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# A new species of inarticulate brachiopods, *Discinisca polonica* sp. n., from the Korytnica Basin (Middle Miocene; Holy Cross Mountains, Central Poland)

ABSTRACT: A new species of inarticulate brachiopods, *Discinisca polonica* sp. n., is established for the specimens represented by isolated dorsal valves, and occurring in the littoral deposits developed along the shores of the Korytnica Basin (Middle Miocene, Badenian; Holy Cross Mountains, Central Poland). The new species, the dorsal valves of which are characterized by their small size, low-conical to strongly and irregularly depressed shape, and by the distinct ribbing, bears some similarities both to the species *D. scutellum* (DREGER) from the contemporaneous deposits of the Vienna Basin, and to some Recent species typical of the Indo-Pacific realm. The bearing of the new species on the content of littoral organic communities of the Korytnica Basin, and on the recognition of its tropical conditions and Indo-Pacific bioprovincial affinities are briefly discussed.

## INTRODUCTION

The inarticulated brachiopods of the genus *Discinisca* DALL, 1871, are extremely poorly represented in the Tertiary deposits of the world. In Europe, their dispersed occurrences, usually realized by a very low number of individuals, or even by single specimens of dorsal valves, distinctly contrast with the frequency of other, usually small-sized brachiopods in many fossiliferous Miocene deposits (*see* DREGER 1889, 1911; BOETTGER 1901; SACCO 1902; de MORGAN 1915; FRIEDBERG 1921; MEZNERICS 1944; GEORGIADES-DIKEOULIA 1974; PEDLEY 1976).

Within the frames of the Middle Miocene (Badenian) marine invasion over the areas of the Fore-Carpathian Depression and neighboring countries of the Central Polish Uplands this genus has never been reported in Poland, although it has long been known in the Ukrainian part of the basin (ŁOMNICKI 1897, FRIEDBERG 1921).

In the Korytnica Basin on the southern slopes of the Holy Cross Mountains (Central Polish Uplands) this genus has hitherto escaped from recognition within all the diverse and ubiquitous organic communities (*see* FRIEDBERG 1930; KOWALEWSKI 1930; BAŁUK 1975; BARCZYK & POPIEL-BARCZYK 1977; BAŁUK & RADWAŃSKI 1977, 1979). The systematic washing and sifting of the fossiliferous clay material have however resulted recently in recognition of this genus in diverse littoral facies of the Korytnica Basin (RADWAŃSKA 1982).

## THE INVESTIGATED MATERIAL

The obtained material consists of a few dozens of dorsal valves, all of them more or less damaged. The damage, realized by the breakage of the valve margin and/or the scaling off along the growth lamellae, is caused by the structure of the shell which is corneus (organo-phosphatic, colored pale straw to dark brown) in composition, and very friable in its physical properties. The ventral valves of the shell are absent.

The morphological features are well readable in the investigated specimens, all of them being quite fresh, not worn to any extent (*see* Pls 1—2). These features are apparently so distant to those of the known taxa in the genus *Discinisca* that the investigated specimens have been attributed to a new species.

## SYSTEMATIC ACCOUNT

Phylum **Brachiopoda** DUMÉRIL, 1806
Class **Inarticulata** HUXLEY, 1869
Order **Acrotretida** KUHN, 1949
Suborder **Acrotretidina** KUHN, 1949
Superfamily **Discinacea** GRAY, 1840
Family **Discinidae** GRAY, 1840
Subfamily **Disciniscinae** SCHUCHERT & LeVENE, 1929
Genus *Discinisca* DALL, 1871
*Discinisca polonica* sp. n.
(Text-figs 1-3 and Pl. 1, Figs 1-6, Pl. 2, Fig. 1)

HOLOTYPE: The specimen presented in Pl. 1, Fig. 1a-1b.
PARATYPES: Five adult specimens (presented in Pl. 1, Figs 2—6) and one juvenile (Pl. 2, Fig. 1).
TYPE LOCALITY: Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mountains, Central Poland.
TYPE HORIZON: Middle Miocene (Badenian).
DERIVATION OF THE NAME: Latin adjective *polonica*, after the country of its finding.

DIAGNOSIS: The dorsal valves of almost circular outline, varying to elongated ovally along the mid-line, or the more or less rectangular or even polygonal; low-conical to strongly and irregularly depressed, with a well developed limbus;

sculptured by well pronounced sparse, radial ribs, more or less distinctly pustulated at the points of intersection with the growth lines; apex sub-central posteriorly; muscle-scar pattern featured primarily by large, arched, slightly reniform anterior adductors, and by oval to tear-shaped posterior adductors elongated laterally.

**SIZE: The holotype (Pl. 1, Fig. 1a—1b) is estimated as about 4 mm long (at the mid-line) and 3.5 mm wide; the smallest specimem (Pl. 1, Fig. 2a—2b) is 3.2 mm by 3 mm, and the largest one (Pl. 1, Fig. 6a—6b) 5 mm by 4 mm respectively. The juvenile specimen (Pl. 2), to judge by its preserved part, was about 2.5—2.6 mm in diameter.**

DESCRIPTION: The dorsal valves, all of which are damaged at their margin, may be reconstructed as almost circular in outline (Text-fig. 1a—b and Pl. 1, Fig. 1a—1b), with a tendency to elongation along the median (anterio-posterial) line. The preserved fragments show some specimens to have broadly angular irregularities of the lateral margins tending to produce a general shape roughly rectangular (*cf.* Text-fig. 2c—d), or even polygonal (Text-fig. 2a): in consequence, the anterior margin sometimes becomes straight (Text-fig. 2a and 2d). The posterior margin is more or less straight, although of a variable length (Text-fig. 1b and 2d). The externmost part of the valves is almost flat and forms the limbus.

The general shape of the dorsal valves is low-conical to strongly and irregualarly depressed (Text-fig. 3). A low-conical shape is well displayed by the apical part of the valve, and subsequently the valve becomes more or less flattened (Text-fig. 3a) and/or contorted to a variable extent along the limbus and the margin (Text-fig. 3c).

The apex is subcentral, slightly displaced posteriorly (*cf.* Text-fig. 1a and 2d), and varying in its inclination (*cf.* Text-fig. 2a—d).

