

THE PALAEOZOIC BRACHIOPODS OF ROMANIA

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Abstract. The paper describes and reviews the Palaeozoic brachiopods from Carpathians and their foreland (Moldavian, Scythian and Moesian Platforms), including the North Dobrogea orogenic belt. In the South Carpathians the presence of the Lower Silurian and Lower Carboniferous is attested by brachiopods. The brachiopod assemblage consisting of **orthids**, **strophomenids**, **pentamerids** and **spiriferids** attests the Middle and upper Llandoveryan age of the Valea Izvorului Formation. The cosmopolitan faunas suggest that this area correlates with England, Norway (the Oslo region) and Sweden (the Gotland region). The lower Carboniferous brachiopods including giant **productids** and **spiriferids** attest a Tournaisian age for the Valea Idegului Formation of the same Danubian domain. The upper calcareous complex of the Moldavian Platform yielded a Silurian shelly fauna facies consisting mainly of brachiopods. The Wenlockian assemblage is characterized by the appearance of Plectambonitaceatids with the predominance of **leptaenids**, lack of **protochonetids** and nearly complete disappearance of **orthids**. The Ludlow-Pridoli±Gedinnian assemblage is characterized by the appearance and predominance of **protochonetids**, appearance of **spiriferids** with predominance of **delthyrids** and by the presence of **orthids**. The palaeontological assemblage proves the similarity with Podolian and Baltic faunas, as the Moldavian Platform represents the south-western margin of the East European Craton. The Romanian part of the Moesian Platform is part of the Protomoesian microcontinent. In the detrital deposits of the Cambrian and Ordovician only inarticulate brachiopods were identified (**lingulellids** and **acrotretids**), together with middle Cambrian trilobites, Ordovician graptolites and with palynomorphs. A graptolite shale facies was described in the Silurian, as well as a shelly fauna facies. Only the mixed type of the graptolite shale facies (Pridolian strata) yielded tiny brachiopods (**orbiculoids**, **strophomenids**, **spiriferids**) which attest a Rhenish and Bohemian type of faunas. The shelly fauna facies, described only in the south-western part of the Platform, yielded a neritic shallow water palaeontological assemblage characteristic for Wenlockian, Ludlovian and Pridolian. In the Devonian time, a rich faunal and floral assemblage was living in the basal argillitic facies (Gedinnian-Emsian) and in the middle gritty one (Eifelian), as much as in the upper carbonate-evaporite facies (Givetian-Famennian). The age indicator brachiopods (Lower Devonian), as well as the brachiopod zones (Middle and Upper Devonian), together with the entire palaeontological association attest a similarity with the Rhenish, Moravian, Barrandian and Turkish Devonian faunas. The Carboniferous brachiopods attest the presence of the Visean (giant **productids**, **strophomenids**, **spiriferids**) and the Namurian-Westphalian (small **productids**) and enable correlations with the Dinant and Namur from the Western Europe as well as with the East European Platform and Poland. In the North Dobrogea orogenic belt, Lower Devonian brachiopods were identified only in the western part, in the Macin zone. They are associated with crinoids, tentaculites and subordinately with trilobites, corals, bryozoans, ostracods and suggest a very shallow-water deposition in a benthic, open shelf environment. The macrofaunal assemblage correlates with the Ardennes and Rhenish massif (Siegenian), as well as with Poland and Turkey.

Key words: Brachiopoda, Palaeozoic, South Carpathians, Moldavian, Scythian & Moesian Platforms, North Dobrogea, Romania

1. INTRODUCTION

In Palaeozoic the brachiopods are the most abundant representative and widespread group of fossils. In Romania, brachiopods contributed for attesting of all the stages of the Palaeozoic system. Based on brachiopod assemblages, the presence of the Devonian was attested for the first time in Romania in the Bujoarele Hills (North Dobrogea) (Simionescu, Cadere, 1908; Simionescu, 1924). Other stages of the Palaeozoic attested on brachiopods are: the Ludlovian in the Moldavian Platform (Macarovici, 1949), the Lower Carboniferous in the South Carpathians (Valea Idegului) (Codarcea *et al.*, 1960) and in the Moesian Platform (Cetate borehole, Patrulea, 1963), as well as all other identifications of Palaeozoic starting with 1960 (Iordan 1981, 1985). The present paper describes and reviews the Palaeozoic brachiopods from the Romanian Carpathians and their foreland (Moldavian, Scythian and Moesian Platforms, as well as from the North Dobrogea orogenic belt) (Fig. 1).

2. SOUTH CARPATHIANS

In the Danubian realm of the South Carpathians the presence of the Lower Silurian and Lower Carboniferous was attested by brachiopods. In the Godeanu Mountains, the phyllitic member of the Valea Izvorului Formation yielded a rich faunal assemblage dominated by brachiopods and trilobites, with subordinate corals, crinoids and bryozoans (Iordan, Stanciu, 1993). The fauna appears as lumachellic lenticular interbeds (coquinas), or as isolated specimens, but always as moulds or casts. The brachiopod assemblage, consisting of **Orthids**, **Strophomenids**, **Pentamerids** and **Spiriferids** attest the Middle and Upper Llandoveryan age (early stage of the Silurian). They are *Dolerorthis* sp., *Mendacella* sp., *Skenidioides lewissi* (Dav.), *Eoplectodonta penkillensis* (Reed), *Leptaena rhomboidalis* (Wahl.), *Mesopholidostrophia salopiensis* (Cocks), *Strophonella euglypha* (Dalm.), *Coolinia* cf. *aplanata* (Salt.), *Clorinda globosa* (J. Sow.), *Atrypa orbicularis* J. Sow., *Eocoelia hemisphaerica* (J. Sow.) (Plate I). The cosmopolitan

