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UPPER KIMMERIDGIAN SCLERACTINIA OF POMERANIA (POLAND)

(1 Fig.)

Scleractinia z górnego kimerydu Pomorza (Polska)

(1 fig.)

Abstract. Scleractinia assemblage from marly and sandy limestones of the lowermost Upper Kimmeridgian of Czarnogłowy (western Pomerania, Poland) is discussed. It appears very close to those known from Upper Oxfordian and Lower Kimmeridgian limestone facies of other parts of Europe.

INTRODUCTION

The coral site at Czarnogłowy yielded rare, most northerly located Late Kimmeridgian hermatypic corals in Europe (compare text-fig. 1) showing at the same time a fairly diversified assemblage of coral species (Table 1) living in rather unfavourable conditions, that is in sedimentary environment of marls and sandy limestones. This locality was known to geologists for a long time (see, e.g., Schmidt, 1905; Dohm, 1925; Richter, 1931a). Corals occurring here were not, however, described but only listed along with other fossils (Table 1).

At Czarnogłowy there are cropping out deposits of the Upper Oxfordian, Kimmeridgian and Volgian. These are marly, limestone and partly oolitic deposits with admixtures of quartz sand and glauconite as well as sandstones (Wilczyński, 1962). Faunal assemblage reported from these deposits is very rich and it comprises: ammonites (Dohm, 1925; Wilczyński, op. cit.), echinoids (Kongiel, 1962), pelecypods and gastropods (Dmoch, 1970) and brachiopods (Richter, 1934). Corals are confined to a part of the profile corresponding to the *Aulacostephanus pseudomutabilis* Zone of the lower Upper Kimmeridgian (Wilczyński, 1962; — Middle Kimmeridgian of the above mentioned German authors).

Corals described here are housed in various institutions. Those from the collections of the Institute of Paleobiology of the Polish Academy

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of Sciences in Warsaw (abbreviated as ZPAL) were gathered by Professor Maria Różkowska, Dr Wanda Szymańska, Dr Andrzej Wilczyński and the present author. They were mainly collected from the waste-heap as the quarry wall was hardly accessible. The specimens from the Paleontological Museum of the Humboldt University in Berlin (abbr. as MB), made available through the courtesy of the Museum curator Dr. Hermann Jaeger, were gathered by the late Dr Fritz Brotzen. At present the collections cannot be supplemented as the quarry is completely