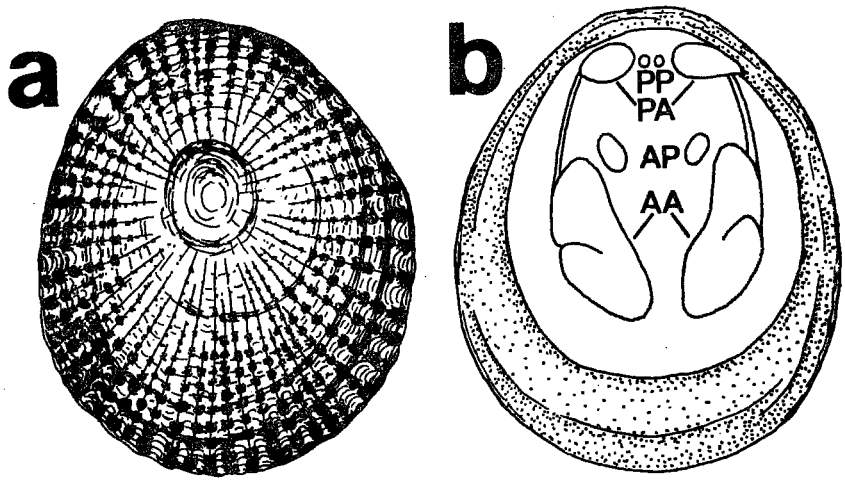
The external sculpture of the dorsal valves is expressed by well-pronounced radial ribs increasing in width to the valve margin, and more or less swollen at points of intersection with the growth lines. At these points the swells are formed by an approximation of the growth lines, some of which become here the denser, and thus a kind of pustules develops. The pustulation which involves a beaded character of the ribs, and appears almost throughout the whole surface of the valves, is distinctly better pronounced near to the valve margin (along the limbus) and in places of a change in the valve profile (*see* Text-fig. 3 and Pl. 1, Figs 1a, 2a, 3a, 4, 6a).

The ribbing of the dorsal valves is generally sparse, and the total number of ribs is estimated to range from 40 to 55, and being 53 in the holotype. All the ribs are single and continuous, and they never bifurcate; the new ones appear as intercalatory in various parts of the valve, and at various growth stages of the adult shell. In some places two intercalatories appear almost simultaneously. The ribs are well separated from each other, and the interspace is usually twice, in places even three times wider than the rib, the differences being dependant upon not uniform distribution of the ribs throughout the valve. In the case of the more densely scattered ribs, especially those pustulated, the interspace equals to the rib width or it becomes even smaller.

The ribbing originates abruptly at a definite growth line. Usually it does at a much better pronounced one which is interpreted as the margin of the postlarval shell (*see* CHUANG 1977, Fig. 11). The postlarval, *i.e.* the brephic shell is therefore recognized as apparently smooth in the investigated species, whilst the youthful (the earliest „adult"), *i.e.* the neanic shell is indicated by the germination of the ribbing (*see* Pl. 1, Figs 1a, 2a, 3a, 4—5, 6a, and Pl. 2, Figs 1a, 1c).

Consequently, within the central part of the valve, all the successive developmental stages of the shell are distinguishable. The apex is formed by the larval shell, *i.e.* the protegulum, which is well preserved in some specimens (Pl. 1,

Figs 2a, 3a, 4, 6a, and Pl. 2, Fig. 1a, 1c), almost circular in outline, and attains about 0.4 mm in diameter. It is completely plain, and bears no difinite growth lines; usually it is irregularly scaled-off to a variable extent (*see* Pl. 1, Fig. 1a, and Pl. 2, Fig. 1c). The postlarval, *i.e.* the brephic shell is featured with distinct growth lines, some of which are more pronouncedly developed (*see* Pl. 2, Fig. 1c); it attains about 1.8 mm in diameter, having the protegulum placed posteriorly (Pl. 2, Fig. 1c). The pustulation is acquired by the ribs coevally with their germination at the proximal margin of the meanic shell (Pl. 2, Fig. 1c).




1. Morphology of the dorsal valves of *Discinisca polonica* sp. n., presented as for the holotype (*see* Pl. 1, Fig. 1a-1b): **a** — outer side, **b** — inner side (stippled is the limbus); magn. x 15 (*cf.* Plate 1)

Muscle scars (terminology *after* THOMSON 1927): **AA** — anterior adductors, **AP** — anterior protractors, **PA** — posterior adductors, **PP** — posterior protractors

The specimen which demonstrates all the developmental stages of the shell growth (Pl. 2, Fig. 1a—1c) is regarded as juvenile since, although also damaged, its preserved posterior margin is situated just near the distal margin of the brephic shell (*see* Pl. 2, Fig. 1a, 1c).

The interior of the dorsal valves is featured by the muscle scars, the area of which is very large and passes much anteriorly the apical part of the valve; posteriorly, it reaches the limbus (Text-figs 1b and 2). The best pronounced are scars of the anterior adductors which are broad, obese but obtuse, and slightly arched externally. In well preserved specimens they are reniform in shape, distinctly bipartite at their external edge. The scars of the posterior adductors are less distinct, but still well discernible; they are either oval (Text-fig. 2b—d), or