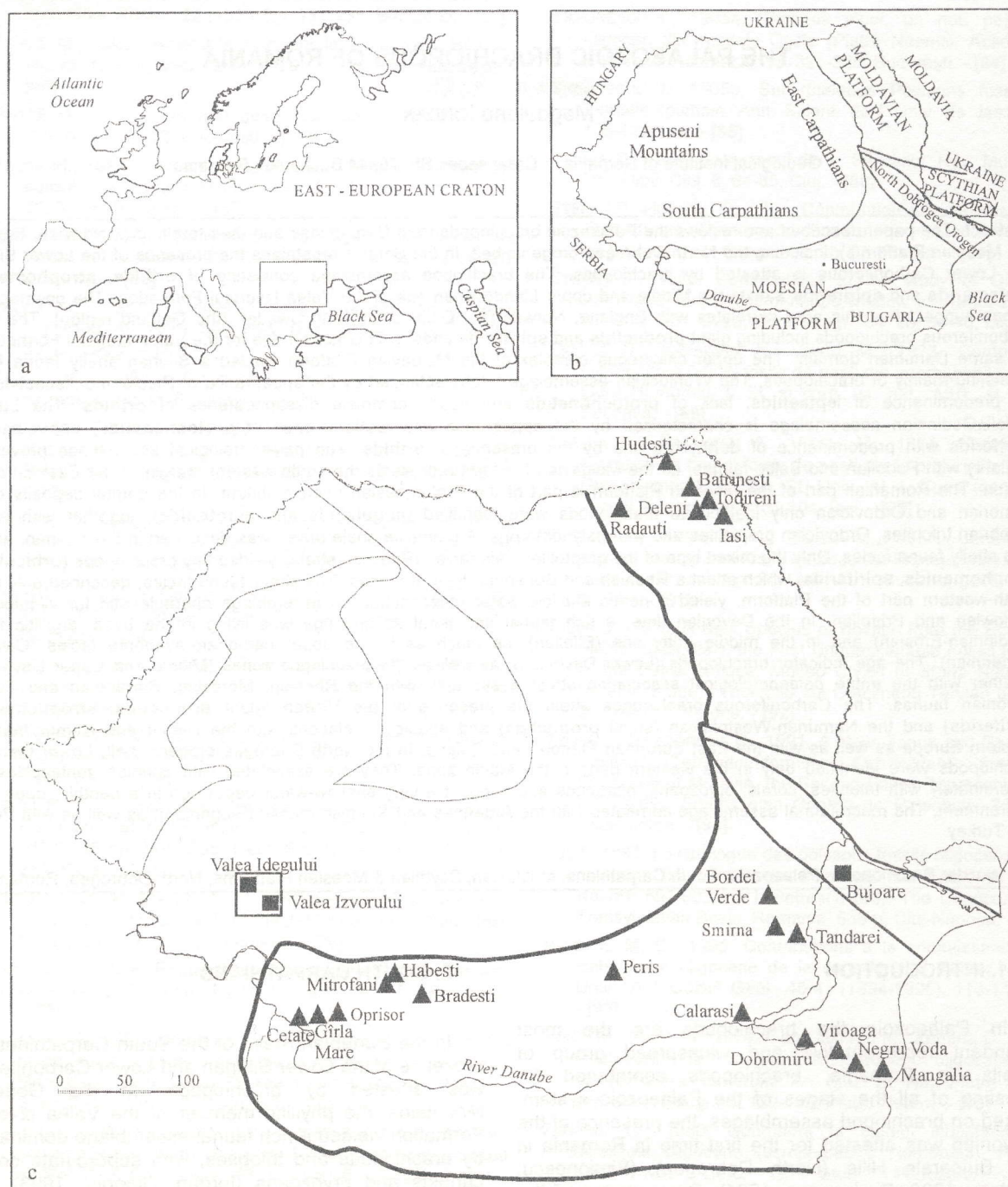


Fig. 1. Location maps: a, location of the study area in Europa; b, main structural units of the Carpathian foreland in Romania; c, location of the main boreholes (triangles) and of outcrops (rectangles) with Palaeozoic brachiopods.

faunas suggest that South Carpathians may be correlated with England (Fronian and Telychian), Norway and Sweden (Late Rytteraker, Vic and base of the Bruflat Formations), as well as with USA, Argentina, Podolia, Siberia. The Lower Carboniferous (sparitic limestones) was identified by brachiopods including giant Productids and Spiriferids. In the same Danubian units, in the Valea Idegului Formation the following Tournaisian-Visean brachiopods were mentioned

(Codarcea *et al.*, 1960): *Dictyoclostus semireticulatus* (Mart.), *Antiquatonia antiquata* (Sow.), *Productus projectus* Muir-Wood, *Spirifer tomacensis* de Kon., *S. clathratus* McCoy, *S. striatus* Mart., *S. (Paleochoiristites) cinctus* (Kays.), *Syringothyris cuspidata* Sow., *Chonetes cf. compressa* Sibly. This brachiopods assemblage needs to be reviewed.

