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Miocene Scleractinia from the Holy Cross Mountains, Poland; Part 2 - Archaeocoeniina, Astraeina, and Fungiina

ABSTRACT: Redescribed is a small fauna of hermatypic corals (*Stylophora, Tarbellastraea, Palaeoplesiastraea, Syzygophyllia, Siderastraea, Porites*), and an ahermatypic astraeid genus (*Stylocora*) from the Korytnica Clays (Middle Miocene; Badenian, NN5 and NN6 Zones), developed on the southern slopes of the Holy Cross Mountains, Central Poland. The studied fauna resembles its ecological equivalent from the Upper Clays (Badenian) of the Vienna Basin but it is considerably impoverished taxonomically and some species are represented only by incipient colonies.

INTRODUCTION

A number of corals were described by DEMBIŃSKA-RÓŻKOWSKA (1932) from the Miocene deposits of Poland and among them 27 hermatypic and ahermatypic species from the southern slopes of the Holy Cross Mountains (*see* Table 1; *and* STOLARSKI 1991, Table 16). A part of the fauna originating from the Korytnica Basin and consisting of 24 species has become subject of redescription: ahermatypic corals, such as Caryophylliidae, Flabellidae, are characterized by STOLARSKI (1991), while corals of the families known as hermatypic in character are discussed in the present paper.

The original list of 10 hermatypic species described from the Holy Cross Mountains by DEMBIŃSKA-RÓŻKOWSKA (1932) is herein synonymized and significantly reduced. The list of species, however, is now completed by some taxa formerly unknown up to 9 species (Table 1). As the original collection of DEMBIŃSKA-RÓŻKOWSKA (1932) does not exist, the new material was completed during fieldworks in the Korytnica region in the years 1960-1989.

The geological setting of the coral-bearing Miocene deposits in the Korytnica Basin is outlined by STOLARSKI (1991). Due to the poor exposition of the sequence of the Korytnica Clays, the relationships of the particular coral-bearing horizons are rather hardly determinable.

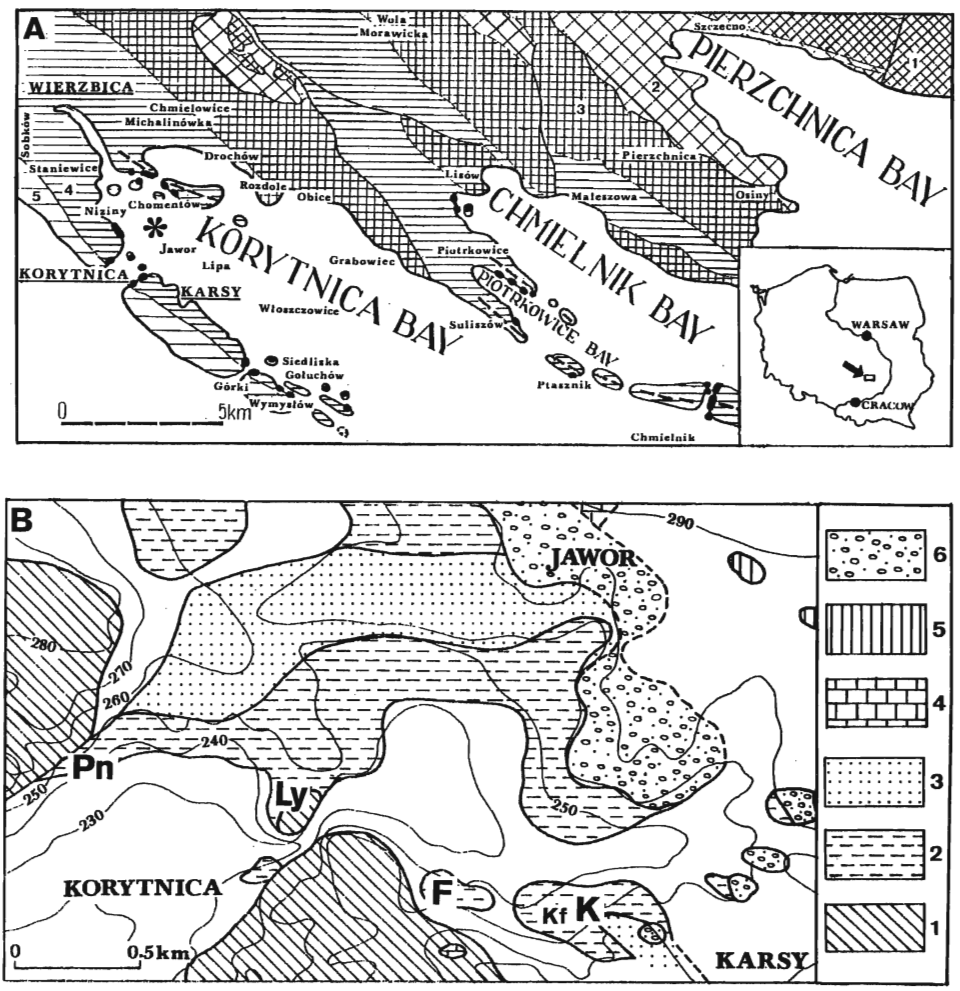


Fig. 1

A — Middle Miocene (Badenian) paleogeography of the zone of bays on the southern slopes of the Holy Cross Mts, Central Poland

Location of the Korytnica Basin is indicated with an asterisk; preserved littoral structures are marked with black spots; ridges in morphology that separate particular bays are marked with heavy dashes (*from* RADWAŃSKI 1969, *modified*)

Legend: *1* Cambrian (including locally Ordovician and Silurian), *2* Devonian, *3* Triassic, *4* Jurassic, *5* Cretaceous

B — Geological sketch-map of the south-western part of the Korytnica Basin (*from* GUTOWSKI 1984, *modified*)

Localities yielding the investigated corals are marked as follows: **Pn** — Korytnica-Plebania, **Ly** — Mt. Lysa, **F** — Korytnica-Forest, **K** — Karsy and **Kf** — arable field near *K* site

Lithology: *1* Jurassic substrate, *2* Korytnica Clays, *3* marly sands, *4* red-algal limestones, *5* sandy red-algal deposits with bentonites, *6* alluvial gravels; Pleistocene glacial deposits and Holocene are blank

The Korytnica Clays have been divided into three parts: the lower, the middle, and the upper; differing from each other in their faunisitic contents (KOWALEWSKI 1930, BAŁUK & RADWAŃSKI 1977). The lower part is represented by clays of the locality Korytnica-Forest (*F* in Text-fig. 1), middle part by clays of Karsy (*K*), while the upper part by clayey beds of the Korytnica-Plebania (*Pn*). The lower, middle and upper parts are exposed in a mosaic manner on the arable fields at NW of Korytnica village (*Af*). Clayey deposits and lumachelles from Mt. Lysa (*Ly*) have been interpreted as littoral (BAŁUK & RADWAŃSKI 1977), however the position of beds with mixed ahermatypic-hermatypic corals remains rather disputable.

Specimens were collected by Ass.-Professor W. BAŁUK and Professor A. RADWAŃSKI as well as by the present authors (*see* STOLARSKI 1988). In 1977-1978, the Institute of Paleobiology of the Polish Academy of Sciences participated in financial support of the fieldworks. The main bulk of the collection is stored at the Institute of Paleobiology, Polish Academy of Sciences (*ZPAL*); some specimens belong to the collection of Ass.-Professor W. BAŁUK and Professor A. RADWAŃSKI, University of Warsaw (*IG UW*).