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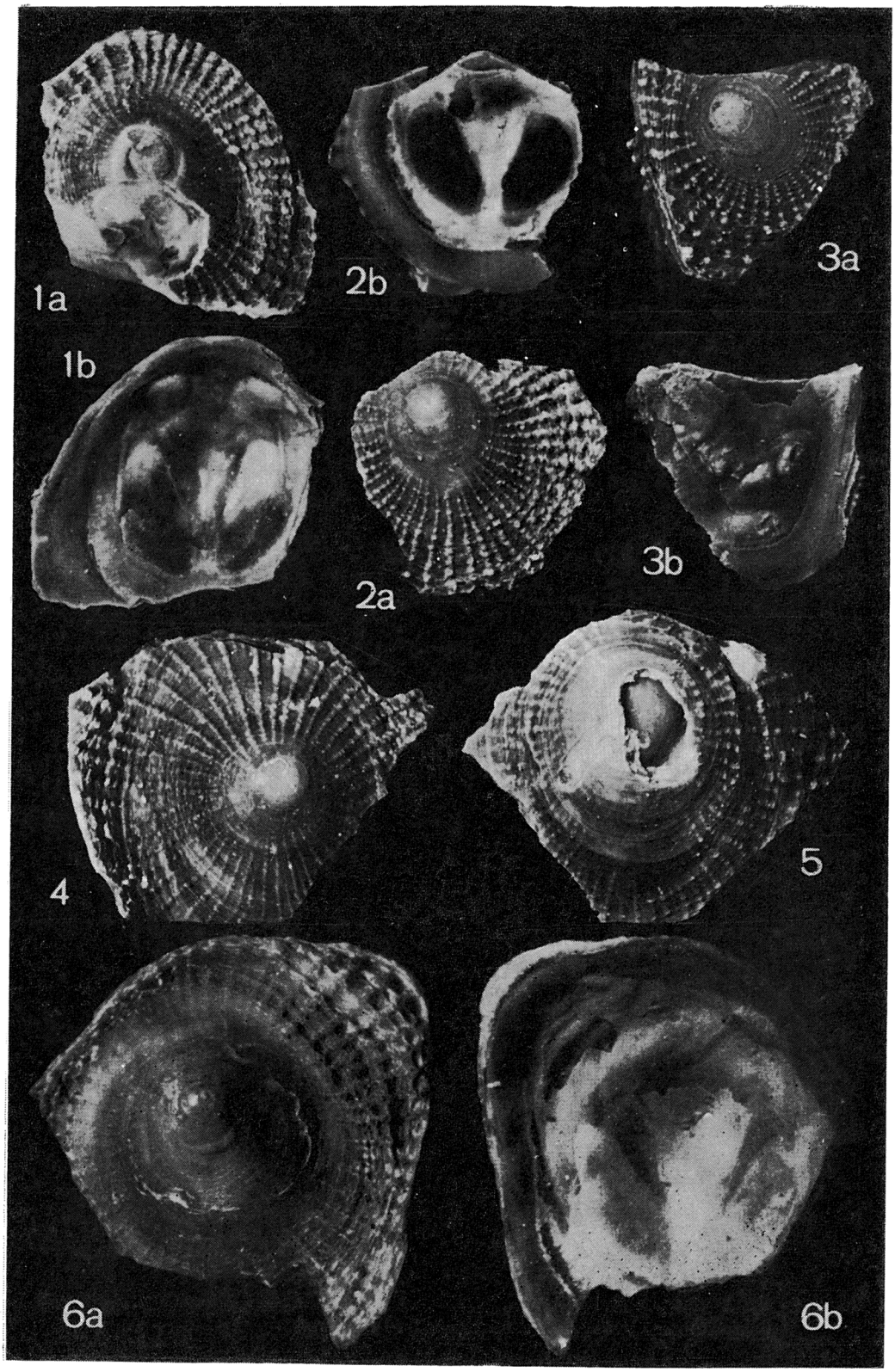
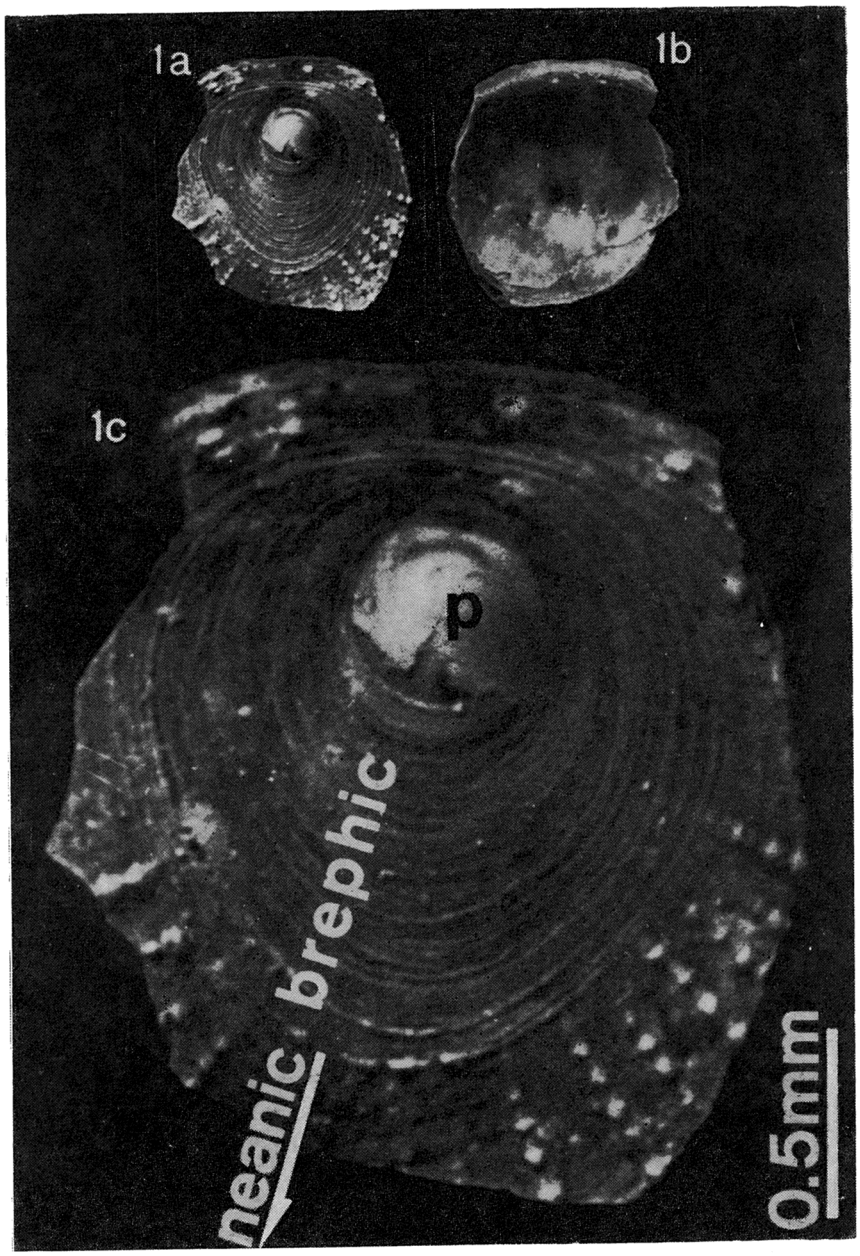
PLATE 1

*Discinisca polonica* sp. n.; dorsal valves, x 15

**1** — Holotype (*1a* outer view, *1b* inner view); **2-3** — paratypes (*2a*, *3a* outer views; *2b*, *3b* inner views); **4-5** — paratypes in outer views; **6** — the largest paratype (*6a* outer view, *6b* inner view)

Photos taken by L. ŁUSZCZEWSKA, M. Sc.