3. MOLDAVIAN PLATFORM

In the foreland area of the Romanian East Carpathians, the Moldavian Platform corresponds geographically with the Moldavian Plateau and geologically to the southwestern termination of the East European Platform. The Sveco-Karelian metamorphic basement is overlain by a sedimentary cover with a lower detrital complex representing the Vendian, Cambrian and Ordovician and an upper calcareous complex ascribed to the Silurian±Early Devonian, Cretaceous, Miocene and Quaternary.

The Silurian is present in a shelly fauna facies consisting mainly of brachiopods and subordinately by ostracods, trilobites, gastropods, corals, bivalves, bryozoans, crinoids and palynomorphs. This palaeontological assemblage proves the similarity with Podolian and Baltic faunas. Based on the faunal assemblage the Wenlockian, Ludlovian and Pridolian rock sequences were identified (Macarovici, 1949, 1956, 1971, 1962, 1965; Iordan 1975, 1977, 1982, 1984, 1985).

The Wenlockian brachiopods identified are: *Dolerorthis* aff. *rustica* (Sow.), *Isorthis* (*Protocortezorthis*) sp. ex gr. *slitensis* Walm., *Resserella* aff. *elegantula* (Dalm.), *Leptagonia* aff. *joachimiana* Havl., *L.* aff. *depressa* (Sow.), *Dubioleptina* *expulsa* (Barr.), *Eoplectodonta* aff. *sowerbiana* (Barr.), *E.* aff. *transversalis-duvalii* (Dav.), *Strophonella* *euglypha* (Dalm.), *Coolinia* aff. *studentitze* (Wenj.), *Strophochonetes* *cingulatus* (Linds.), *Antirhynchonella* cf. *linguifera* (J.Sow.), *Sphaerirhynchia* aff. *dumanovi* (Wenj.), *Howellella* aff. *cuneata* (Dalm.), *Atrypa* *orbicularis* Sow. (Plate I). The above mentioned species are characteristic for Kitaigorod and Muksha Formations of the Podolian Wenlockian from the East European Platform, for the Bardo Beds of the Polish Llandoveryan-Wenlockian, for the Liten Formation of Bohemia and for the Wenlockian from England.

The Ludlovian brachiopods recorded are *Isorthis* aff. *crassa* (Linds.), *Leptaena* aff. *rhomboidalis* (Wilck.), *Mesodouvillina* *costatula* (Barr.), *Protochonetes* *dniestrensis* (Kozl.), *P. striatellus* (Dalm.), *P. ludloviensis* Muir-Wood, *Strophochonetes* sp., *Sphaerirhynchia* *wilsoni* (Sow.), *Atrypa* aff. *reticularis* (Lin.), *Delthyris* *elevata* Dalm., *D. magnus* (Kozl.) (Plate I). The macrofauna is characteristic for the Ludlovian of Podolia and Baltic Sea (Malinovetk and Skala Formations), Mielnik Beds of Poland, Kopanina Formation from Bohemia and for the Ludlovian of England.

The Pridolian ± Gedinian was recorded at the upper part of the pile with calcareous Silurian deposits based on the following brachiopod species: *Protochonetes* *dniestrensis* (Kozl.), *'Camarotoechia'* *infelix* Barr., *Atrypa* *dzvinogradensis* Kozl., *Protathyris* *infantile* Kozl., *Delthyris* *magnus* (Kozl.) (Plate I), characteristic for the Pridolian (Dzvinograd Beds) of Podolia; *Resserella* *elegantuloides* (Kozl.) characteristic for the Pridolian-Gedinian and the species *Isorthis* (*I.*) *szajnochai* (Kozl.) and *Iridistrophia* *praeumbracula* (Kozl.) for the Gedinian Borschov Horizon from Podolia, the Budnianian of Bohemia and the Downtonian of England.

4. MOESIAN PLATFORM

The Moesian Platform is the foreland of the South Carpathians and corresponds geographically with the Romanian Plain and the Central and Southern Dobrogea. This platform is regarded as a Precambrian block incorporated in the Hercynian European platforms, representing the nucleus of the Protomoesian microcontinent (Haydoutov, Yanev, 1997). Borehole evidence indicates that the basement rocks (Neoproterozoic and older metamorphic Formations) are overlain by a sedimentary cover including Palaeozoic, Mesozoic and Neozoic deposits.

Cambrian-Silurian

In the detrital deposits of the Cambrian and Ordovician, only inarticulate brachiopods (*Lingulellids* and *Acrotretids*) were identified together with Middle Cambrian trilobites, Ordovician graptolites and with palynomorphs. In the north-western part of the platform, the black shales pierced by Mitrofani and Habesti boreholes yielded Middle Cambrian trilobites associated with *Lingulella* *feruginea* Salt. and the merostomat *Hyolites* cf. *oelandicus* Holm. (Mutiu 1988, 1991; Iordan 1990, 1992b, 1999a,c).

In the eastern part of the platform, the black shales of the Bordei Verde borehole contain the Upper Arenig (Ordovician) graptolites with the brachiopod *Lingulella* aff. *davisi* McCoy (Murgeanu, Spasov, 1968). In the black shales and tuffaceous grey-greenish mudstones of the Tandarei borehole, minute *Acrotretids*, *Lingulella* fragments and a ?*Didymograptus* fragment were mentioned; together with the palynomorphs, they suggest Tremadoc and Caradoc-Ashgill ages (O₃) (Iordan 1972, 1981, 1992b, 1999c; Iordan, Spasov, 1989).

The Silurian shows a graptolite shale facies, developed mainly in the east and a shelly fauna facies which occurs in the south-western part of the Romanian Moesian Platform. Only the mixed type of the graptolite shale facies yielded tiny brachiopods.