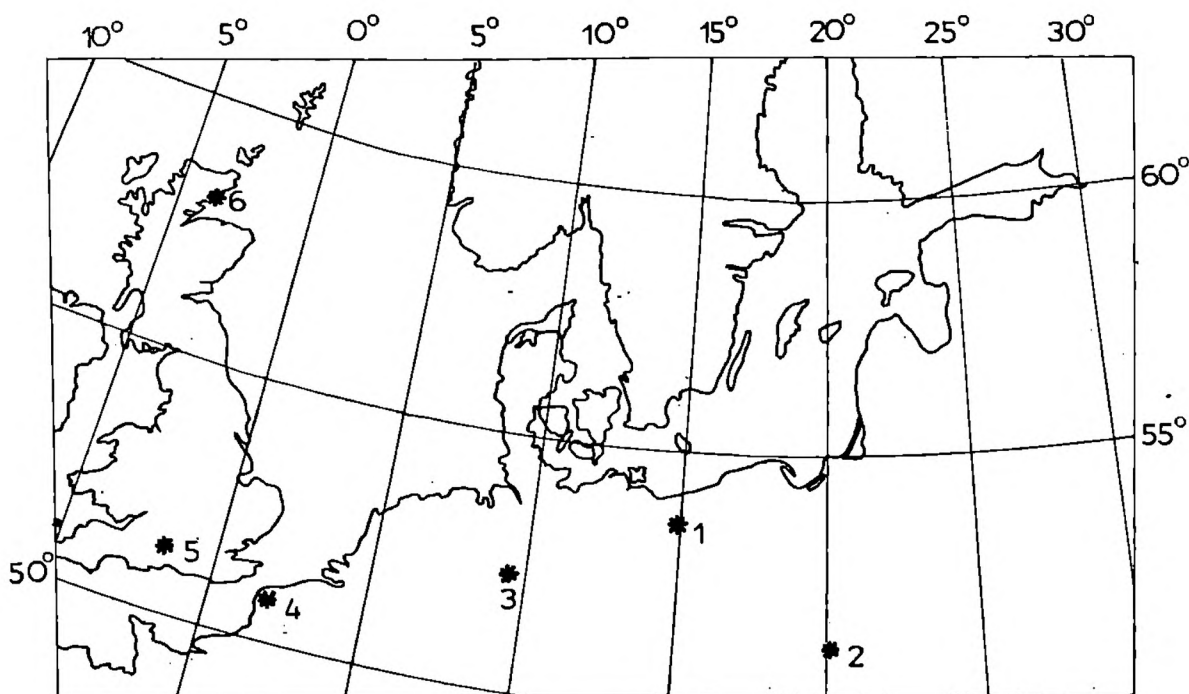


Fig. 1. Northern extent of hermatypic corals in Europe during the Kimmeridgian and Portlandian (after Beauvais, 1975, modified); 1 — Pomerania (Czarnogłowy, NW Poland), 2 — Holy Cross Mts (central Poland), 3 — Hannover area, 4 — Boulonnais, 5 — Wiltshire (Tisbury), 6 — E Scotland (Helmsdale).

Fig. 1. Zasięg ku północy koralu hermatypowych w Europie (wg Beauvais, 1975, uzupełnione)

flooded. The corals from Czarnogłowy are not very suitable for paleontological analysis as only external surface of colony is preserved and either the interior is completely recrystallized or the skeleton is dissolved and the interior infilled with deposit.

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THE CHARACTERISTICS OF CORALS FROM CZARNOGŁOWY

The longest list (8 species) of corals from Czarnogłowy was given by Schmidt (1905). Moreover, preliminary identifications of several coral species made by W. O. Dietrich, were given by Richter (1931a). Table 1

presents an attempt to identify the species reported from that locality by previous authors with 19 coral species identified by the present author. The species reported by Richter (1931a) were identified on the basis of labels from the F. Brotzen collection.

The collections comprise randomly gathered specimens which, however, may be treated as belonging to a single assemblage. This is because of the fact that they are derived from a single, small section of the profile — from limestone and marly layers. The specimens from F. Brotzen collection display limestone matrix identical to that of the remaining specimens.

The number of coral species identified slightly exceeds 20 including unidentifiable forms present in the collections. This Pomeranian assemblage appears closely affined to other assemblages from the Upper Oxfordian and Lower Kimmeridgian of Europe. It appears relatively impoverished in plocoid forms which is reflected by a surprisingly small contribution of corals of the suborder *Stylinina*. Several species are in common with the Upper Kimmeridgian assemblages (Table 1). Similarly as in the case of other Upper Jurassic assemblages, branching colonies are fairly common here contributing a third of a total number of species. The remaining species are represented by lamellar and massive colonies. The representatives of the suborder *Fungiina* (i.e. *Thamnasteria*, ? *Thamnoseris*, *Baryphyllia*, *Latiastrea* *Meandrophyllia* and *Comoseris*) are most common. Other corals occurring here belong to the suborders *Astraeoina* (genera *Isastrea*, *Complexastraeopsis* and *Calamophylliopsis*) and *Stylinina* (genus *Stylina*) or to the genera with uncertain systematic position (*Cladophyllia* and *Solenocoenia*). The composition of that coral assemblage appears common in comparison with that of most close coral sites of the Hannover area which were derived from somewhat older deposits. The latter are characterized by the large number of species of the genera *Montlivaltia* and *Thecosmilia* (Speyer, 1926).

The systematic composition and frequency of accompanying fauna is poorly known because of unsuitable exposure of coral-bearing rocks. It is known that the corals are accompanied by oysters and terebratuloids which is in accordance with the data given by Richter (1931a). Richter noted also an increase in numbers of nerineids in the neighbourhood of coral accumulations.

At Czarnogłowy there were not found any larger clusters of coral colonies except of that consisting of branching *Cladophyllia* colonies reported by Schmidt (1905) and subsequent authors. The present studies have shown that the representatives of *Thamnasteria concinna* are also the exception as they sometimes form clusters of several colonies growing one on another. It follows that the corals did not form a continuous layer but rather they were scattered on sea floor.