SYSTEMATIC ACCOUNT

The systematics is given after ALLOITEAU (1952, 1957), modified by CHEVALIER (1971); the synomy is limited. Abbreviations used are: **s** — number of septa, **d** — diameter, **e** — density of endothecal dissepiments in longitudinal section, **h** — height, **c-c** — distance between corallite centres, **sd** — septal density measured at the corallite wall.

Suborder **Archaeocoeniina** ALLOITEAU, 1952
Family **Stylophoridae** MILNE-EDWARDS & HAIME, 1857

Genus *Stylophora* SCHWEIGGER, 1819
Stylophora reussiana MONTANARO-GALLITELLI & TACOLI, 1951
(Pl. 1, Figs 1a-1b)

1871. *Stylophora* nov. sp.; A. E. REUSS, p. 251; Pl. 19, Fig. 6.
1951. *Stylophora Reussiana* n. sp.; E. MONTANARO-GALLITELLI & M. L. TACOLI, p. 35; Pl. 1, Fig. 1.
1961. *Stylophora reussiana* MONTANARO-GALLITELLI & TACOLI; J. P. CHEVALIER, p. 115; Pl. 1, Fig. 2.
1972. *Sylophora* of *reussiana* MONTANARO-GALLITELLI & TACOLI; J. P. CHEVALIER, p. 4.

MATERIAL: 1 fragmentary colony from Korytnica-Forest (*ZPAL H. I/559*).

DIMENSIONS (*in* mm):

colony d	est. 6
colony h	2
calice d (lumen)	ca. 0.8
depth	ca. 1
c-c	1.5
s	*6S1 + 6S2 + nS3*

DESCRIPTION: Lamellate incipient colony with flat lower and slightly convex upper surfaces, composed of about 20 corallites. Calices circular and deep. Calicular rims not raised. Intercorallite area covered with granules. Polygonal intercorallite boundaries slightly marked. Costae well expressed at the calicular rim. Septal apparatus consists of 6 well developed *S1* fused with the columella and rudimentary *S2* and *S3* septa reduced to vertical ridges or rows of granulae on the

inside surface of the wall. Distal portion of the *S1* septum differentiated into two parts: a thick peripheral part extending about one third of the distance from wall to columella and then steeply falling down to the calicular bottom and continuing into a thin, adaxial part fused with the columella slightly above the calicular bottom. Free portion of the adaxial border of *S1* septum ornamented with irregular denticles and spines. Columella very high, reaching nearly to the level of the calicular rim.

REMARKS: A feature well differentating this species from the others of the genus is the shape of distal portion of septa and the corallite diameter. The colony described differs from specimens in literature in its deep calices. This difference may be due to the fact that its surface is exellently preserved while in the colonies illustrated by REUSS, MONTANARO-GALLITELLI & TACOLI and CHEVALIER (*see synonymy*) the surfaces are damaged.

OCCURRENCE: Miocene of the Holy Cross Mts (Korytnica Basin) and other localities in the Paratethys; Miocene of Algeria and Madeira.

Table 1

A synonymized and updated list of Miocene coral species described in the paper and their distribution in particular localities of the Korytnica Basin and selected European regions

▒ - "oyster marls". ■ - "plastic clays" xx - undetermined horizon Ko - Korytnica Ka - Karsy Ch - Chomentów Ma - Małoszów	* - The species described by DEMBIŃSKA-RÓŻKOWSKA (1932) from localities outside the Holy Cross Mts

DEMBIŃSKA-RÓŻKOWSKA (1932)				RONIEWICZ & STOLARSKI (1991, this paper)
Ko–Ch	Ka	Ma		Korytnica (F, Ly, Pn, Af sites) Karsy (K site)
				Stylophora reussiana
▒		xx	*Orbicella reussiana* →	*Tarbellastraea reussiana*
			Orbicella reussiana minor →	
		xx	*Orbicella conoidea* →	
		xx	*Orbicella plana* →	
	■		*Stylocora exilis* →	*Stylocora exilis*
			→	*Palaeoplesiastraea desmoulinsi*
▒		xx	*Cyphastraea distans* →	
			Cyphastraea manipulata →	
			Plesiastraea romettensis →	
▒			*Plesiastraea desmoulinsi* →	*Palaeoplesiastraea inaequalis*
				* *Syzygophyllia brevis*
				Porites leptoclada
		xx	*Porites vindobonarum prima* →	*Porites vindobonarum prima*
				* *Siderastraea italica*

Suborder **Astraeina** ALLOITEAU, 1952
Family **Faviidae** GREGORY, 1900
Genus *Tarbellastraea* ALLOITEAU, 1952
Tarbellastraea reussiana (MILNE-EDWARDS & HAIME, 1850)
(Pl. 2, Figs 1-3)

pars 1847. *Explanaria astroites* nov. sp.; A. E. REUSS, p. 17; Pl. 2, Figs 7-8 (non Figs 9-14).
1850. *Asraea Reussiana*; H. MILNE-EDWARDS & J. HAIME, p. 110.
1871. *Heliastraea Reussiana* MILNE-EDWARDS & HAIME; A. E. REUSS, p. 44; Pl. 9, Fig. 2; Pl. 18, Fig. 4.
1932. *Orbicella Reussiana* MILNE-EDWARDS & HAIME M. DEMBIŃSKA-RÓŻKOWSKA p. 124; Pl. 2, Fig. 2.; Pl. 7, Fig. 1.
1932. *Orbicella Reussiana* MILNE-EDWARDS & HAIME var. *minor* FELIX; M. DEMBIŃSKA-RÓŻKOWSKA,p. 125.
1932. *Orbicella conoidea* REUSS; M. DEMBIŃSKA-RÓŻKOWSKA, p. 125; Pl. 2, Fig. 3.
1932. *Orbicella plana* MICHELIN; M. DEMBIŃSKA-RÓŻKOWSKA, p. 125; Pl. 2, Fig. 4.
1961. *Tarbellastraea reussiana* (MILNE-EDWARDS & HAIME); J. P. CHAVALIER, p. 205; Pl. 10, Fig. 1; Pl. 24, Fig. 4.

MATERIAL: 26 colonies and fragments from Korytnica-Plebania, and arable fields (*ZPAL H. I/329-333, 336-343, 499-511, 561-565* and a collection of fragmentary colonies (*IG UW*).

DIMENSIONS (*in* mm):

minimum colony d	5-12
minimum colony h	2-5
maximum colony d	50
maximum colony h	80
d of calice	(1.8) 2 — 2.5
s	*6S1 + 6S2 +12S3*

REMARKS: The collection consists, first of all, of specimens of a typical morphotype having well developed costae, calicular diameters of 2-2.5 mm, calices rather densley distributed (c-c 2.5-3.3 mm), septa disposed in three well differentiated orders, septal ornamentation moderately developed, density of the perithecal dissepiments 9-11/3 mm (example: *ZPAL H. I/333* presented in Pl. 2, Fig. 5).

