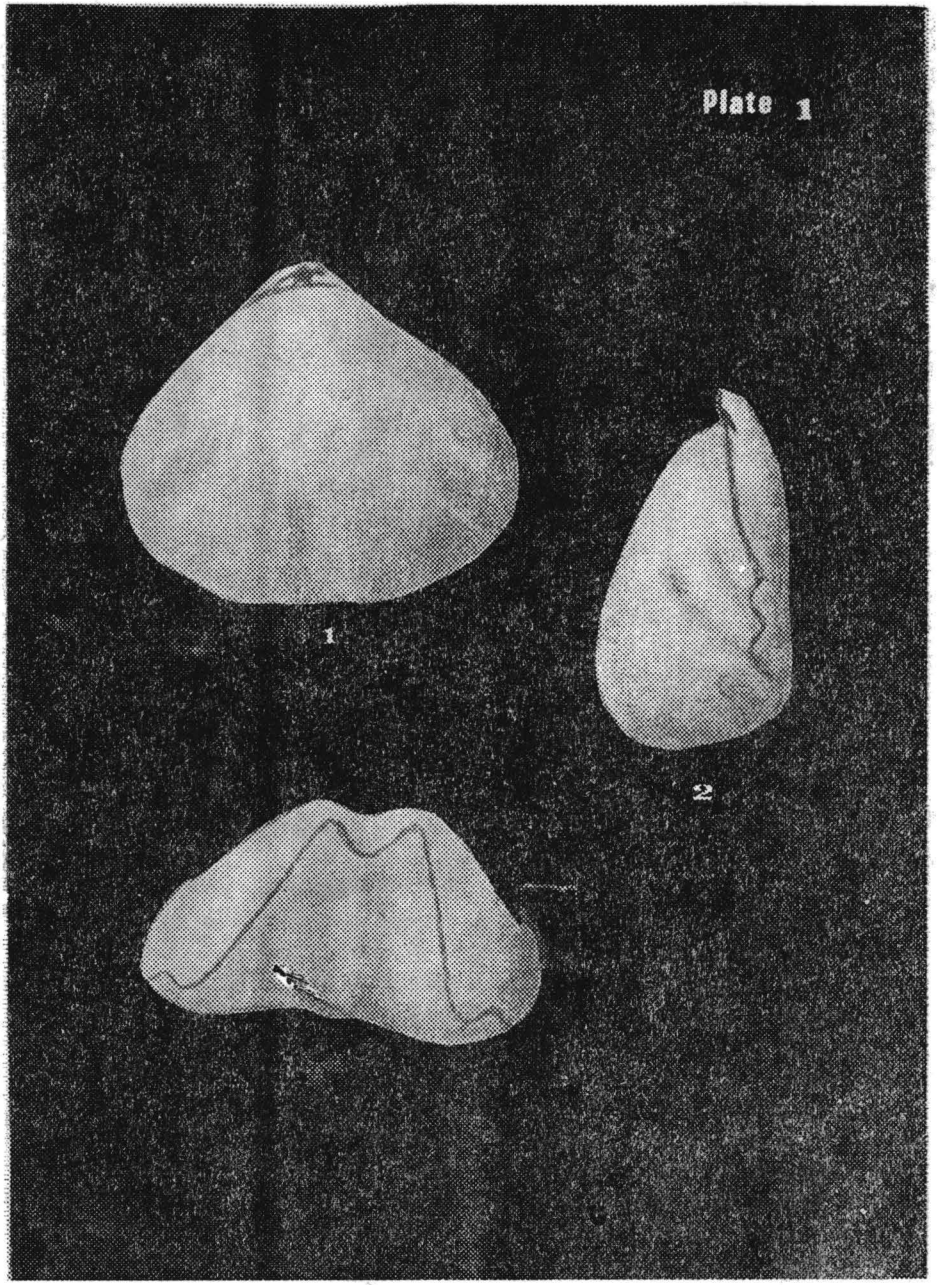

Plate 1: Slovenirhynchia jurcsaki sp. nov. Holotype. 1 — dorsal view; 2 — lateral view; 3 — frontal view. All the figures: ×4. All the figures were realised by the author.