1a
2b
3a
1b
2a
3b
4
5
6a
6b




*Discinisca polonica* sp. n.; dorsal valve of the juvenile

**1a-1b** — The specimen in outer (*1a*) and inner (*1b*) views; taken x 15, to compare with other paratypes presented in Pl. 1

**1c** — Outer view, magnified x 45, to show the protegulum (*p*), and the postlarval (brephic) and youthful (neanic) parts of the shell

Photos taken by L. ŁUSZCZEWSKA, M. Sc.

wider at the median line, and taper laterally to acquire a tear-like shape (Text--fig. 1b). Of the protractor scars, the posterior ones are recognizable in some specimens, the holotype including; they are small, almost circular and situated

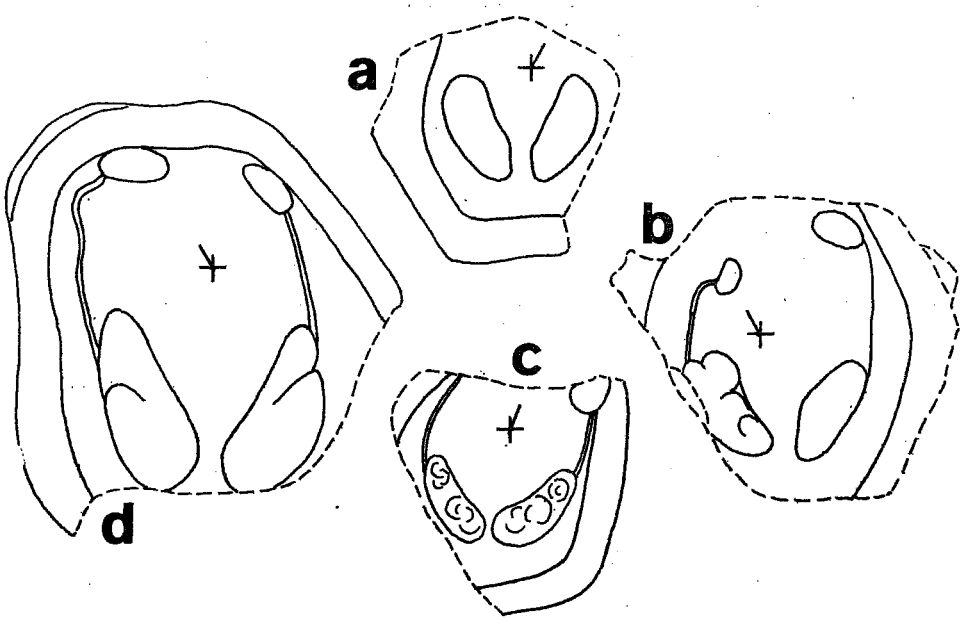



Fig. 2. Interiors of the dorsal valves of *Discinisca polonica* sp. n., to show variability of the muscle scars, position of the apex (indicated by a cross) and its inclination (indicated by a leader): **a** — specimen illustrated in Pl. 1, Fig. 2b; **b** — in Pl. 1, Fig. 4; **c** — in Pl. 1, Fig. 3b; **d** — in Pl. 1, Fig. 6b

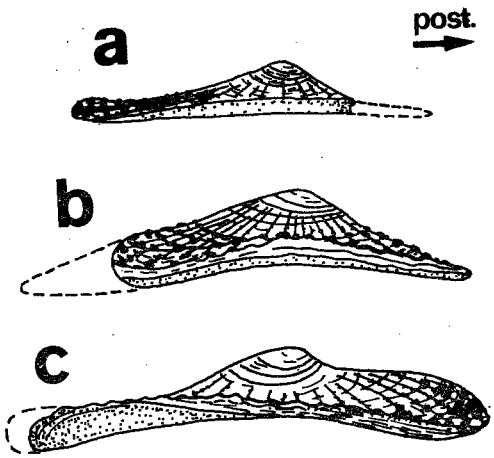



Fig. 3

Side views of some dorsal valves of *Discinisca polonica* sp. n., to show variability of their shape; the drawings taken along the mid-line (arrowed is the posterior) of the specimens illustrated in Text-fig. 2 and in Plate 1; magn. x 15

**a** — paratype illustrated in Text-fig. 2*a* and Pl. 1, Fig. 2a-2b

**b** — holotype illustrated in Pl. 1, Fig. 1a-1b

**c** — paratype illustrated in Text-fig. 2*d* and Pl. 1, Fig. 6a-6b

more or less obliquely (asymmetrically) to the median line. The scars of the anterior protractors are weakly readable, very shallowly etched, and thus not well definied in most of the specimens, excepting the holotype. The malformations,

resulting presumably from pathological changes of the muscles, are recognizable in some of the anterior adductors (Text-fig. 2b—c). The juvenile specimen does not display any defined muscle scars (*see* Pl. 2, Fig. 1b).

The muscle-scar area in adult specimens is partly bordered by two narrow ridges which join the external sides of the adductor scars either tangentially or bluntly (*see* Text-figs 1—2).

The limbus which is thick and runs along the whole valve, becomes more distal to the muscle-scar area anteriorly, and also anteriorly it enlarges along the valve margin in the holotype (Text-fig. 1b), or remains of a more or less constant width in other specimens (Text-fig. 2).

REMARKS: The new species, *Discinisca polonica* sp. n., is characterized primarily by small-sized, isolated dorsal valves of a low-conical shape, with a limbus, and with well developed ribs (pustulated more or less distinctly), and by pattern of the muscle scars. The specimen chosen as the holotype, which generally averages morphological features of the species, is the most circular in its outline when compared to the others (*see* Text-figs 1a—b and 2a—d), but it is the only which possesses the muscle scars wholly preserved.

The flattening of the valves, combined with their shape variabilities and formation of the limbus (*see* Text-fig. 3), is interpreted as an adaptation to the life conditions within a high-energy environment of the shorezone. Precisely, it is thought to correspond to the best adherence of the whole shells to the substrate, the phenomenon not being recognized in any other species of *Discinisca*, either present-day or ancient *. The greatest irregularities of the shape, displayed by the largest specimen (*see* Text-figs 2d and 3c), may consequently result from its greater longevity.

The presence of the postlarval (brephic) shell completely smooth in *Discinisca polonica* sp. n. is to be noted, because in other species the ribbing is sometimes reported (or illustrated) as continuous just to the apex of the dorsal valves (MUIR-WOOD 1929). A smooth apical part has however been recognized when creating many, both ancient (DREGER 1889, deMORGAN 1915, YABE & HATAI 1935) and present-day species (d'ORBIGNY 1853, GOULD 1860, DALL 1920, JACKSON & STIASNY 1937).

The color banding, reported in some of the ancient species (MUIR-WOOD 1929, 1939) is not recognizable in the investigated specimens.

## COMPARISON WITH RECENT AND ANCIENT FORMS

According to the accepted systematic status (ROWELL 1965), within the family Discinidae GRAY, 1840, the three subfamilies are distinguished viz. (*1*) Orbiculoideinae SCHUCHERT & LeVENE, 1929, which contains only Paleozoic (Ordovician-Permian) forms; (*2*) Disciniscinae SCHUCHERT & LeVENE, 1929, which contains the discussed genus *Discinisca* DALL, 1871, and abyssal *Pelagodiscus* DALL, 1908; and (*3*) Discininae GRAY, 1840, which is represented by one, Recent genus *Discina* LAMARCK, 1819.