RONIEWICZ & STOLARSKI (1991) S I T E S					REUSS (1871)		CHEVALIER (1961)
					VIENNA BASIN	TRANSILVANIAN BASIN	MEDITERRANEAN REGION
K	F	Ly	Pn	Af	Grund	Lapugy	
	▓						▓
			▓	▓	▓ *O. reussiana* *O. conoidea*	▓ *O. reussiana* *O. conoidea*	▓
	▓	▓	▓	▓	▓		
				▓	▓ *Plesiastraea desmoulinsi*		▓
				▓		▓?▓ *S. approximata*	▓
▓						▓	
		▓	▓				▓
			▓		▓ *P. incrustans*		?
		▓					▓

One colony (*ZPAL H. I/332*; *see* Pl. 2, Fig. 1) represents a different morphotype, with calices slightly larger in diameter (2.5-2.8 mm) and more widely spaced (3.5-5.5 mm) than in the morphotype discussed above, and with less dense peritheca (ca. 6/8 mm).

In some incipient colonies built of a few corallites, the costae are very low, with trabecular tips well marked. Lower colony surface is epithecate, wrinkled.

The colonies investigated seem to be representative for the genus *Tarbellastraea* from the Korytnica Basin. Its monospecific composition allows to assume that the small collection (7 specimens) described by DEMBIŃSKA-RÓŻKOWSKA (1932) was of the same content.

In colonies of *T. reussiana* from Korytnica, a commensal cirripede, *Creusia sanctacrucensis* BAŁUK & RADWAŃSKI is frequently domiciled (*see* BAŁUK & RADWAŃSKI 1967, 1977, 1984). Moreover, other diverse organisms (bivalves, polychaetes, sponges) bored colonies of this species.

OCCURRENCE: Miocene of the Holy Cross Mts (Korytnica Basin), Carpathian Foredeep, and other localities in the Paratethys; common in the Miocene of the Mediterranean region.

Genus *Stylocora* REUSS, 1871

The genus *Stylocora* is a monospecific, rare, endemic component of coral assemblages of the Parathetys region, and remains up to now a very poorly known taxon.

New observations allow for the following emendation of the original diagnosis.

Dendroid colonies of monopodial growth, built of main corallites and their offsprings of one or two generations. Increase extratentacular, extrathecal, with new corallites appearing near the distal part of the adult corallite, directly on its wall. Branching angle usually 90° or so. New corallites surrounded by rudimentary exotheca. Exotheca composed of one, rarely two layers of vesiculae, its extent restricted to the immediate vicinity of the branching place or the place of fusion of independent branches. Costae covering the external corallite surface continue on the exothecal surface.

Stylocora exilis REUSS, 1847
(Pl. 3, Figs 1-6)

1871. *Stylocora exilis* nov. sp.; A. E. REUSS, p. 39; Pl. 8, Figs. 4-7.
1932. *Stylocora exilis* REUSS; M. DEMBIŃSKA-RÓŻKOWSKA, p. 130; Pl. 4, Fig. 2.

MATERIAL: About 600 fragmentary branches from Korytnica-Forest, Mt. Lysa, Plebania and arable fiels (*ZPAL H. I/554-557*).

DIMENSIONS (*in* mm);

corallite d	2.5-3.5
s	*6S1 + 6S2 + 12S3*

DESCRIPTION: Corallites covered with costae or rows of small granulation. Septa exsert, costae 12 in number, well expressed at the calicular rim and continuing on the corallite surface at the variable distance from the calice. Hexameral symmetry is a rule, but calices with 5 and 7-fold symmetry can be observed. Septa *S1* approach a small and flattened columella, deeply hidden in the calice. Distal edge delicately granulated, internal edge with regularly distributed denticles. Faces with rows of granulae, parallel to the distal edge. Endotheca of large, rare, tabuloid dissepiments and rare vesicular dissepiments appearing sporadically at the columella. Simultaneously 1-3 offsprings can apper at the same level. Intervals between branching can be very irregular, beginning from 3 mm up to centimeters. The longest single corallite is 20 mm long.

OCCURRENCE: Miocene of the Holy Cross Mts (Korytnica Basin) and other localities in the Paratethys.

Genus *Palaeoplesiastraea* CHEVALIER, 1961
Palaeoplesiastraea desmoulinsi (MILNE-EDWARDS & HAIME, 1851)
(Pl. 2, Fig. 4)

1871. *Solenastraea distans* nov. sp.; A. E. REUSS, p. 45; Pl. 7, Fig. 4; Pl. 8, Fig. 1.
1871. *Plesiastraea desmoulinsi* MILNE-EDWARDS & HAIME; A. E. REUSS, p. 47; Pl. 9, Fig. 1.
?1932. *Cyphastraea distans* REUSS; M. DEMBIŃSKA-RÓŻKOWSKA, p. 126; Pl. 2, Fig. 6.
1932. *Cyphastraea manipulata* REUSS; M. DEMBIŃSKA-RÓŻKOWSKA, p. 126; Pl. 2, Fig. 5.
1932. *Plesiastraea Romettensis* SEGUENZA; M. DEMBIŃSKA-RÓŻKOWSKA, p. 127; Pl. 2, Fig. 8.
non 1932. *Plesiastraea Desmoulinsi* MILNE-EDWARDS & HAIME; M. DEMBIŃSKA-RÓŻKOWSKA, p. 128; Pl. 2, Fig. 7
1961. *Palaeoplesiastraea desmoulinsi* (MILNE-EDWARDS & HAIME); J. P. CHEVALIER, p. 264; Text-figs 96 and 97; Pl. 13, Fig. 4; Pl. 24, Fig. 5.

MATERIAL: 3 fragmentary colonies from arable fields at Korytnica (*ZPAL H. I/334, 513, 514*).

DIMENSIONS (*in* mm):

maximum colony h	more than 30
maximum colony d	more than 80
corallite d	2.5-3.0
c-c	3.0-3.5 in *ZPAL H. I/334* (4.0-5.0 in *ZPAL H. I/513* and *514*)
s	12*S1*/2 + 12*S3*
e	ca. 10/5 mm

DESCRIPTION: Upper colony surface subhorizontal, covered by circular, slightly raising calices. Intercalicular surface wide. Costae low and granulated. The septa *S1* and *S2* approach to the axis and give an irregular crown of paliform projections surrounding the columella. Septal faces are covered by thick, irregularly distributed granulation. Scarce perforation may be observed at the adaxial bord. Endotheca composed of thin tabuloid dissepiments, slightly concave at the axis. Perithecal dissepiments vesiculous (ca. 10 in 5 mm in longitudinal section). In the peritheca, the layers composed of thin-walled vesicular dissepiments mutually superimpose, in more or less regular intervals, with compact sclerenchymal deposits. In some colony parts only massive perithecal sclerenchyme can be deposited, in others, each vesicula or vesicular layer is strengthened on its upper surface with a sclerenchymal deposit.

REMARKS: The synonymy presented includes a number of taxa that show features which may be observed in colonies of a single species differing in the structure of peritheca. Of the four species of *Cyphastraea* and *Plesiastraea* distinguished by DEMBIŃSKA-RÓŻKOWSKA (1932) in the Korytnica Basin three enter the synonymy of *P. desmoulinsi*. The diversity of this fauna is far smaller than it was assumed by this author (*see also* remarks on *Tarbellastraea reussiana*). The features of the investigated specimens are consistent with the characteristics of the neotype of *P. desmoulinsi* (*see* CHEVALIER 1961). It is highly possible that the form described hereafter as *P. inaequalis* represents a peculiar morphotype from the variability range of *P. desmoulinsi*.