At the base of the Mangalia borehole (1940-1942 m depths), only few brachiopod fragments were found within the black marly shales which yielded a palinological assemblage specific for the Wenlockian (Beju, 1972). In black argillites from the Calarasi borehole (4970-4500 m depth), tiny brachiopods were ascribed to genera *Plectodonta*, *Leptostrophia*, *Howellella* (Iordan, 1977; 1981; 1984; 1989; 1999c). These brachiopods, together with graptolites, crinoids, bivalves, orthoconic nautiloids and ossicles of crinoids, attest the presence of the Upper Ludlovian. In upper, Pridolian strata (4400-4500 m) of the same mixed facies, the following brachiopods are mentioned: *Orbiculoidea* sp., *Leptostrophia* sp., *Plectodonta* sp., *Howellella* sp. (Iordan 1981, 1982, 1984, 1985, 1989, 1992b, 1999c). The palaeontologic assemblage attests Rhenish and Bohemian type of faunas.

In the south-western part of the Moesian Platform a Silurian shelly fauna was distinguished. Based on the presence of brachiopods, which are dominant, together with rare and scarce trilobites, tentaculites, corals, crinoids, bryozoans, bivalves and ostracods, the presence of the Wenlockian, Ludlovian and Pridolian was established in boreholes Gîrla Mare and Oprisor

PLATE I

SOUTH CARPATHIANS

Valea Izvorului Formation, Lower Silurian: Middle and Upper Llandoveryan

Fig. 1 – *Dolerorthis* sp.; Fig. 2 – *Eoplectodonta penkillensis* (Reed); Fig. 3 – *Ecocoelia hemisphaerica* (J. de C. Sowerby)

MOLDAVIAN PLATFORM

Bătrânești borehole, Silurian: Wenlockian

Fig. 4. – *Strophonella euglypha* (Dalman); Fig. 5 – *Leptagonia* aff. *depressa* (Sowerby); Ludlovian: Fig. 6 – *Isorthis* aff. *crassa* (Lindström); Fig. 7 – *Mesodouvillina costatula* (Barrande); Fig. 8 – *Protochonetes dniestrensis* (Kozłowski); Fig. 9 – *Delthyris elevata* Dalman; Pridolian: Fig. 10 – *Delthyris magnus* (Kozłowski)