The majority of corals from Czarnogłowy represent species character-

Table — Tabela 1
Corals from the Kimmeridgian of Czarnogłowy
Korale z osadów kimerydu w miejscowości Czarnogłowy

Schmidt, 1905	Richter, 1931a	Here assigned to	Stratigraphic range (Pomerania excluded)
—	<i>Astrocoenia</i> sp.	1. <i>Enallocoenia crasso-ramosa</i>	UO—UK
—	—	2. <i>Stylina subornata</i>	UO—UK
—	<i>Cryptocenia</i> sp.	3. <i>Stylina valfinnensis</i>	LK
Montlivaltia sp.	—	—	
—	—	4. <i>Complexastraeopsis</i> cf. <i>lobata</i>	
<i>Isastraea bernensis</i> .	<i>Isastraea</i> sp.	5. <i>Isastraea helianthoides</i>	UO—UK
<i>Deurosmilia</i> sp.	—	—	
—	<i>Calamophyllia flabellum</i>	6. <i>Calamophylliopsis</i> cf. <i>compacta</i>	
—	—	7. <i>Calamophylliopsis moreauana</i>	UO—LK
—	<i>Dermosmilia</i> sp.	—	
—	—	8. <i>Meandrophyllia amedei</i>	UO—LK
<i>Thamnastraea minima</i>	<i>Thamnastraea concinna</i>	9. <i>Thamnasteria concinna</i>	UO—LK
—	—	10. <i>Thamnasteria</i> aff. <i>concinna</i>	MO
<i>Thamnastraea gracilis</i>	—	11. <i>Thamnasteria gracilis</i>	MO—UK
<i>Chorisastraea</i> sp.	—	12. <i>Baryphyllia</i> sp.	
<i>Latimeandra</i> sp.	—	13. <i>Latiastreaa variabilis</i>	UO—Ti
—	—	14. <i>Latiastreaa cylindrica</i>	UO—LK
—	—	15. ? <i>Thamnoseris</i> sp.	
—	—	16. <i>Comoseris minima</i>	UO—LK
—	—	17. <i>Solenocoenia semiradiata</i>	UO—LK
<i>Cladophyllia</i> cf. <i>ramea</i>	—	18. <i>Cladophyllia dichotoma</i>	UO—UK
—	—	19. <i>Cladophyllia rollieri</i>	UO

Identity of *Chorisastraea* sp. and *Baryphyllia* sp. is inferred but not proved. Identity of *Latimeandra* sp. and *Latiastreaa* sp. is as above. MO, UO; LK, UK; Ti: Middle, Upper Oxfordian; Lower, Upper Kimmeridgian; and Tithonian, respectively

ized by wide geographic and stratigraphic ranges. All the species are known from purely carbonate facies of Europe. A zone of shoals delineating the Scandinavian land from the south in the Late Jurassic was situated in the area of the present-day southern Baltic Sea (see Dohm, 1925; Richter, 1931a). The sedimentary conditions predominating in that zone were highly variable, from purely carbonate to clastic, terrigenous. Corals were developing only in times of moderate supply of terrigenous material². Similarly as in the case of Sequanian reef from La Rochelle studied by Lafuste (1959) a pollution of the environment with fine clastic material was not harmful to coral growth. The corals from Czarnogłowy do not differ from typical forms in shape of corallites nor in shape of colonies.

Upper Jurassic corals are not limited to the Czarnogłowy area in Pomerania. Redeposited coral colonies were reported from Quaternary deposits of the southern Baltic coast by Brinkmann (1924), Richter (1931b) and others. These are also Pomeranian corals which indicates predominance of conditions favourable for blooming of warm-water fauna in this part of the Boreal Sea in the Late Jurassic times.

REMARKS ON THE INVESTIGATED SPECIES

The majority of corals from Czarnogłowy (Table 1) represent well known and often described species (Koby, 1880—1889; Geyer, 1954, 1955a, b, 1965; Beauvais, 1964; Morycowa, 1974; Eliášová, 1976; Roniewicz, 1966, 1976), so instead of paleontological descriptions are given remarks on development of some features of the specimens studied.

1) *Enallocoenia crasso-ramosa* (Michelin, 1843): numerous broken branches with skeleton replaced by sediment; corallites are somewhat smaller (2—2.3 mm) in diameter, septa most commonly 28 to 32 in number, than given for that species by Geyer (1955 a). Fragments of branches from F. Brotzen collection were determined as *Astrocoenia richteri* n.sp. by O. W. Dietrich (in coll.). Subsequently, Geyer (1954, pl. 9, fig. 2) presented under the name *Astrocoenia ramulifera* a single specimen — a fragment of branching coral from Czarnogłowy — which also belongs to this species. Collection MB.

2) *Stylina subornata* (d'Orbigny, 1850): three subspherical colonies (ZPAL and MB) a few centimeters in diameter, pedunculate. Corallite diameters fall within the range of mean values for that species. Septa 24 in number, well developed, differentiated into three orders. The species is common in the Lower Kimmeridgian of the Holy Cross Mts. (Roniewicz, 1966).