OCCURRENCE: Miocene of the Holy Cross Mts (Korytnica Basin) and other localities in the Paratethys; Miocene of the Mediterranean region.

Paleoplesiastraea inaequalis CHEVALIER, 1961
(Pl. 2, Fig. 5)

1871. *Solenastraea approximata* nov. sp.; A. E. REUSS, p. 47; Pl. 8, Fig. 3.
1932. *Plesiastraea Desmoulinsi* MILNE-EDWARDS & HAIME; M. DEMBIŃSKA-RÓŻKOWSKA, p. 128; Pl. 2, Fig. 7.
1961. *Palaeoplesiastraea inaequalis* sp. n.; J. P. CHEVALIER, p. 268; Pl. 21, Fig. 1; Pl. 24, Fig. 1.

MATERIAL: Fragments of 1 large and 2 small colonies from arable fields at Korytnica (*ZPAL H. I/335, 512, 560*). In the colonies. frequent are borings of bivalves and polychaetes.

DIMENSIONS (*in* mm):

maximum colony d	150
maximum colony h	80
d (calices)	1.8-2.5 (rarely 2.8-3.0)
s	12 *S1*/2+ 12 *S3*
c-c	2.0-3.0 (rarely 3.5)
e	8/5 mm

DESCRIPTION: Colonies lamellate or submassive and slightly convex. Intercalicular area extremely reduced resulting in subcerioid appearance of the calicular colony surface. Calices circular to irregular in shape, shallow. Calicular rim slightly raising above the surface. columella small, surrounded by an irregular crown of paliform lobes, which may fuse to it to form a spongy axial structure. Septa *S1* and *S2* provided with paliform lobes. Septal faces covered with prominent granulation. Scarce perforation can be observed at the adcolumellar portion of *S1-S2* septa. Endotheca formed by large, tabuloid dissepiments. Peritheca compact or subcompact showing in the longitudinal section its thic-walled, rare dissepiments.

REMARKS: Small corallite dimensions and irregular, densely arranged calices in the species from Korytnica Clays are consistent with the description and illustrations of the holotype. It is worth of notion, that the specimens described resemble much *S. approximata* REUSS. Unfortunately, a more precise comparison is impossible without investigating REUSS' type material.

The species differs from *P. desmoulinsi* in its smaller and densely crowded calices. A comparison of a series of colonies of both species, however, shows intergradations in development of these features.

OCCURRENCE: Miocene of the Holy Cross Mts and, possibly, of the Vienna Basin; Miocene of the Mediterranean region.

Family **Mussidae** ORTMANN, 1890
Genus *Syzygophyllia* REUSS, 1860
Syzygophyllia brevis REUSS, 1860
(Pl. 1, Fig. 2)

1871. *Syzygophyllia brevis* nov. sp.; A. E. REUSS, p. 36; Pl. 5, Figs 6-9.
1932. *Syzygophyllia brevis* REUSS; M. DEMBIŃSKA-RÓŻKOWSKA, p. 123; Pl. 2, Fig. 1.

MATERIAL: 1 specimen from Karsy (*ZPAL H. I/572*).

DIMENSIONS (*in* mm):
h 25
d 25 x 35
s 75
sd 7-8/10 mm

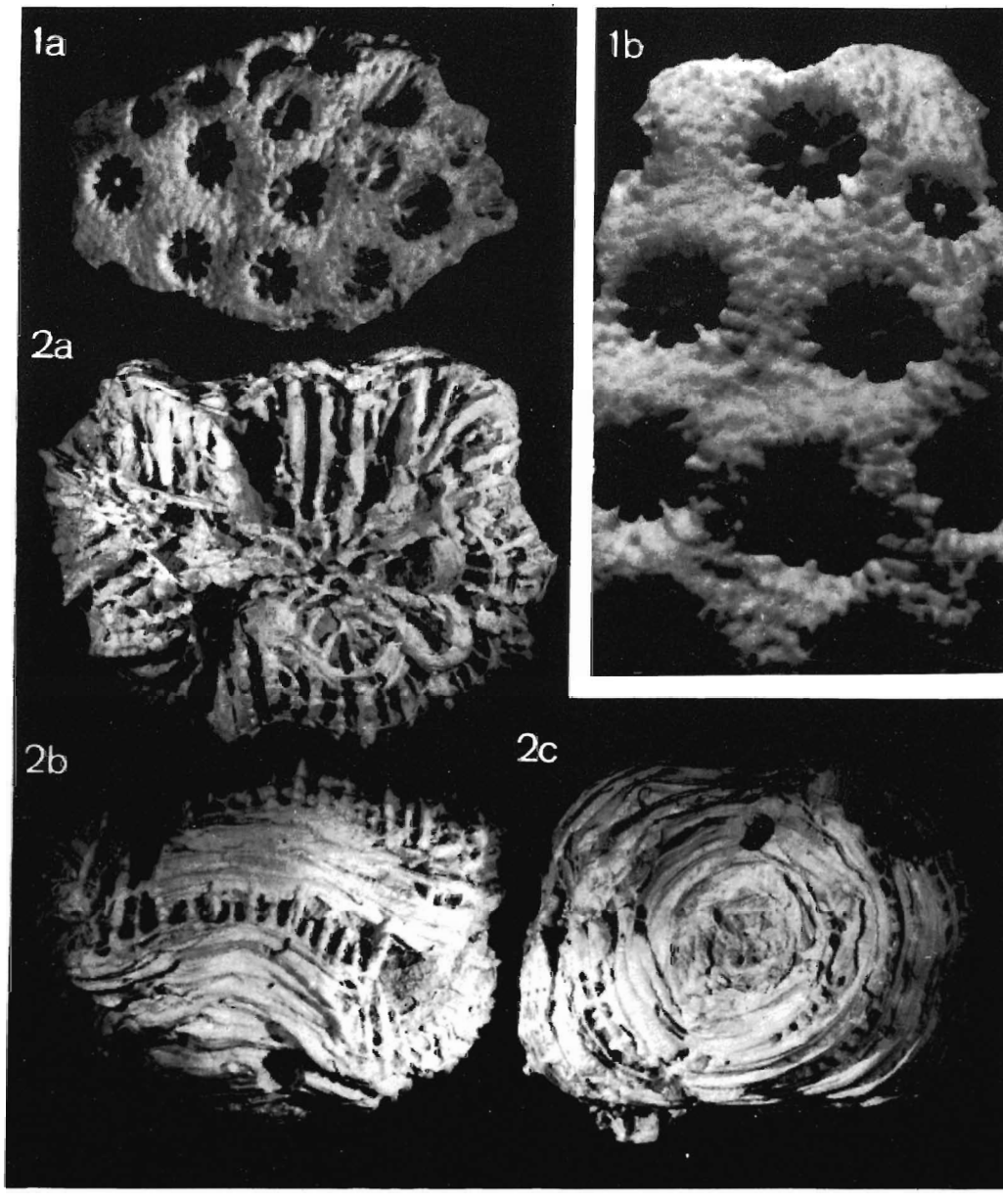
DESCRIPTION: The protocorallite at an early transitory stage to the colonial state is characterized by its calice slightly lobate, displaying three new centres connected with the central one by lamellar linkages. Corallum covered with an incomplete epicostal paratheca (*holotheca* of CHEVALIER 1961). Radial elements of 4 orders: *S1* approach to the axis, *S2* slightly shorter, *S3* half the length of *S1* and *S4* short and irregularly distributed. Septal blades formed of well delimited elements of a septal-spine type with tendency to individualize at the distal margin. Free spine tips are 2 mm long. Internal margin with projections producing small, spongy columella. Septal faces covered wih short, sharp and dense granules. Dissepiments rather thick-walled.