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* It is, however, apparent in specimens of the present-day *Discina striata* (SCHUMACHER), as illustrated by REEVE (1862, Pl. 1, Fig. 7b).

All the ancient forms which had previously been assigned to the genus *Discina*, were first put into the genus *Discinisca* by THOMSON (1927), and this statement was accepted by HERTLEIN & GRANT (1944), and by ROWELL (1965). The first attribution of an ancient species to *Discinisca* was given already by deMORGAN (1915).

The genus *Discinisca* thus contains both the present-day and ancient species. Within its Recent representatives, the three groups of species are distinguishable (*see* DALL 1920, THOMSON 1927, MUIR-WOOD 1929), as follows:

(*i*) Large, lamellose, flexible, without radiating sculpture; examples: *D. lamellosa* (BRODERIP, 1834), *D. laevis* (G. de B. SOWERBY, 1822). These two species typically form clusters, living even in sandy environments (*see also* DAVIDSON 1888, pp. 195—198; RICHARDS 1974);

(*ii*) Large, less lamellose, with feeble irregular radiations, more solid; examples: *D. strigata* (BRODERIP, 1834), *D. cumingi* (BRODERIP, 1834);

(*iii*) Small, with regular radiating sculpture, not lemellose, solid; examples: *D. antillarum* (d'ORBIGNY, 1853), *D. stella* (GOULD, 1860), *D. sparselineata* DALL, 1920, *D. indica* DALL, 1920, *D. keiensis* JACKSON & STIASNY, 1937.

The groups (*i*) and (*ii*) are confined to the western coasts of the Americas, whereas the group (*iii*) primarily to the east coast of Asia (the Indian Ocean, Malay Archipelago, Philippines, China nad Japan), and one species (*D. antillarum*) to the shores of the Caribbean and Brazil (DALL 1871, 1920; THOMSON 1927; MUIR-WOOD 1929).

The comparison with the extinct species of *Discinisca* will be confined to the Tertiary forms, because those of older stratigraphic age, usually poorly known and often of uncertain attribution (*see* THOMSON 1927, MUIR-WOOD 1929, HERTLEIN & GRANT 1944, ROWELL 1965, STENZEL 1965), bear little relations to the investigated new species.

The number of the Tertiary species of *Discinisca* is relatively not small, as it attains the figure of sixteen. Of the five species listed by THOMSON (1927), only three are acceptable (*see below*), which are accompanied by two species estabilished earlier (S. WOOD 1874, de MORGAN 1915), ten subsequently added, and completed by the here introduced new one.

All the Europen Tertiary species were established upon isolated dorsal valves, the interior of which is often unknown. Although some species are reported to have been found as attached to the substratal shells (ŁOMNICKI 1897; MUIR-WOOD 1929, 1939), their ventral valves remained unaccessible.

The following review of the Tertiary species is given to acquaint with the sculptural variabilities of their valves, and with the possible affinities to the newly established species.

All the American species correspond to the groups (*i*) and (*ii*) in modern *Discinisca*. They are represented by *Discinisca lugubris* (CONRAD, 1834) (*see* DALL 1909, THOMSON 1927), as well as by *D. jenkinsi*, *D. loeli*, and *D. perrini*, all three established by HERTLEIN & GRANT (1944). The latter species, *D. perrini* HERTLEIN & GRANT, is the only in which the ventral valve was described (HERTLEIN & GRANT 1944, p. 36 and Pl. 2, Fig. 15).

The species *„Discinisca oregonensis"* of DALL (1909), regarded by THOMSON (1927, p. 132) as valid (however, erronously referred to *Discina* in the original description, and also erronously attributed to CONRAD), has appeared to be the external cast of a fish vertebra (*see* HERTLEIN & GRANT 1944, pp. 25, 178, and 212).

Of the four species recognized by MUIR-WOOD (1929, 1939) from the Eocene deposits of England, two bear their dorsal valves smooth, viz. *Discinisca insularis* MUIR-WOOD, 1939, and an unnamed *Discinisca* sp. (MUIR-WOOD, 1939), and thus they evidently belong to the group (*i*). The species *D. davisi* MUIR-WOOD, 1939, has highly conical and slightly convex dorsal valves, and densely spaced ribs with specific morphology. A comparable species is only *Discinisca ferroviae* MUIR-WOOD, 1929, which has a low-conical dorsal valve and numerous small ribs but it differs in other morphological features; its affinities will be discussed hereafter.

The species *„Discina suessi"* established by BOSQUET (1862) from the Oligocene deposits of the Netherlands, and regarded by THOMSON (1927, p. 132) as belonging to *Discinisca* (under the name *„Nysti"*, what is an evident error: *„Nysti"* is a new species of *Terebratulina* in the same paper of BOSQUET!) characterizes by a very solid structure of the valves, especially of the ventral one, their rectangular outline, and internal structure of the cranioid type (*see* BOSQUET 1862, Figs 1—5; *c.f. also* MUIR-WOOD 1929, p. 466). Further discussion on the real nature of this species is omitted here the more so that the name *„Crania Suessi"* was formerly used by BOSQUET (1859) for an Upper Cretaceous species of different morphology (*see also* CARLSSON 1958), and by REEVE (1862) for a Recent species from Australia (*see also* DAVIDSON 1888, p. 192; THOMSON 1927, p. 136). Anyway, the discussed species has confusingly been attributed to the genus *Pelagodiscus* by THOMSON (1927, p. 131; *see also* HERTLEIN & GRANT 1944, p. 21).

The species regarded by THOMSON (1927, p. 132) as belonging to *Discinisca* and cited as *„Discina leopolitana* ŁOMNICKI" from the Miocene of Poland, was first noted really by ŁOMNICKI (1897, p. 17). as *„Discina* sp. (*leopolitana* m.)", but without any diagnosis, description or illustration. This name, according to the ICZN rules, has obviously been a *nomen nudum* until its adequate description by FRIEDBERG (1921, pp. 6—7 and Pl. 1, Fig. 2), as *„Discina leopolitana* M. Łom. in litt.". It is therefore also obvious, according to the same rules, that FRIEDBERG is the creator of the species, the name of which is *Discinisca leopolitana* (FRIEDBERG, 1921). The specimens of this species, featured by small-sized (9 × 7 mm) smooth valves, are known rarely from the Middle Miocene (Badenian) deposits exposed just in the city of Lwów (in medieval Latin: *Leopolis*, adjective *leopolitanus*), at present the western Ukraine, Soviet Union. ŁOMNICKI (1897) mentioned that some specimens were attached to scallops, but FRIEDBERG (1921) had only dorsal valves at his disposal which he recognized as almost identical with those of present-day *Discinisca lamellosa* (BRODERIP), and differing from them only by a smaller size and a less eccentric position of the apex (*see also* HERTLEIN & GRANT 1944, p. 35).