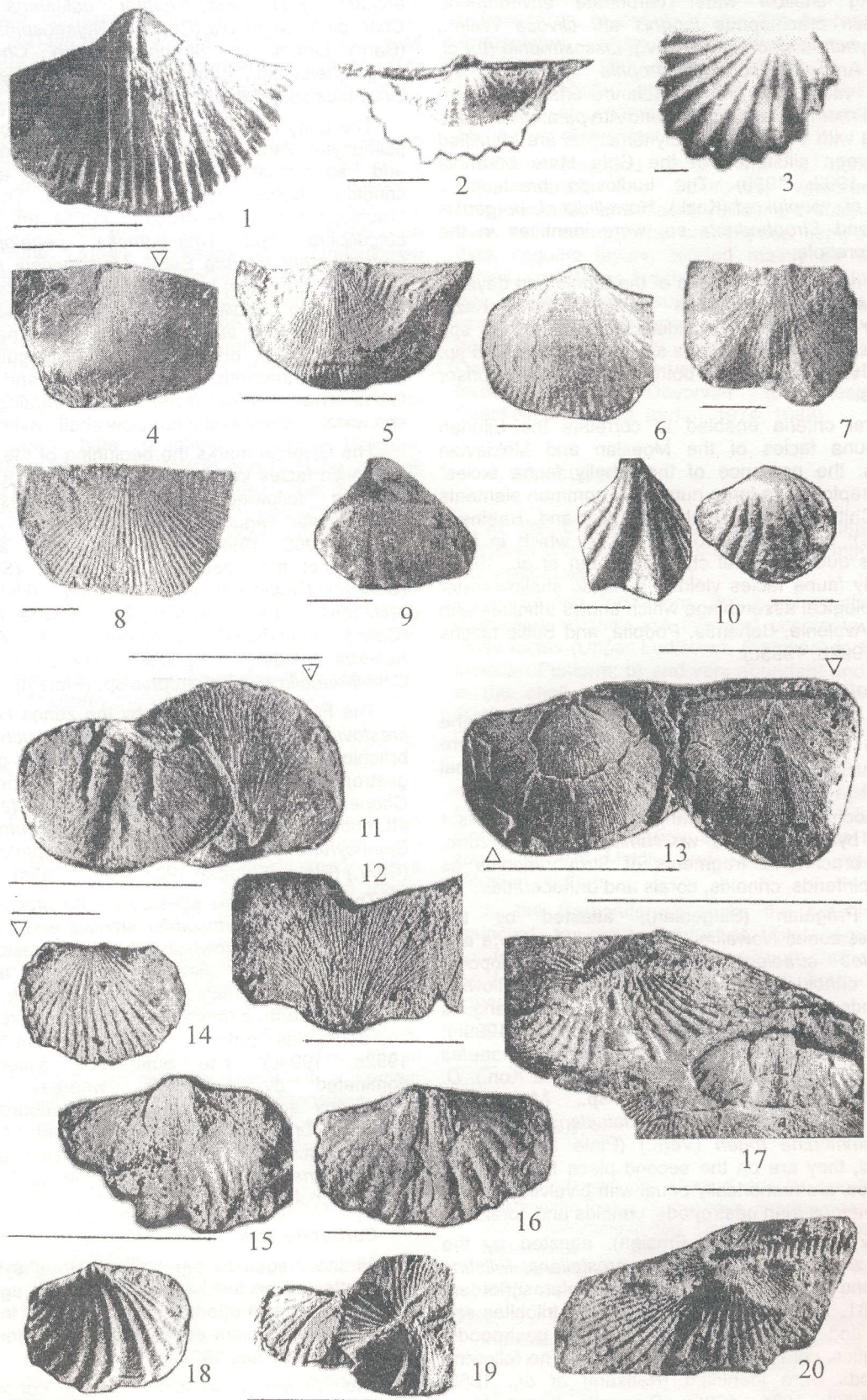
NORTH DOBROGEA

Bujoarele Hills, Lower Devonian: Siegenian-Emsian

Fig. 11 – a) *Schizophoria provulvaria* (Maurer); b) *Platyorthis circularis* (Sowerby); Fig. 12 – *Fascistropheodonta* aff. *sedgwicki* (Arch. et Vern.); Fig. 13 – *Iridistrophia hipponyx* (Schnur); Fig. 14 – *Plebejochonetes plebejus* Schnur; Fig. 15 – *Acrospirifer primaevus* (Steininger); Fig. 16 – *Arduspirifer arduenensis latestriatus* (Maurer); Fig. 17 – a) *Euryspirifer pellicoi* (Arch. et Vern.); b) *Hysterolites hystericus* (Schlotheim); Fig. 18 – *Brachyspirifer* (B.) *carinatus* (Schnur); Fig. 19 – *Hysterolites hystericus* Schlotheim, *Brachyspirifer* (B.) *carinatus* (Schnur); Fig. 20 – *Vandercammenina bischoffi* (Roemer)

Scale bar = 10 mm

PLATE I



(Iordan 1984, 1985; Iordan *et al.*, 1985; Iordan, Spasov, 1989). In both boreholes the faunal assemblages are of neritic and litoral type, sometimes with characters suggesting shallow water carbonate environment. Wenlockian brachiopods *Isorthis* aff. *clivosa* Walm., *Morinorhynchus* cf. *orbignyi* (Dav.), *Lissostrophia* (L.) cf. *cooperi* Ams., *Mesopholidostrophia* sp. (Plate II), together with long range (Llandoveryan-Ludlovian) *Leptaena rhomboidalis* (Wahl.) and *Atrypa* aff. *reticularis* Linn. and with Wenlockian palynomorphs are identified in the green siltstones of the Gîrla Mare borehole (Iordan, 1992, 1999). The Ludlovian brachiopods *Fardenia* cf. *wieniukovi* (Kozl.), *Howellella* cf. *bragensis* (Wenj.) and *Strophodonta* sp. were identified in the Oprisor borehole.

The Pridolian brachiopods of the *tenuis* and *dayana* zones are *Mesodouuvillina subinterstitialis* Kozl., *Eospirifer* cf. *schmidtii* Lindstr., *Leptostrophia* sp., *Spondilostrophia* sp., *Shaleria* sp., *Strophochonetes* sp. (Plate II), were identified in both Gîrla Mare and Oprisor boreholes.

Several criteria enabled to correlate the Silurian shelly fauna facies of the Moesian and Moldavian Platforms: the presence of the "shelly fauna facies" without graptolites; a large number of common elements in the Chitinozoan assemblage (lasi and Batrinesti boreholes); the green colour of rocks, which in both regions is due to detrital chlorite (Iordan *et al.*, 1985). The shelly fauna facies yielded a neritic shallow-water palaeontological assemblage which shows affinities with those in Avalonia, Bohemia, Podolia, and Baltic basins (Iordan, 1992b, 1999c).

Devonian

In the Romanian part of the Moesian Platform, all the Devonian stages of the Renish-Ardenne type were identified. We try to correlate these with the international standards.

The Lochkovian (Gedinnian), attested in the Oprisor borehole by the *Icriodus woschmidtii* conodont zone, contains brachiopod fragments of Strophomenids as well as Spiriferids, crinoids, corals and orthoceratids.

The Praguian (Siegenian), attested by the tentaculites zones *Nowakia* (*Turkestanella*) *acuaria* and *Tentaculites straeleni* also contains brachiopods, bivalves, crinoids, corals, gastropods. The following brachiopods were identified in the Oprisor and Mangalia boreholes (Iordan, 1981, 1985, 1988, 1992b, 1999c): *Orbiculoidea* sp., *Iridistrophia euzona* (Fuchs), *Chonetes amaliana* de Kon., *Delthyris dumontianus* (de Kon.), *D. infans* Dahmer, *Stropheodonta* sp., *Mutationella podolica* Kozl., *Trigonorhynchia daleidensis* (Roem.), *Vandercammenina trigeri* (Vern.) (Plate II). Although diversified, they are on the second place following the tentaculites, are numerically equal with bivalves and are more numerous than gastropods, crinoids and corals.