OCCURRENCE: Miocene of the Holy Cross Mts and other localities in the Paratethys.

Suborder **Fungiina** VERRILL, 1865
Family **Siderastraeidae** VAUGHAN & WELLS, 1943
Genus *Siderastraea* de BLAINVILLE, 1830
Siderastraea italica (DEFRANCE, 1826)
(Pl. 4, Fig. 1)

1847. *Astraea Froehlichiana* nov. sp.; A. E. REUSS; p. 22; Pl. 3, Fig. 2.
?1871. *Astraea Froehlichiana* REUSS; A. E. REUSS, p. 49; Pl. 13, Figs 2-3.
1932. *Siderastraea italica* DEFRANCE; M. DEMBIŃSKA-RÓŻKOWSKA, p. 133; Pl. 4, Fig. 1.
1961. *Siderastraea miocenica* OSASCO var. *italica* (DEFRANCE); J. P. CHEVALIER, p. 425; Pl. 25, Fig. 8.

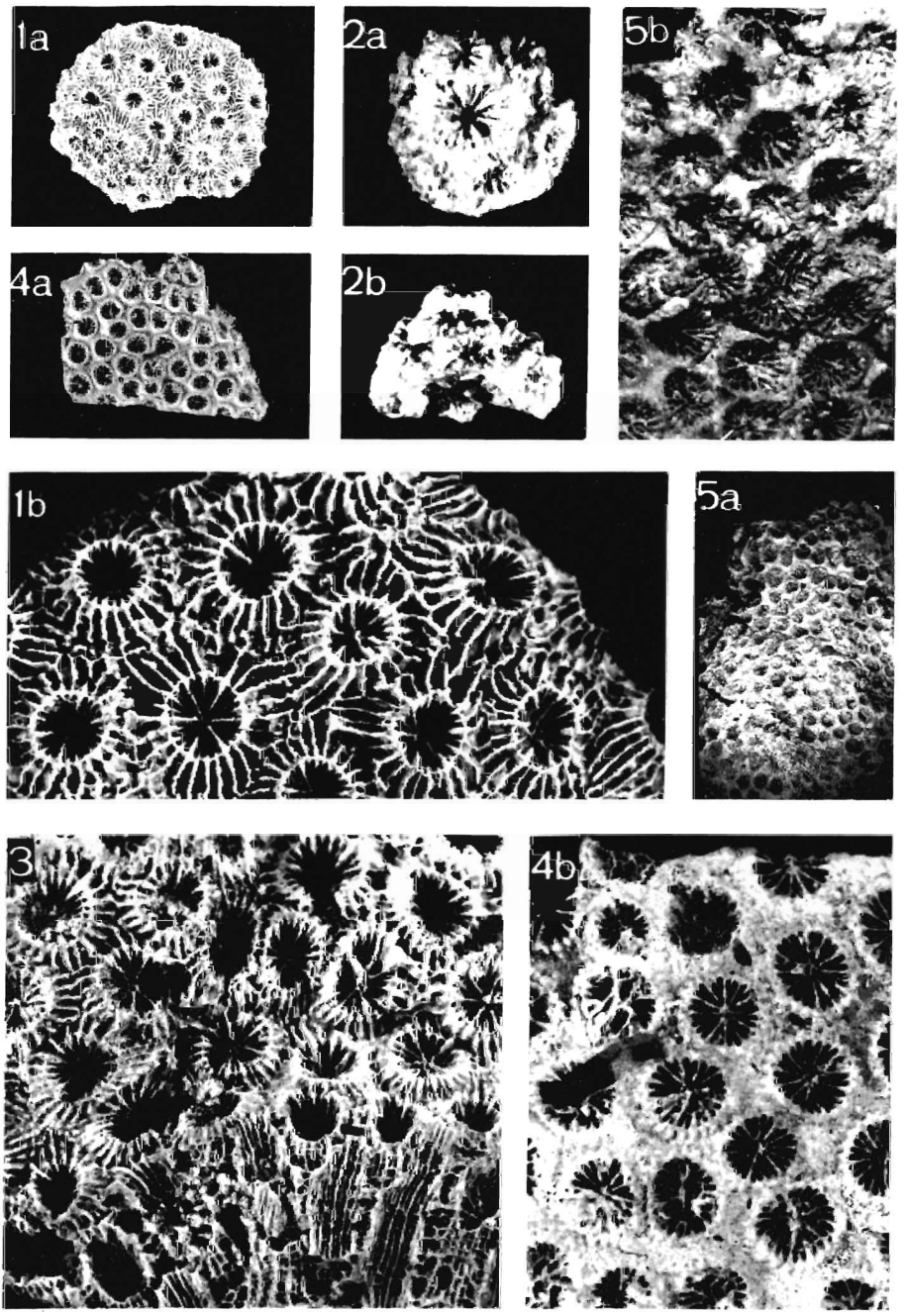
MATERIAL: One fragment of a small colony from Mt. Lysa (*ZPAL H. I/558*).



1 — *Stylophora reussiana* MONTANARO-GALLITELLI & TACOLI; ZPAL H. I/559; **1a**—incipient colony, × 10, **1b** — detail of Fig. 1a, × 20; note intercorallite granulation and differentiation of septa *S1* into thick, exsert peripheral and thin, deeply hidden parts

2 — *Syzygophyllia brevis* REUSS; ZPAL H. I/572; **2a** — distal view [note evidence of initial budding (*arrows*)], **2b** — lateral view, **2c** — proximal view; all × 2

All photos taken by J. STOLARSKI

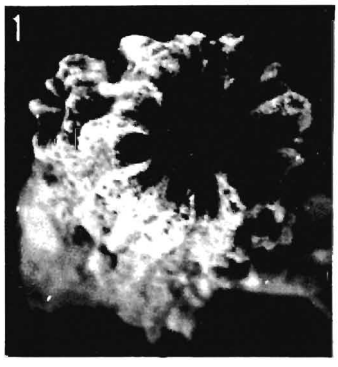


1-3 — *Tarbellastraea reussiana* (Milne-Edwards & Haime); **1** — ZPAL H. I/332, colony with widely spaced corallites, 1a × 1, 1b × 4; **2** — ZPAL H. I/337, incipient colony in *2a* distal and *2b* lateral views, × 5; **3** — ZPAL H. I/333, typical morphotype, × 4

4 — *Palaeoplesiastraea desmoulinsi* (Milne-Edwards & Haime); ZPAL H.I/334, 4a × 1, 4b detail × 4

5 — *Palaeoplesiastraea inequalis* Chevalier; ZPAL H. I/512, 5a × 1, 5b detail × 4