A similar *nomen nudum* case had also been displayed by the species *multiradiata*, the name of which was first used by DOLLFUS & DAUTZENBERG (1901, p. 280) who attributed it to the genus *Discina*, and reported from the Miocene deposits of France (faluns of Touraine) as a small species, with numerous radial ribs, and similar to *D. stella*. A description and illustration of its dorsal valves was offered by deMORGAN (1915) who is therefore regarded here as the creator of the species *Discinisca multiradiata* deMORGAN, the affinities of which will be discussed hereafter.

The species *Discinisca scutellum* (DREGER, 1889), the third of the accepted species listed by THOMSON (1927, p. 132), was established by DREGER (1998, pp. 182—183 and Pl. 1, Fig. 16a—c) for one, partly damaged low-conical dorsal valve from the Middle Miocene (Badenian) sandy deposits exposed at Immendorf near Grund in the Vienna Basin, Austria. This small specimen (5 × 4 mm), being obviously the holotype, is kept in the collection of the *Naturhistorisches Museum* in Vienna (*NHM Wien, Geol.-Paläontolog. Abt.;* Catalogue Number *1861. XXXV. 102)*, and it is actually more damaged than at time of its illustration. Its inner side is scaled off and/or worn, thus the muscle scars being not detectable. The outer surface is well preserved and sculptured by sparse ribs of a distinctly beaded appearance (well pictured in illustration by DREGER 1889, Pl. 1, Fig. 16b; referred to as fine pustules on ribs by MUIR-WOOD 1929, p. 466).

The well established species is *Discinisca carpathia* CTYROKY & FEJFAR, 1963, from the Miocene deposits of Czechoslovakia; it is featured by larger size (up to 30 mm) and fine ribbing of the dorsal valves (*see* CTYROKY & FEJFAR 1963, pp. 162—166, Figs 1—2 and Pl. Figs 1—5). Ventral valves are unknown, and the inner side of the dorsal ones exhibits posterior adductor scars relatively narrow and laterally much elongated (*see* CTYROKY & FEJFAR 1963, Fig. 2). This first large-sized *Discinisca* species from the Tertiary deposits of Europe bears great resemblances to the American species *D. lugubris* (CONRAD), the outer surface of which (in dorsal valves) is however almost plain, and ribbing is hardly detectable, usually in the apical and posterior parts of the valves (as seen in specimens kept in the collection of the National Museum of Natural History in Washington, and kindly supplied by the Manager). It is reasonable to suggest the attribution of this species to the group (*iii*) of the present-day *Discinisca*.

To the same group (*ii*) attributable are also two Pliocene species from Japan, *Discinisca sendaiensis* HATAI & HAYASAKA, 1965, of larger size (up to 20.8 mm) and *D. miyagiensis* HATAI & HAYASAKA, 1965, characterized by smaller size (up to 10.7 mm) and distinct ribs in the posterior part of dorsal valves (*see* HATAI & HAYASAKA 1965, pp. 174—176 and Text-figs 1—2).

The species *Discinisca fallens* (S. WOOD, 1874), regarded earlier by DAVIDSON (1852, p. 7 and Pl. 1, Figs 9, 9a, 9b) as possibly conspecific with *D. lamellosa*, and coming from the Pliocene Coralline Crag of England, was established as separate by WOOD (1874, p. 172 and Pl. 11, Fig. 6). This species which has also been suggested (WOOD 1874; THOMSON 1927, p. 131) to belong to the genus *Pelagodiscus*, characterizes by the small-sized smooth shells, and thus should be attributed to the group (*i*) of the *Discinisca* species (*see also* MUIR-WOOD 1929, 1939). It is the only European species of *Discinisca* for which ventral valves were investigated (MUIR-WOOD 1929, p. 466), but they remained not illustrated.

The species *Discinisca kamikatetuensis* YABE & HATAI, 1935, reported from the Pleistocene „Ryukyu Limestone" of the Ryukyu Islands, Japan, is regarded as close to the Recent species *D. stella* (GOULD) of the same region (*see* YABE & HATAI 1935, Pl. 14, Figs 11—12; HERTLEIN & GRANT 1944, p. 26).

The above presented review shows that within the Tertiary species of *Disicinisca* suitable for further comparisons are those with small, ribbed shells, and thus corresponding to the group (*iii*) of the present-day species.

The greatest resemblance is recognizable (*see* REEVE 1862, Pl. 1, Fig. 1a—1b; deMORGAN 1915, Fig. 15; MUIR-WOOD 1929, Fig. 42 and 1939, Fig. 7/3; COOPER 1973, Pl. 1, Figs 18—25) between the Tertiary species

*Discinisca ferroviae* MUIR-WOOD and *D. multiradiata* deMORGAN, and the present-day *D. stella* (GOULD) and *D. indica* DALL. All these species have low-conical dorsal valves, ornamented by very numerous ribs (attaining the number of 100—120), but in the two ancient species the position of the apex is less stable (subcentral to subposterior), whereas in the present-day ones it is always slightly subposterior. The pattern of the muscle scars in all these four species is similiar: the muscle--scar area stretches from the adapical region towards the valve posterior, and thus the anterior-adductor scars either escape posteriorly from the apex (*D. ferroviae*), slightly overlap it (*D. multiradiata*), or embrace it tightly (*D. indica*); the anterior-adductor scars are relatively small, of a sausage shape, and narrow. The ancient species *D. multiradiata* seems to be comparable rather to the present-day *D. indica*, the both having about 120 ribs, than to *D. stella* as suggested formerly (DOLLFUS & DAUTZENBERG 1901, p. 280; deMORGAN 1915, p. 272), when the species *D. indica* was yet unknown. All these discussed densely ribbed species differ from *Discinisca polonica* sp. n. both in ornamentation, and in a position and a general pattern of the muscle scars, the shape of the anterior-adductor scars including. The two species allied either to *D. stella* or *D. indica* (namely, *D. sparselineata* DALL, 1920, and *D. keiensis* JACKSON & STIASNY, 1937, respectively) are still poorly known, and thus they tentatively may be combined with the former ones in this comparisons.