The Zlichovian (Lower Emsian), attested by the trilobites zones *Pseudocryphaeus prostellans*, *Pillettina asiatica* and *Dipleura formix* (Mangalia, Calarasi) (Iordan, 1967, 1981, 1985) contains predominantly trilobites and bivalves and subordinately brachiopods, gastropods, orthoceratids, corals, crinoids, bryozoans. The following brachiopods were identified (Raileanu *et al.*, 1966; Iordan, 1981, 1985, 1988): *Dignomia hunsruckiana* Fuchs, *Levenea* cf. *subcarinata* (Hall), *Mutationella*

podolica Kozl., *Schellwienella umbraculum* (Schl.), *Plethorhynchia* cf. *speciosa* (Hall), *Chonetes* (*Plebejochonetes*?) *unkelensis* Dahm., *Eodevonaria arcuata* (Hall), *Fimbrispirifer daleidensis* (Stein.), *Costispirifer arenosus* (Conrd.), *Najadospirifer najadum* (Barr.), *Isorthis* sp., *Strophodonta* sp., *Chonetes* sp., *Megantheris* sp., *Camarotoechia* sp., *Delthyris* sp., *Ucinulus* sp. (Plate II).

The gritty Eifelian is characterized by abundance of psilophytil plants, placodermi and ostracodermi fishes and subordinately by brachiopods, tentaculitids, crinoids, bivalves, gastropods, corals. The following brachiopods were recorded: *Lingula* aff. *nuda* Hall, *Lingulipora* sp., *Rhipidomella penelope* (Hall), *Leptostrophia rotunda* Bubl., *Markitoechia marki* Havl. (Calarasi borehole), *Fimbrispirifer* sp., *Isorthis* sp., *Ucinulus* sp., *Pholidostrophia* sp. (Mangalia borehole), *Mediospirifer* aff. *audacula* (Conr.) (Smirna borehole) (Plate II). The presence of the Lingulids beside eurypterid arthropods, psilophytil plants and placodermi fishes attest a littoral facies with alternating fresh and sea water sedimentation (shallow shelf environment).

The Givetian marks the beginning of the carbonate-evaporitic facies in the Moesian Platform. It is attested by the following zones: *Tentaculites conicus*, *Fimbrispirifer venustus* and *Mucrospirifer mucronatus* (Iordan 1988, 1999c). The brachiopod assemblage consists of the species *Strophodonta* (S.) *demissa* (Conr.), *Devonochonetes scitulus* (Hall), *Atrypa reticularis kuzbasica* Rzhon., *Mucrospirifer mucronatus* (Conr.), *Fimbrispirifer venustus* (Hall), *Punctatrypa nalivkini* Havl., *'Spirifer' laevicosta* Valenc., *Schellwienella* sp., *Iridistrophia* sp. (Plate II).

The Frasnian is attested by the zones *Homoctenus krestovnikovi* and *Mucrospirifer bauchardi*. The brachiopods associated with fragments of crinoids, gastropods, corals and tentaculites are the following: *Chonetes rowei* Cl. et Sw., *Athyris* aff. *vittata* Hall., *A. aff. nuculoidea* Coop., *Mucrospirifer bouchardi* (Murch.), *Spinocyrtia martianoffi* (Stuck.), *Mediospirifer audacula* (Conr.) (Plate II) (Iordan 1981, 1988, 1999c).

The Famennian is attested by the brachiopods and conodont zones *Cyrtospirifer archiaci* and *Palmatolepis crepida*. Only the brownish-light grey limestones of the Viroaga borehole yielded a faunal assemblage consisting of brachiopods, gastropods, crinoids, conodonts, forams (moravaminids), holothurian sclerites and ophiuroids (Iordan *et al.*, 1987a; Iordan 1985, 1988, 1992b, 1999c). The brachiopod assemblage is dominated by Spiriferids, whereas Chonetids, Productids and Rhynchonellids are subordinate. The following brachiopods were identified: *Cyrtospirifer archiaci* (Murch.), *C. cf. tchernychevi sibirica* Ivania, *C. spp.*, *Athyris* sp., *Productella* sp., *Megachonetes* sp., *Camarotoechia* sp. (Plate II).

Carboniferous

All the stages of the Carboniferous system have been attested on the base of zones and age indicator fossils like gastropods, orthoceratids, fenestelides, corals, crinoids, plant debris, fish scales (Iordan *et al.*, 1987b; Iordan 1985, 1992a, 1999a,c).

The Viséan is attested by the conodont zone *Ligonodina fragilis* and the brachiopods *Schizophoria resupinata gigantea* Dem., *Gigantoproductus giganteus*

(J.Sow.), *G. bisati* Paeck., *Echinochonchus defensus* (Thom.), *Dictyoclostus* cf. *multispiniferus* (Muir-Wood), *D. semireticulatus* (Martin), *Daviesiella* sp. cf. *D. llangollensis* (Dav.), *Antiquatonia antiquata* (Sow.), *Linoprotonia corrugato-hemisphaerica* (Flem.), *Reticulariina* cf. *spinosa* (Nor., Prat.), *Megachonetes* ex. gr. *M. zimmermani* (Paeck.), *Schellwienella* sp., *Schuchertella* sp., *Choristites* sp., '*Lingula*' sp. (Plate II) (Iordan et al., 1985, 1987b).

The Namur-Westphalian in the paralic facies with coals, carbons and plant debris is attested by a palaeontological assemblage consisting of bivalves, brachiopods, goniatites, orthoceratids, crinoids, holothurian sclerites, forams. The brachiopods identified so far include: *Lingula mytiloides* Sow., *Orbiculoidea missouriensis* (Schum.), *Schizophoria* sp., *Choristites mosquensis* Fisher, *Productus carbonarius* de Kon., *Dictyoclostus retiformis* Muir-Wood, *D. semireticulatus hermosanus* Girty, *Semiplanus* cf. *latissimus* Sow. (Plate II) (Iordan 1985, 1992a, 1999a, c; Iordan et al. 1987b).