3) *Stylina valfinnensis* Etallon, 1960: a single, large, a few cm in diameter

² The sand content of three randomly selected samples of matrix of coral-bearing layers from Czarnogłowy is equal about 2%. Grains of the fraction 0.01—0.1 mm are most common. The samples primarily consist of angular quartz and fresh glauconite grains as well as single plates of mica, occasional feldspars and rounded zircon, tourmaline and rutile grains.

spherical colony (labeled *Cryptocoenia* sp. in the collection MB), similar to the specimens from the Jura Mts (Koby, 1880, p. 77, pl. 15, fig. 2), and three young colonies. Diameter of calice ranging from 2.8 to 3.3 mm, septa 24 in number, differentiated into 3 orders.

4) *Complexastraeopsis* cf. *lobata* (Geyer, 1965): a single colony (ZPAL) 10 cm in diameter, slightly convex. Corallites 20—25 mm in diameter; corallite centers in series, 13—25 mm distant from one another; septa 40—45 in number, 10—13 in number per 10 mm between the valleys. Endotheca composed of relatively small, convex vesicles similarly as in specimens from the Lower Kimmeridgian of the Holy Cross Mts. The form described as *C. lobata* (Geyer) from the Tithonian of the Carpathians by Morycowa (1974) and Eliášová (1976) displays endotheca composed of large vesicles and partly subtabuloid. This indicates that there are two types of endotheca in the genus *Complexastraeopsis*, similarly as in the genus *Complexastraea* d'Orbigny (see Roniewicz, 1960). However, no information on the nature of endotheca was given in the description of the holotype of *C. lobata* (see Geyer, 1965, p. 237) which precludes unequivocal identification of forms of that group of species.

5) *Isastraea helianthoides* (Goldfuss, 1826): three lamellar colonies a few cm thick (ZPAL and MB); corallites 4.5 to 8.5 mm in diameter; septa differentiated in 3—4 orders, 30—62 in number, 11—13 in number per 5 mm in the wall; septa are generally finer and more numerous (in large specimens) than in specimens from the Lower Kimmeridgian of the Holy Cross Mts (Roniewicz, 1966).

6) *Calamophylliopsis* cf. *compacta* (Koby, 1884): numerous fragments of coral branches with obliterated internal structure (MB collections), 5—8 mm in diameter, with 7—9 ribs per 2 mm; ribs even. Budding under a very sharp angle; often 2 or 3 individuals originate simultaneously. Young individuals are more than two times narrower than the mature. This form resembles *C. compacta* (Koby) (see Roniewicz, 1976) in dimensions and size relations between young and mature individuals.

7) *Calamophylliopsis moreauana* (Michelin, 1853): some branches (MB) finely ribbed (5 to 7 ribs per 1 mm); the preservation is insufficient for counting the number of septa but the features such as corallite diameter (3—3.5 mm) and the mode of budding (very sharp angle, single or multiple, diameter of a new individual equal a half of diameter of mature individual or less) are typical of *C. moreauana*, one of the species of *Calamophylliopsis* characterized by the smallest corallite diameter (Roniewicz 1976).

8) *Meandrophyllia amedei* Etallon, 1862: two fragments of branches (MB). In Poland this species is common in the Holy Cross Mts. (see Roniewicz, 1966, p. 232, pl. 23, fig. 1 a—d).

9) *Thamnasteria concinna* (Goldfuss, 1826): this species, most common in the Upper Jurassic of Czarnogłowy, is represented by several specimens in the collections ZPAL and MB. In comparison with the Lower Kimmeridgian of the Holy Cross Mts the specimens occurring here represent both lamellar and submassive colonies with mamillary surface. Corallites 1.3—1.6 mm (or, sometimes, 2 mm) in diameter; septa 16—24 in number. Some specimens from the MB collections display very fine corallites resembling those of *T. gracilis*.

10) *Thamnasteria* aff. *concinna* (Goldfuss, 1826): a cast of surface of colony (ZPAL) well displaying features of that species which is known from the Middle Oxfordian of Bałtów, Holy Cross Mts., and which was hitherto assigned to *T. concinna* (see Roniewicz, 1966, pl. 19, fig. 4 a—b, not figs 1, 2, 3). Corallite diameter (about 2 mm) and number of septa (30—34; 18—19 per 5 mm section) are greater than in *T. concinna* s. s.

11) *Thamnasteria gracilis* (Münster, 1826): small knob-like colony with very densely spaced very small corallites (MB); this species is common in uppermost Middle Oxfordian of the Holy Cross Mts (Roniewicz, 1966).