The last of the Recent species of the group (*iii*), viz. *Discinisca antillarum* (d'ORBIGNY, 1853), is distinguished by an oval shape and convexity of the dorsal valves, and by the slightly irregular ribs distributed sparcely (*see* d'ORBIGNY 1853, Pl. 28, Figs 34—36; REEVE 1862, DALL 1920, MUIR-WOOD 1929), although its separateness from *D. stella* has long been doubted (REEVE 1862, DALL 1871, DAVIDSON 1888).

Consequently, the newly established species *Discinisca polonica* sp. n. may generally be ascertained as well suited to the group (*iii*) of the Recent *Discinisca* species. It has, however, only very poor morphological similarities to both *D. indica* DALL and to *D. stella* (GOULD). Of these similarities noteworthy is a tendency to pustulation of the ribs in *D. stella* (GOULD), as recognized already by DALL (1920).

Amongst the ancient *Discinisca* species weakly comparable with *Discinisca polonica* sp. n., basides the two discussed species (*D. ferroviae* and *D. multiradiata*), is only *D. scutellum* (DREGER, 1889) from the contemporaneous deposits of the Vienna Basin, but established upon one, damaged specimen, and thus the differences in morphology may be studied to a very limited extent.

To summarize, the group of the *Discinisca* species characterized by a small size (about 10 mm or less) and a ribbed sculpture (group *iii*) is well definied both for the Recent and ancient forms. It includes the following species, arranged accordingly to their stratigraphic age:

EOCENE: *Discinisca ferroviae* MUIR-WOOD, 1929
possibly *Discinisca davisi* MUIR-WOOD, 1939
MIOCENE: *Discinisca scutellum* (DREGER, 1889)
*Discinisca multiradiata* deMORGAN, 1915
*Discinisca polonica* sp. n.
PLEISTOCENE: *Discinisca kamikatetuensis* YABE & HATAI, 1935
RECENT: *Discinisca stella* (GOULD, 1860)
*Discinisca sparselineata* DALL, 1920
*Discinisca indica* DALL, 1920
*Discinisca keiensis* JACKSON & STIASNY, 1937
possibly *Discinisca antillarum* (d'ORBIGNY, 1853)

A still unadequate, very poor indeed, state of the knowledge on most of these species makes efficient difficulties in the recognition of their phyletic lineages and relations between the Tertiary ancestors and their Recent descendants.

## NOTES ON THE BIOTOPE

The Middle Miocene (Badenian) sequence of the Korytnica Basin consists of the four members lying horizontally within the frames of a larger bay (the Korytnica Bay) developed during the transgression onto the southern slopes of the Holy Cross Mountains (*see* Text-figs 4—5). The basin, being a terminal part of the Korytnica Bay is bounded by rocky ridges composed of Upper Jurassic limestones, and featured by diverse littoral deposits and/or damaged due to the bioerosion caused by various rock-borers (RADWAŃSKI 1969). The four lithological members are successively filling the basin (*see* Text-fig. 5), as follows: (*1*) local brown-coal-bearing deposits of brackish origin, (*2*) world-famous, extremely fossiliferous Korytnica Clays, (*3*) marly sands, (*4*) red-algal (lithothamnian) limestones. All these deposits, very shallow marine (or brackish in member *1*) were formed during a gradual shallowing of the basin, and filling it up with the sediments almost to sea level (RADWAŃSKI 1969, BAŁUK & RADWAŃSKI 1977). The age of the whole sequence corresponds to the Badenian Stage of the Vienna Basin, and is definied as straddling the boundary of the nannoplankton zones NN5 and NN6 (MARTINI 1977).

The section which has yielded the investigated material of *Discinisca polonica* sp. n. is situated along the shores of a small island (exposed now as Mt. Lysa; *see* Text-figs 4—5). At these shores an oyster shellbed

has developed, and this forms a littoral facies of the Korytnica Clays. The faunal content of the oyster shellbed and intercalating parts of clays comprises *i.a.* diverse corals, cirripedes (*Scalpellum, Verruca, Balanus, Acasta*), chitons (*Cryptoplax*), bivalved gastropods (*Berthelinia krachi*

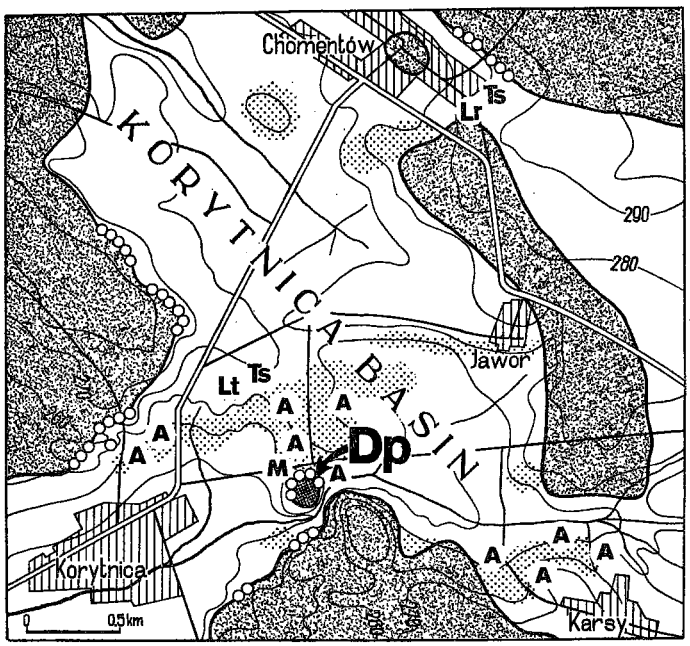


Fig. 4. Paleoenvironmental sketch of the Korytnica Basin (*adopted from:* BAŁUK & RADWAŃSKI 1977, Text-fig. 2)

Indicated are: marine area of the Korytnica Basin during the Middle Miocene (Badenian) transgression *(blank)* and present-day outcrops of the Korytnica Clays *(stippled);* preserved fragments of littoral structures *(circled);* land or island areas along the seashore *(hachured),* the island of the present-day Mt. Lysa including *(densely dotted)*

The occurrence sites of the brachiopods are completed in regard with the former data (FRIEDBERG 1930, BARCZYK & POPIEL-BARCZYK 1977, RADWAŃSKA 1982, GUTOWSKI 1984), as follows:

**Dp** — *Discinisca polonica* sp. n., **M** — *Megathiris detruncata* (GMELIN), **A** — diverse species of *Argyrotheca,* **Lt** — *Lingula dumortieri* NYST, **Lr** — *Lingula* cf. *dregeri* ANDREAE, **Ts** — *Terebratula styriaca* DREGER

BAŁUK & JAKUBOWSKI) and other mollusks, associated with diverse invertebrates and fish otoliths (*see* RADWAŃSKI 1969; BAŁUK & RADWAŃSKI 1977; RADWAŃSKA 1982, 1984).