Figs 1, 3-4 taken by M. Dziewiński; Figs 2, 5 by J. Stolarski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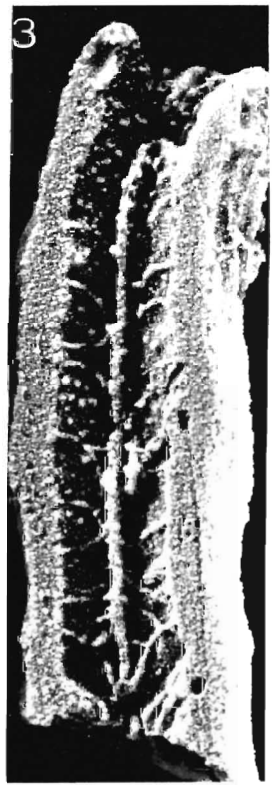
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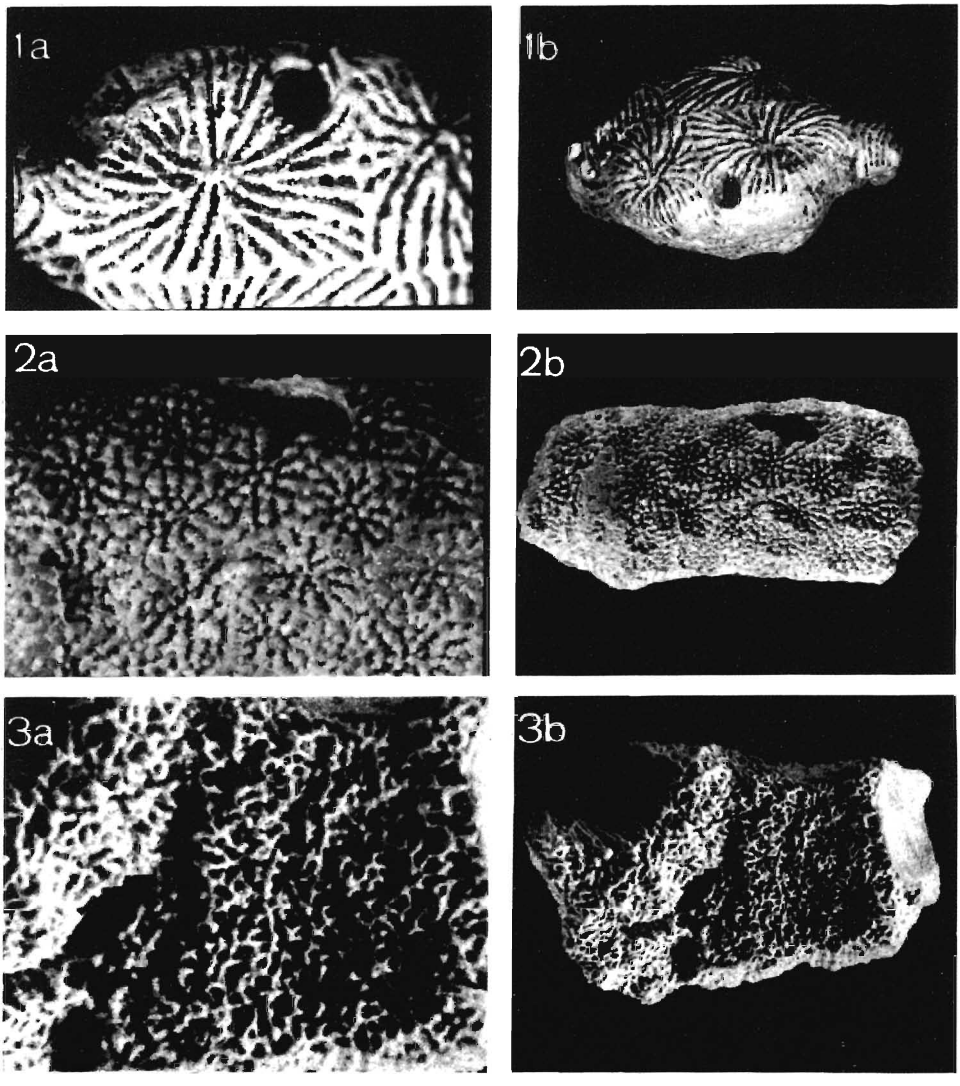

1 — *Siderastraea italica* (DEFRANCE); ZPAL H. I/558; 1a × 10, 1b × 5
2 — *Porites leptoclada* REUSS; ZPAL H. I/517; 2a × 10, 2b × 5
3 — *Porites vindobonarum prima* KÜHN; ZPAL H. I/547; 3a × 10, 3b × 5

Figs 1-2 taken by J. STOLARSKI; Fig. 3 by M. DZIEWIŃSKI

PLATE 3 (*preceding page*)

Stylocora exilis REUSS

1 — ZPAL H. I/555/21; calice deep, columella invisible; **2** — ZPAL H. I/555/2; calica with small columella and prominent costae; **3** — ZPAL H. I/555/12; tabuloid endotheca and septal ornamentation seen in longitudinal section, polished surface; **4** — ZPAL H. I/555/9; longitudinal section, polished surface (note dissepimental exotheca at the place of divergence of new corallites; **5** — ZPAL H. I/555/11; longitudinally broken surface (note dissepimental exotheca at the place of fusion of independent branches); **6** — ZPAL H. I/555/8; diverging branches in longitudinal section, polished surface

All × 10 except for Fig. 2 × 20

Figs 1-3, 5 taken by M. DZIEWIŃSKI; Figs 4, 6 by J. STOLARSKI

DIMENSIONS (*in* mm):

colony h	5
corallite d	ca.4
s	34-39
sd	9-11/3 mm

REMARKS: The species is very rare and is represented in the collection studied by a fragment of an incipient colony. Corallite diameters, number of septa and abundant synapticulae of the investigated form are typical of *S. italica*. CHEVALIER (1961, p. 426) considers that *S. lomnickii* of DEMBIŃSKA-RÓŻKOWSKA (*see* DEMBIŃSKA-RÓŻKOWSKA 1932, p. 132 and Pl. 3, Figs 3-4) may be conspecific with *S. italica*, as their diameters of corallites are comparable.

OCCURRENCE: Miocene of the Holy Cross Mts (Korytnica Basin) and the Carpathian Foredeep; Miocene of the Vienna Basin and of the Mediterranean region.

Family **Poritidae** GRAY, 1842

Genus *Porites* LINK, 1807

Porites leptoclada REUSS, 1871
(Pl. 4, Fig. 2)

1871. *Porites leptoclada* nov. sp.; A. E. REUSS, p. 65; Pl. 17, Figs 3-4.
1953. *Porites leptoclada* REUSS; M. MOENKE, p. 264, Text-fig. 17.
1962. *Porites* cf. *leptoclada* REUSS; J. P. CHEVALIER, p. 56; Pl. 3, Fig. 1a-b.

MATERIAL: Fragments of branching colonies and their lamellate bases from Korytnica-Plebania (*ZPAL H. I/517-544*).
DIMENSIONS (*in* mm):

d of branches	ca. 5
d of calices	1.2-1.5
c-c	1.2-1.5
s	12-16

DESCRIPTION: The colonies are small and composed of delicate bifurcating branches. Calices shallow, separated by polygonal walls. Radial elements regularly thickened, densely ornamented and differentiated into 12 subequal *S1* and *S2* and rare *S3* septa. Distal edge provided with thick teeth (3-4 in number in *S1*). Adaxial teeth of S1 septa isolated from the blades and forming a crown of paliform elements surrounding a small columella. Synapticulae thick, forming incomplete synapticular floors (11/2 mm in longitudinal section). Dissepiments very rare.