Carboniferous faunal palaeontological assemblages and lithological features of the Moesian Platform are of West-European type (England, France, Belgium, Dinant-Namur basins), of Poland and Bulgaria, as well as of East-European type. This suggests that during the Carboniferous the Moesian Platform has worked like a transitional bionomical zone (Iordan, 1985, 1992a, 1999a, c).

The brachiopod assemblages of the Visean consist largely of giant Productids and subordinately Strophomenids, Spiriferids, Orthids and Inarticulates; small Productids with some Strophomenids and Inarticulates characterize the Namurian-Westphalian of the Moesian Platform.

5. NORTH DOBROGEA

In the Eoalpine North Dobrogea orogenic belt, the Palaeozoic shows shallow marine (detrital and calcareous) facies in the western Macin zone, and a deep water facies (siliceous pelagites and distal turbidites) in the northern part of the eastern Tulcea zone.

Lower Devonian brachiopods were identified only in the Macin zone, in the Bujorul Românesc and Bujorul Bulgaresc hills. They are associated with crinoids and tentaculites and subordinately with trilobites, corals, bryozoans and ostracods. This macrofaunal assemblage attests an open marine shelf, a benthic environment with a very shallow-water deposition. Both the lithological characters and the fossil content correlates with the Ardennes and the Rhenish massif (Siegenian), as well as with Poland and Turkey (Bithynia-Bosphorous) (Haas, 1968; Jahnke, 1971; Iordan, 1974, 1985, 1988, 1999 a, b; Carls et al., 1982; Becker, Jansen, 1998; Jansen, 1998).

The Brachiopods are represented by: *Schizophoria provulvaria* (Maur.), *Platyorthis circularis* (Sow.), *Dalmanella fascicularis* (d'Orb.), '*Orthis*' *strigosa* Sow., *Leptaena* sp. ex gr. *rhomboidalis* (Wilck.), *Pholidostrophia* aff. *naranjoana* (Vern.), *Rhenostrophia subarachnoidea* (Arch. et Vern.), *Fascistropheodonta* aff. *sedgwicki* (Arch. et Vern.), *Leptostrophiea* sp. ex gr. *explanata* (Sow.), *Douvillina interstitialis* (Phill.),

Iridostrophia hipponyx (Schnur), *Chonetes sarcinulatus* (Schl.), *Plebejochonetes plebejus* Schnur, *Retichonetes* aff. *minutus* (Buch), *Strophochonetes tenuicostatus* (Oehlert), *Acrospirifer primaevus* (Stein.), *Euryspirifer pellicoi* (Arch. et Vern.), *Hysterolites hystericus* (Schl.), *Arduspirifer arduennensis latestriatus* (Maur.), *Brachyspirifer* (B.) *carinatus* (Schnur), *Vandercammenina bischofi* (Giebel), '*Spirifer*' cf. *undulifer* Kayser, *Uncinulus* cf. *antiquus* (Schnur), *Camarotoechia* sp., *Meganteris* cf. *archiaci* (Vern.) (Plate I).

The brachiopod assemblage is dominated by Strophomenids and Spiriferids, whereas Orthids, Rhynchonellids and Terebratulids are subordinate and even very scarce. The brachiopods compose 1-2 cm thick coquina layers, formed mainly by disarticulate valves, sometimes broken and with the convexity high up. These features suggest that after disarticulation coquinas were transported by waves and deposited on a beach of a quiet bay. Compared to the widespread Devonian facies of the world, our data attest the mixed facies of the Devonian (Simionescu, 1924; Paeckelmann, 1935; Iordan, 1974, 1988).

6. CONCLUSIONS

In the Cambrian and Ordovician deposits from Romania only inarticulate brachiopods (Lingulellids and Acrotretids) were identified.

In Silurian formations the brachiopods are very diversified: a) they are tiny and scarce in the mixed shale facies (Upper Ludlovian, Pridolian) in the eastern Moesian Platform; b) and very abundant and diversified in the shelly fauna facies of the western Moesian Platform, of the Moldavian Platform and of the South Carpathians Danubian units.

In the Devonian time the brachiopod assemblage is very rich and diversified. They have given age indicators for the Lower Devonian of the Moesian Platform and North Dobrogea orogenic belt, as well as brachiopod zones for the Middle and Upper Devonian of the Moesian Platform.

In the Carboniferous rocks the brachiopods are restricted to giant Productids, Strophomenids and Spiriferids in its lower part in the South Carpathians and the Moesian Platform and to small Productids in its upper part in the Moesian Platform.

No macrofauna was identified so far in the Permian strata of Romania.