The presence of the genus *Discinisca,* the littoral and shallow-marine requirements of which are commonly stated under present-day conditions (*see* DAVIDSON 1852, 1888; DALL 1920; THOMSON 1927; MUIR-WOOD 1929; HERTLEIN & GRANT 1944), supplements well a typically littoral community of the locality at the slopes of Mt. Lysa (*see* Text-fig. 4).

## BRACHIOPOD ASSEMBLAGE OF THE KORYTNICA BASIN

The finding of the new species of *Discinisca* supplements also the record of the brachiopod occurrences in the Korytnica Basin (*see* Text--figs 4—5).

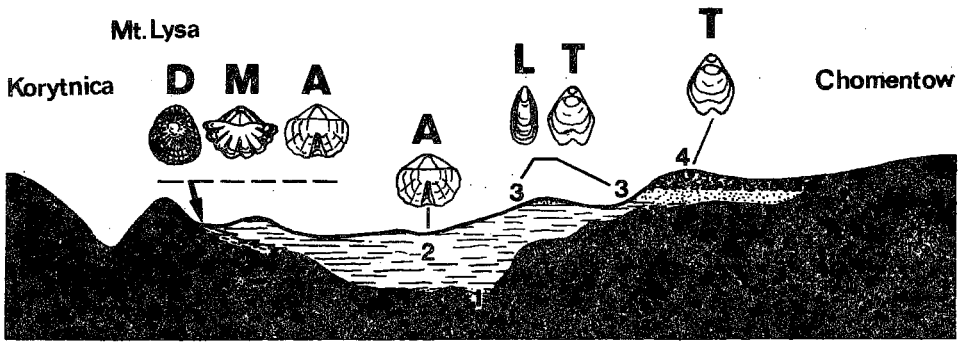


Fig. 5. Idealized section through the Korytnica Basin (*adopted from:* BAŁUK & RADWAŃSKI 1977, Text-figs 4 and 6), to show the distribution of the brachiopod genera in particular lithological members of the Middle Miocene (Badenian) sequence developed upon the Upper Jurassic substrate (*cf.* Text-fig. 4)
Lithologies: 1 — brown-coal deposits, 2 — Korytnica Clays with a littoral facies of the oyster shellbed at Mt. Lysa, 3 — marly sands, 4 — red-algal (lithothamnian) limestones
Brachiopod genera: **D** — *Discinisca*, **M** — *Megathiris*, **A** — *Argyrotheca*, **L** — *Lingula*, **T** — *Terebratula*

Within the littoral facies at Mt. Lysa, as associated with *Discinisca polonica* sp. n. reported are (BAŁUK 1975, BARCZYK & POPIEL-BARCZYK 1977, RADWAŃSKA 1982) *Megathiris detruncata* (GMELIN), as well as (RADWAŃSKA 1982) *Argyrotheca cistellula* (S. WOOD) and *A. subcordata* (BOETTGER).

Within the Korytnica Clays, only diverse species of the genus *Argyrotheca* DALL are known (BAŁUK 1975, BARCZYK & POPIEL-BARCZYK 1977), viz.: *Argyrotheca cistellula* (S. WOOD), *A. subcordata* (BOETTGER), *A.? squamata* (EICHWALD) and *Argyrotheca* sp.

Within the marly sands, primarily the genus *Lingula* BRUGUIÈRE is known (FRIEDBERG 1930, BAŁUK 1975, BARCZYK & POPIEL-BARCZYK 1977, GUTOWSKI 1984), and it locally occurs gregariously (BAŁUK 1975, GUTOWSKI 1984). This mass occurrence concerns the species *Lingula dumortieri* NYST which was previously described in single valves (BARCZYK & POPIEL-BARCZYK 1977), whereas the second species, *L.* cf. *dregeri* ANDREAE was reported only as one, half--broken valve (FRIEDBERG 1930).

The latter species, *Lingula* cf. *dregeri* ANDREAE, 1893, was formerly reported from the discussed member of the Korytnica sequence as "*L.* cf. *suessi* DREGER" (*see* FRIEDBERG 1930, p. 374; BARCZYK & POPIEL-BARCZYK 1977, pp. 158 and

160). The specific name *suessi*, when established by DREGER (1889) was preoccupied by an Upper Triassic species, named identically in the same genus (!) by STOPPANI (1860—65). It was ANDREAE (1893) who discovered the case, and introduced the specific name *dregeri* for the species established by DREGER (*see* ANDREAE 1893, p. 16; DREGER 1911, p. 132; MEZNERICS 1944, p. 19).

The lingulids of the marly-sands member are locally associated (GUTOWSKI 1984) with the terebratulid, *Terebratula styriaca* DREGER, which is also the only brachiopod species reported from the red-algal limestones (BARCZYK & POPIEL-BARCZYK 1977, GUTOWSKI 1984).

## CLIMATIC AND BIOPROVINCIAL SIGNIFICANCE

All the Recent species of the genus *Discinisca* DALL are regarded as tropical (DAVIDSON 1851, 1888; DALL 1871, 1920; THOMSON 1927; MUIR-WOOD 1929; HERTLEIN & GRANT 1944). This general statement matches well to the hitherto recognized tropical and/or subtropical conditions prevailing during the development and sedimentary history of the Korytnica Basin (BAŁUK & RADWAŃSKI 1967, 1977, 1979; RADWAŃSKI 1969; BAŁUK 1975).

A general resemblance of the new species, *Discinisca polonica* sp. n., to the Recent species *D. indica* DALL and *D. stella* (GOULD) plus *D. sparselineata* DALL, *D. keiensis* JACKSON & STIASNY, and *D. kamikatetuensis* YABE & HATAI from the Indian Ocean and the Pacific (*cf.* GOULD 1860, REEVE 1862, DALL 1920, MUIR-WOOD 1929, YABE & HATAI 1935, JACKSON & STIASNY 1937, HATAI & HAYASAKA 1965, COOPER 1973) completes the list of invertebrate and vertebrate faunas which indicate close seaway connections between the Middle Miocene (Badenian) sea of southern and Central Europe and the coeval Indo-Pacific (*cf.* RADWAŃSKI 1975; BAŁUK & RADWAŃSKI 1977, 1979, 1984).

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