REMARKS: In its colony structure this species resembles much Recent *Porites porites furcata* LAMARCK. However, its colonies must be much more delicate than in the Recent species, as their last order branches are from 3 to 5 mm in diameter. The colonies from Korytnica have calices sligtly smaller than characterized by REUSS (1871) and being 1.5-2 mm.

OCCURRENCE: Miocene of the Holy Cross Mts (Korytnica Basin); Miocene of Podolia and other localities in the Paratethys.

Porites vindobonarum prima KÜHN *in* FELIX, 1927
(Pl. 4, Fig. 3)

1871. *Porites incrustans* DEFR; A. E. REUSS, p. 65; Pl. 17, Figs 5-6.
1927. *Porites vindobonarum prima* KÜHN; J. FELIX, p. 473.
1932. *Porites vindobonarum* prima KÜHN; M. DEMBIŃSKA-RÓŻKOWSKA, p. 154; Pl. 6, Fig. 10.

MATERIAL: Fragments of 3 small, lamellate colonies from Korytnica-Plebania (*ZPAL H. I/547-553*) and arable fields (*IG UW*).
DIMENSIONS (*in* mm):

d of calices	0.8-(1.2)
c-c	ca. 1
s	12 + n*S3*

REMARKS: Fragmentary material does not allow for a detailed description of the species. The

form differs from *P. leptoclada* in having far thinner skeleton structure and smaller calices. However, its density of synapticular floors (11/2 mm in longitudinal sections) is the same as in *P. leptoclada*. In its delicate structure and small calicular diameters it fits well with the characteristics of *P. vindobonarum prima* given by DEMBIŃSKA-RÓŻKOWSKA (1932). The form resembles *P. manacietensis* described by CHEVALIER (1961) from the Helvetian of Aquitania, and considered by this author as an aberrant species for its calices abnormally small for the genus.

A commensal cirripede, *Creusia moravica* PROCHÁZKA (*see* BAŁUK & RADWAŃSKI 1984), appears rarely in thin plate colonies of *P. v. prima*.

OCCURRENCE: Miocene of the Holy Cross Mts (Korytnica Basin) and other localities in the Paratethys.

HERMATYPIC CORALS IN THE KORYTNICA SEQUENCE AS ENVIRONMENTAL INDICATORS

The collection of hermatypic corals, containing six genera with eight species, consists of over thirty specimens of *Tarbellastraea* (mostly fragments), with seven incipient colonies, eight colony fragments of *Palaeoplesiastraea* (among them the largest colonies in the collection), one incipient colony of *Stylophora*, one fragments of incipient *Siderastraea* colony, several dozens of fragments of thin-branched and thin lamellate *Porites* colonies and one corallum of *Syzygophyllia*. In comparison, the collection of ahermatypic corals containing thirteen genera (subgenera) with fifteen species (Table 2) is composed of about 7000 specimens (STOLARSKI 1991). Although the frequency and specific diversity of hermatypic corals in no way are comparable to those of ahermatypic corals, each group is represented by the same number of families (hermatypes by the families Stylophoridae, Faviidae, Mussidae, Poritidae and Siderastraeidae, while ahermaptypes by the Faviidae, Micrabaciidae, Flabellidae, Dendrophylliidae, and the dominant family Caryophylliidae).

Distribution of corals in the localities examined is as follows:

Korytnica-Forest (*F*), clays: numerous and variable ahermatypic fauna represented by branching *Stylocora* and 6 genera of simple corals (*see* STOLARSKI 1991, Table 15); hermatypic corals represented by a fragment of incipient colony of *Stylophora*.

Mt. Lysa (*Ly*), clayey deposits passing into lumachelles with clayey matrix: numerous branches of *Stylocora*, numerous and diversified ahermatypic corals represented by branching *Stylocora* and 8 genera of simple corals (*see* STOLARSKI 1991, Table 15); hermatypic corals represented by a fragment of an incipient *Siderastraea* colony and small lamellate and thin-branched *Porties* fragments.

Korytnica-Plebania (*Pn*), clayey deposit with calcareous organodetrital debris of fine psammitic fraction: relatively frequent hermatypic corals represented by *Porites* (thin-branched and thin-lamellate), *Tarbellastraea* (small fragments of colonies and incipient colonies), *Palaeoplesiastraea* (small fragments); ahermatypic corals represented by *Peponocyathus, Paracyathus*, and numerous branches of *Stylocora*.

Arable fields (*Af*) yielded: large colonies and fragments of *Palaeoplesiastraea*, numerous colony fragmnts of *Tarbellastraea* with original deposit remants found on the surface of colonies (white limestone or marl, with calcareous organoclasts of fine psammitic fraction and quartz grains, or clayey sediment with fine calcareous organoclasts); numerous *Flabellum* from yellowish clays and a fragment of *Stylocora* in a piece of dense limestone.

Karsy (K), clays: single *Syzygophyllia*.

The originally mixed fauna composed of hermatypic and ahermatypic elements is characteristic of some of the sites (*Pn, F, Ly*). At others (*Af*), however, the fauna of diverse horizons must have mixed during collecting. The list of corals from the Korytnica Basin (Table 1) shows close affinity to the Badenian fauna of the Vienna and the Transilvanian basins. The investigated assemblage from the lower part of the section is close to the assemblage from the Tegel of Baden, whereas the coral fauna of the rest of the sequence resemble those from the Oberer Tegel from Grund or Lapugy. The main feature of the hermatypic fauna discussed here is its small frequency, poor taxonomic variability and, generally, small size of colonies with the only exception of *Tarbellastraea* and *Palaeoplesiastraea* from the upper part of the sequence. In its small taxonomical diversity it resembles much the Helvetian subreefal assemblages from France (locality Manciet in Aquitania; *see* CHEVALIER 1961).

Table 2

Coral species from the Korytnica Basin

H — hermatypic corals, **A** — ahermatypic corals

Stylophoridae:	
Stylophora reussiana MONTANARO-GALLITELLI & TACOLI, 1951	H
Faviidae:	
Tarbellastraea reussiana (MILNE-EDWARDS & HAIME, 1850)	H
Stylocora exilis REUSS, 1847	A
Palaeoplesiastraea desmoulinsi (MILNE-EDWARDS & HAIME, 1851)	H
Palaeoplesiastraea inaequalis CHEVALIER, 1961	H
Mussidae:	
Syzygophyllia brevis REUSS, 1860	H
Siderastraeidae:	
Siderastraea italica (DEFRANCE, 1826)	H
Poritidae:	
Porites leptoclada REUSS, 1871	H
Porites vindobonarum prima KÜHN, 1927	H
Micrabaciidae:	
Stephanophyllia elegans (BRONN, 1837)	A
Caryophyllidae:	
Caryophyllia sp.	A
Acanthocyathus transilvanicus REUSS, 1871	A
Tethocyathus microphyllus REUSS, 1871	A
Tethocyathus velatus REUSS, 1860	A
Paracyathus cupula REUSS, 1871	A
Paracyathus sp.	A
Polycyathus confertus (REUSS, 1847)	A
Ceratotrochus granulatus DEMBIŃSKA-RÓŻKOWSKA, 1932	A
Ceratotrochus (E.) duodecimcostatus (GOLDFUSS, 1826)	A
Peponocyathus duncani (REUSS, 1871)	A
Flabellidae:	
Flabellum roissyanum MILNE-EDWARDS & HAIME, 1848	A
Dendrophylliidae:	
Balanophyllia praelonga (MICHELOTTI, 1838)	A
Dendrophyllia taurinensis MILNE-EDWARDS & HAIME, 1848	A

Hermatypic corals of the Holy Cross Mts represent genera which are regarded as most resistant to the unfavorable environmental conditions: *Palaeoplesiastraea, Siderastraea*, and *Porites* (see CHEVALIER 1961). Probably, the extinct genus *Tarbellastraea* was also relatively eurytopic as it can be found allover Europe in well developed reef assemblages as well as in strongly reduced subreefal ones.