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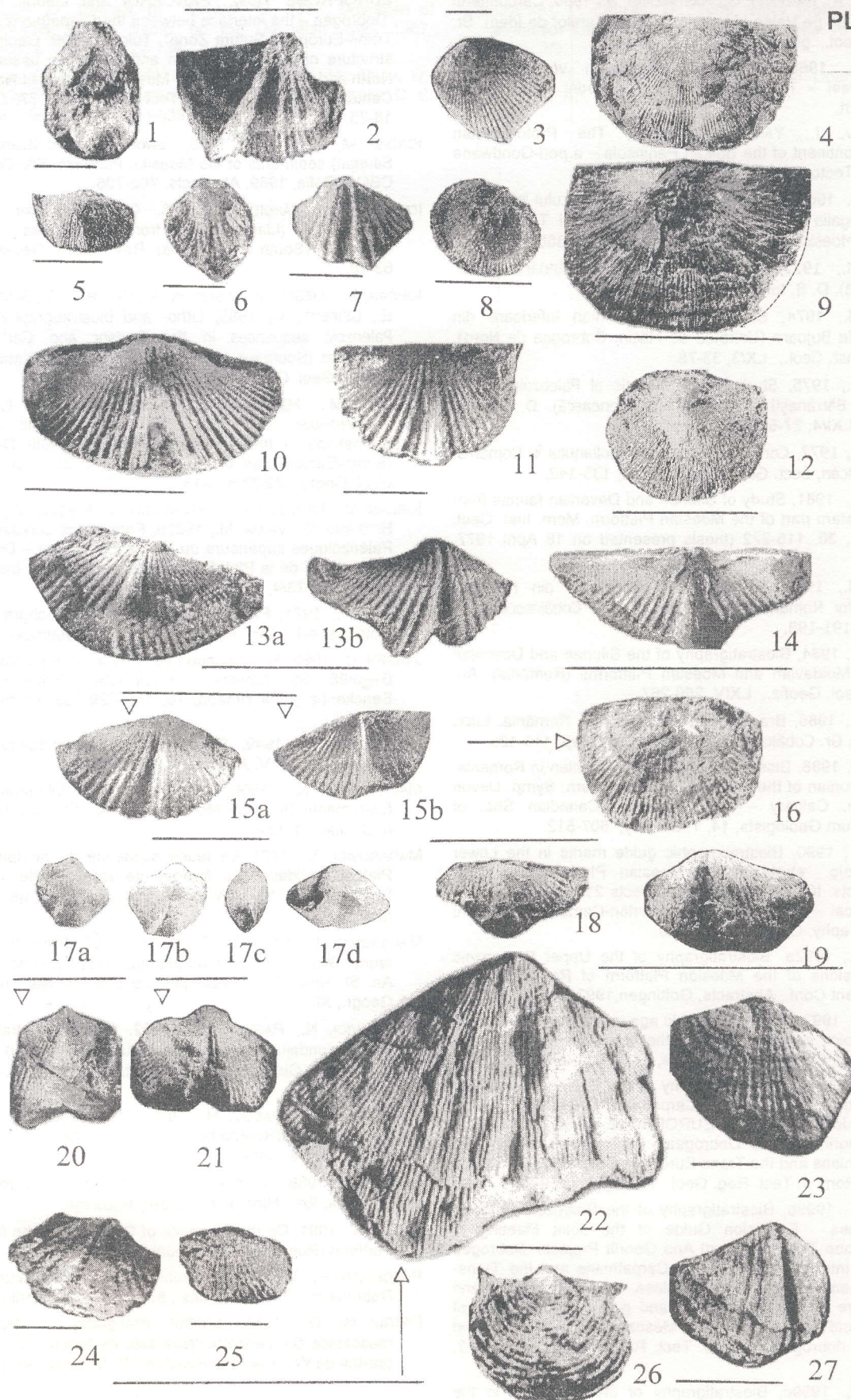
PLATE II

MOESIAN PLATFORM

Silurian: Wenlockian. Fig. 1 – *Lissostrophia cooperi* Amsden, *Isorthys* aff. *clivosa* Walmsley, Gârla Mare borehole. Pridolian. Fig. 2 – *Eospirifer* cf. *schmidtii* Lindström (Gârla Mare borehole); Devonian, Pragian: Fig. 3 – *Mutationella podolica* Kozłowski (Oprisor borehole); Mangalia borehole: Fig. 4 – *Iridostrophia euzona* (Fuchs); Fig. 5 – *Chonetes omaliana* de Koninck; Fig. 6 – *Trigonorhynchia daleidensis* (Roemer); Fig. 7 – *Delthyris dumontianus* (de Koninck); Zlichovian: Fig. 8 – *Levenea* cf. *subcarinata* (Hall); Fig. 9 – *Schellwienella umbraculum* (Schlothheim); Fig. 10 – *Fimbrispirifer daleidensis* (Steininger); Fig. 11 – *Costispirifer arenosus* (Conrad); Călărăsi borehole; Eifelian: Fig. 12 – *Leptostrophia rotunda* Bublicenko (Călărăsi borehole); Fig. 13 – *Mediospirifer audacula* (Conrad), a) brachial valve, b) pedicle valve; Givetian: Fig. 14 – *Mucrospirifer mucronatus* (Conrad); Fig. 15 – *Fimbrispirifer* aff. *venustus* (Hall) a, b; Fig. 16 – *Strophodonta* (S.) *demissa* (Conrad) (Gârla Mare borehole); Frasnian: Fig. 17 – *Athyris* aff. *vittata* Hall; Fig. 18 – *Mucrospirifer* cf. *bouchardi* (Murchison); Fig. 19 – *Spinocyrtia martianoffi* (Stuckenbergh); Famennian: (Viroaga borehole) Fig. 20 – *Cyrtospirifer archiaci* (Murchison); Fig. 21 – *Cyrtospirifer tchernychevi sibirica* Ivania; Carbonifer: Visean (Dobromir borehole); Fig. 22 – *Gigantoproductus giganteus* (J. Sowerby); Fig. 23 – *Dictyoclostus semireticulatus* (Martin); Fig. 24 – *Reticulariina* cf. *spinosa* (Nor. et Prat); Namurian-Westphalian: Fig. 25 – *Dictyoclostus retiformis* Muir-Wood; Fig. 26 – *Productus carbonarius* de Koninck; Fig. 27 – *Choristites mosquensis* Fisher.

Scale bar = 10 mm

PLATE II



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