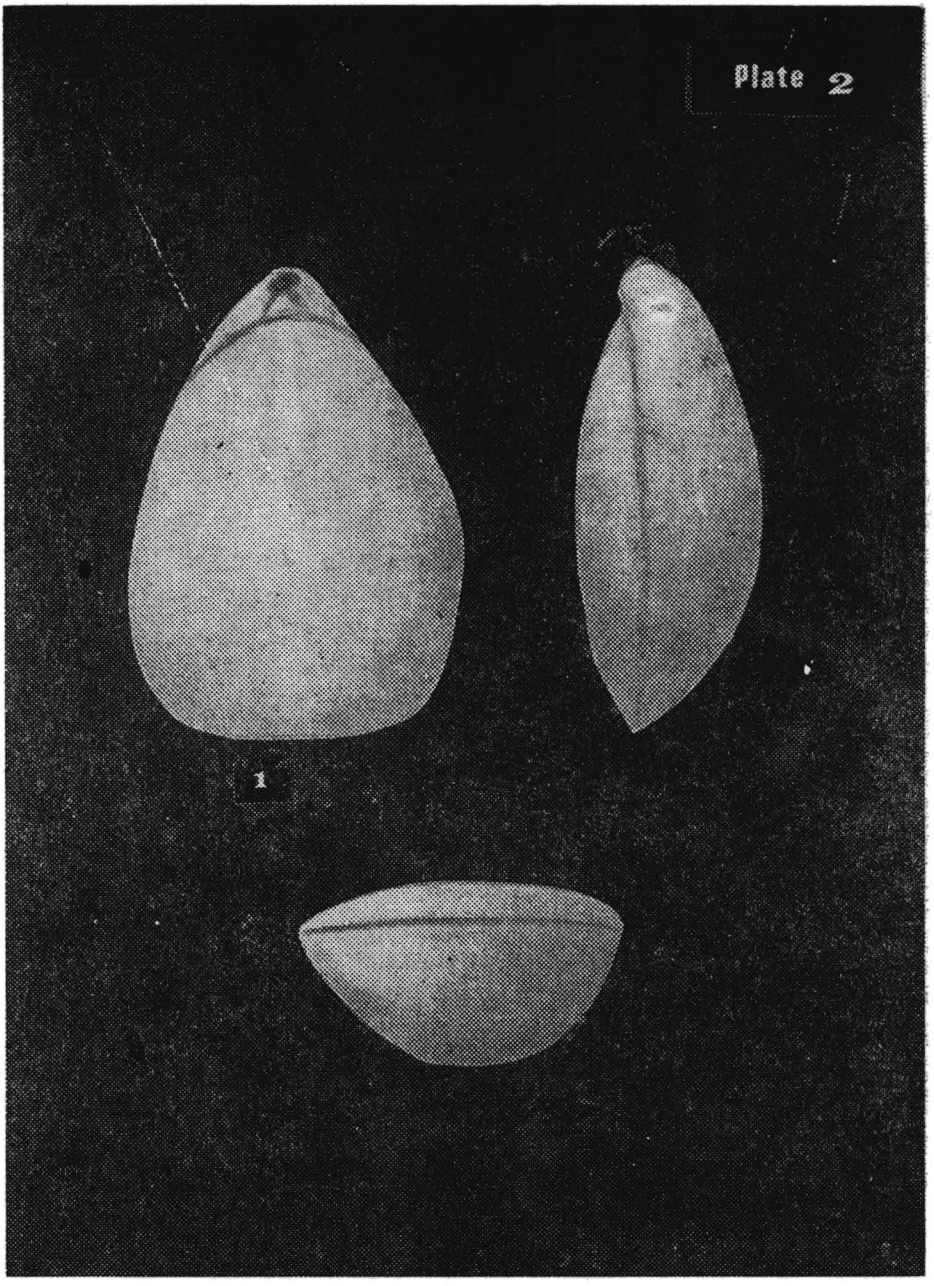

Plate 2: Pyraenaica (?) huzai sp. nov. Holotype. 1 — dorsal view; 2 — lateral view; 3 — frontal view. All the figures: ×3. All the drawings were realised by the author.