Among environmental factors which could have influenced the development of the hermatypic fauna in the Korytnica Basin, its possible isolation, depth and a kind of bottom consolidation are to be discussed. Climatic control must have influenced in some extent this development as well. For assemblages of a mixed ahermatypic/hermatypic character the depth is difficult to guess. This is true about assemblages from Mt. Lysa and Korytnica-Forest, where ahermatypic corals are aboundant whereas the hermatypes occur as small colonies. They may have got there by chance, as a penesynchronously redeposited element, or they may have also developed there, at considerable depth. Their dwarfed colonies and good preservation state of colony surface seem to confirm that second supposition. Here, hermatypic corals lived in unfavorable conditions in the environment typical of the ahermatypic ones. As they co-occurred with the abundant ahermatypic fauna whose growth was controlled by water depth (and low temperature), we must agree that they lived in a relatively deep sublittoral zone. Thus, the depth and soft bottom unsuitable for settlement of larvae were among the main factors controlling the development of hermatypic corals.

The coral assemblages from Korytnica-Plebania, Korytnica-Forest, and Mt. Lysa differ in the content of ahermatypic and hermatypic elements and this may suggest any correlation with different depth they developed at. At Korytnica-Plebania, where the ratio of hermatypic (*h*) to ahermatypic genera (*a*) is 3:3, *Stylocora* is the only frequent ahermatypic component. The abudance of its bushy colonies, similar to recent *Goniocorela*, may suggest the depth of some dozen meters. Here, on soft bottom developed thin branching colonies of *Porites* and incipient colonies of *Tarbellastraea*, with their lower surface covered by epitheca and lying free on the substrate. Scarce *Peponocyathus* and *Ceratotrochus* occurring there are regarded as redeposited elements (STOLARSKI 1991). At Korytnica-Forest, where the *h:a* ratio is 1:7, *Stylophora* is the only known hermatypic component, represented by an incipient colony. In contrast with this, the environmemnt was very suitable for ahermatypic corals. Their abudance and taxonomic diversity suggest that the depth could exceed the one considered above. At Mt. Lysa the *h:a* ratio is 2:8, and the hermatypic corals, *Siderastraea* and *Porites*, have as well the form of dwarfed colonies. The ahermatypic assemblage differs from the one at Korytnica-Forest mainly in the presence of numerous dendrophylliids and *Tethocyathus*, whose development was undobtedly connected with the occurrence of thin oyster shells, which provided the substrate (STOLARSKI 1991). It is worth of mention that DEMBIŃSKA-RÓŻKOWSKA (1932) reported from the oyster shellbed ("oyster marls") from Korytnica, not only dendrophylliids and other ahermatypic corals, but also numerous and, it

seems, normally developed hermatypic corals: "*Orbicella conoidea, O. reussiana, O. r. minor, O. plana, Cyphastraea manipulata, Plesiastraea desmoulinsi*". Apparently, this author colleted the specimens from another horizon than that which provided the corals exmined here.

Taking into account some peculiar, recently observed conditions in the Chinese Sea and at the Hawaii, it is acceptable that such mixed Miocene assemblages lived at the depth of 50-100 meters (*see* CHEVALIER 1961). Due to considerable taxonomic variability of ahermatypic corals in the Korytnica sequence, as well as the presence of typically deep-water ones, the upper depth limit must be determined for about 100 meters. This is confirmed by the detailed analysis of depth requirements of the genera occurring here (STOLARSKI 1991).

In conclusion, we may say that the coral assemblages, observed in the Korytnica sequence, changed their character according to the changes in the depth of the Korytnica Basin. The oldest assemlages seem to be the fauna of a relatively deep sea of sublittoral zone, ahermatypic/hermatypic in character, with very few, poor taxonomically, underdeveloped hermatypic forms. The differences in composition of the ahermatypic corals are clearly connected with differences in their substrate (*F* and *Ly* sites). The younger assemblage, with relatively many hermatypic corals and very few ahermatypic ones (*Pn*), developed in shallower water, however, in conditions still unfavorable for hermatypic fauna due to the unstable substrate. The youngest ones are corals typical of shallow littoral zone, poor taxonomically but with normally developed colonies (*Af*). In the uppermost parts of the sequence, coral were replaced by red-algal assemblages. As it has been mentioned, climatic control of the hermatypic corals development in the Korytnica Basin cannot be neglected. In this basin, the northernmost (50° 40' N) in the Miocene Paratethyan coral assemblage developed, whose composition is evidently poorer than that of the assemblage from the Vienna and the Transilvanian basins (situated near to 48° N). Significant is that the difference in generic composition, striking when diversity of hermatypic corals of the two basins is compared, disappears in the case of ahermatypic, cool-and deep-water corals. Thus, the poor and dwarfish hermatypic coral assemblage may be regarded as a typical Paratethyan one but rudimentary and sharply impoverished (8 species, 6 genera, 5 families) in relation to the normally developed one known from the Vienna Basin and adjacent seas.

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KORALOWCE MIOCEŃSKIE (Scleractinia) Z GÓR ŚWIĘTOKRZYSKICH; CZĘŚĆ 2 — Archaeocoeniina, Astraeina, Fungiina

(Streszczenie)

Zrewidowano dotychczasowe oznaczenia (Dembińska-Różkowska 1932) badeńskich korali hermatypowych z Basenu Korytnicy (*patrz* fig. 1) oraz opisano 8 gatunków korali hermatypowych i 1 gatunek astreidowego kolonijnego korala ahermatypowego z iłów korytnickich (*patrz* tab. 1-2 oraz pl. 1-4). Korale hermatypowe reprezentują tutaj ubogi zestaw taksonomiczny w porównaniu z zespołem korali ahermatypowych (*patrz* Stolarski 1991).

Wysunięto przypuszczenie, iż niedorozwój hermatypowej fauny Gór Świętokrzyskich spowodowany był wieloma przyczynami, wśród nich dość dużą głębokością, która mogła schodzić do około 100 m (*patrz* Stolarski 1991) i nieustabilizowanym charakterem podłoża, oraz wpływem klimatu. Mieszany charakter fauny koralowej obserwowany w wielu stanowiskach może mieć charakter pierwotny, bądź wtórny, jako skutek redepozycji (*patrz* Stolarski 1991).