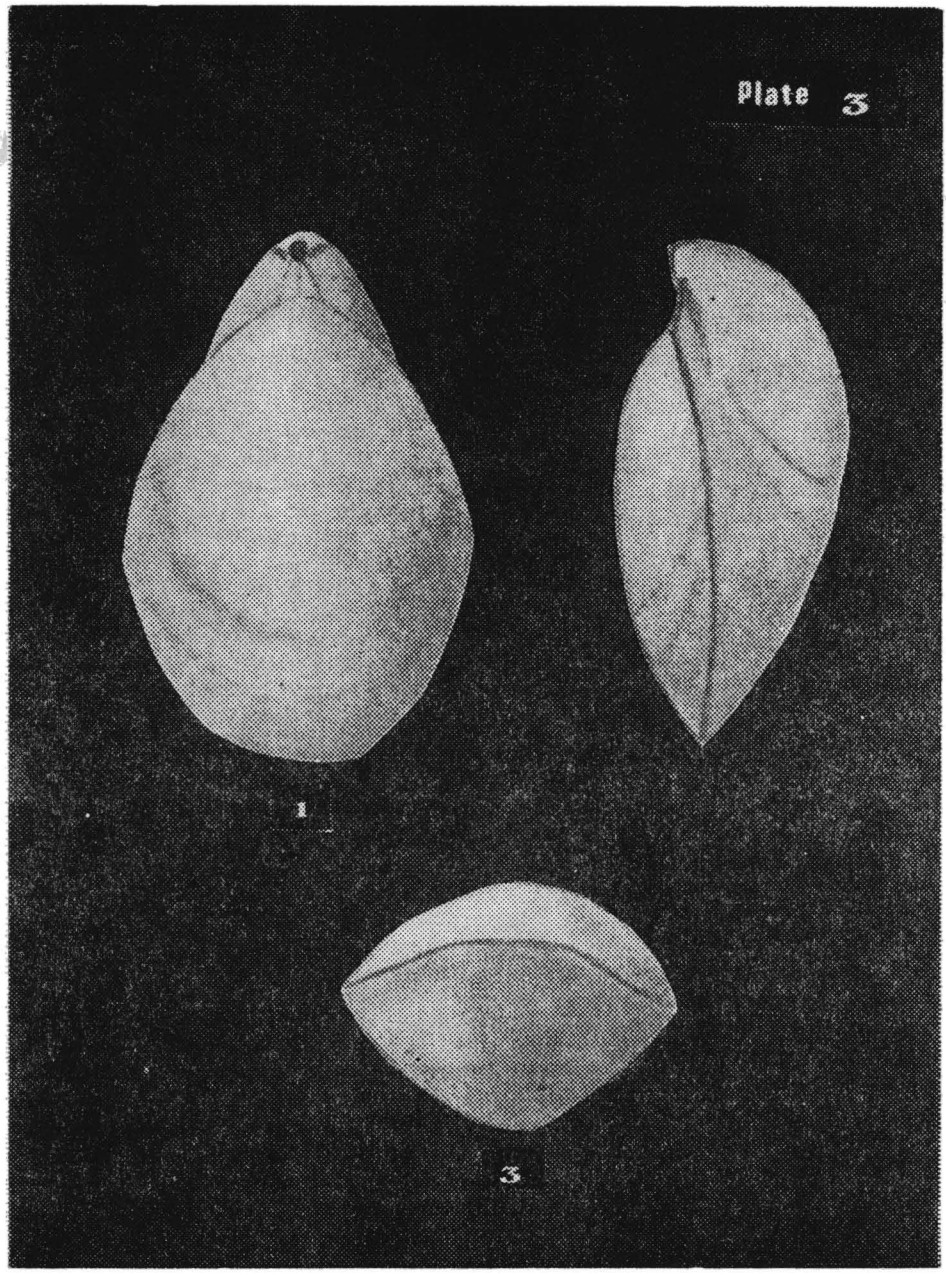

Plate 3: Plesiothyris reissi sp. nov. Holotype. 1 — dorsal view; 2 — lateral view; 3 — frontal view. All the figures: ×4. The drawings were realised by the author.