12) *Baryphyllia* sp.: a single branch (MB) 10×13 mm in diameter; diameter of ovate calices 4.5×5 mm, and of circular calices 6 mm; density of ribbing of colony surface 20—24 ribs per 5 mm. This is the only site of the genus *Baryphyllia* on the north.

13) *Latiastreaa variabilis* (Etallon, 1859); one complete, and a fragment of colony (MB and ZPAL, respectively); colony spherical; calicular dimensions (ovate — 5×7 mm, circular — 6 mm in diameter) and number of septa (50—60) falling within the range of values typical of this species. It is very common in the Oxfordian and Kimmeridgian of the Holy Cross Mts. (Roniewicz, 1966).

14) *Latiastreaa cylindrica* (Koby, 1905): numerous fragments of branches (MB) 10 to 20 mm in diameter; calices 3.5×5 mm in diameter; septa 10 in number per 2 mm in the wall. This is the first record of that species from this part of Europe.

Geyer (1955 a, p. 355) cited this species along with others with uncertain systematic position, questioning the validity of that taxon. However, a specific, branching bushy appearance of the colony with the meandroidal-ceroidial arrangement of corallites as well as small dimensions of calices and the development of septal apparatus are sufficiently specific for recognition of taxonomical separateness. Such forms are not found in any homeomorphic genera of the *Latiastreaa* and *Meandrophyllia* group. Sharp crests, very deep calices, thin septa and a trend to anastomosis indicate that this species should be assigned to the genus *Latiastreaa*.

15) ?*Thamnoseris* sp.: three specimens (ZPAL); colonies pedunculate, thamnasterioid or pseudoceroid when corallites are strongly depressed; thick septa with pennulae, anastomosis and vesicular endotheca make possible to assign this form to the family Latomeandridae (see Roniewicz, 1976). The generic status cannot be precised because of insufficient knowledge of homeomorphic genera belonging to the same family and/or affined families.

16) *Comoseris minima* Beauvais, 1964: a large hemispherical colony (ZPAL) with wide valleys and some specimens with uniserial valleys (MB); corallites 1.5 to 1.8 mm in diameter; septa 14—16 in number in the calice and 19 in number per 5 mm in the wall. This species is common in the Oxfordian and Kimmeridgian of the Holy Cross Mts. (Roniewicz, 1966) and in the Upper Oxfordian of eastern border of the Częstochowa Jurassic.

17) *Solenocoenia semiradiata* (Etallon, 1864): fragments and complete convex massive colonies (MB); calices 1.7—2 mm in diameter, about 20 in number per 1 cm², septa 12 in number.

This species was formerly assigned to the genus *Convexastreaa* d'Orbigny (see Thurman, Etallon, 1864; Koby, 1881) or *Adelocoenia* d'Orbigny (see Beauvais, 1964). However, on account of highly specific elements — channels connecting corallites and bizonation of endotheca — this was selected as the type species of a new genus, *Solenocoenia* Roniewicz et Gill, 1976 (in Roniewicz, 1976).

18) *Cladophyllia dichotoma* (Goldfuss, 1826): numerous fragments of branches (MB); corallite surface transversally wrinkled; bifurcation in short intervals; corallites 4—5 mm in diameter, similarly as in typical specimens from Goldfuss collection. Septa 24 or more in number. The branches belonged to a colony with loose and irregular structure, close to that of the Goldfuss' *flexuosa* form.

19) *Cladophyllia rollieri* (Koby, 1889): some fragments of colony (MB); corallites relatively long and straight, set closely adjoining one another; surface of branches

transversally wrinkled; bifurcation typical of the genus *Cladophyllia* is well visible. Corallites 2.5—3 mm in diameter. This species was originally assigned (Koby, 1889) to the genus *Schizosmillia* Koby.

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STRESZCZENIE

Treść: Omówiono korale sześciopromienne z wapieni marglistych i piaszczystych górnego kimerydu z kamieniołomu w Czarnogłowach. Jest to zespół ściśle nawiązujący do zespołów górnego oksfordu i dolnego kimerydu z wapiennych facji europejskich.

Stanowisko z koralami w Czarnogłowach (Pomorze Zachodnie) jest jednym z nielicznych i daleko na północ wysuniętych stanowisk w górnym kimerydzie Europy (fig. 1) i przedstawia dość zróżnicowany zespół gatunków, które rozwijały się w warunkach uważanych za mało sprzyjające koralom hermatypowym — w środowisku osadzania się wapieni marglistych i piaszczystych. Było ono znane geologom od dawna (Schmidt, 1905; Dohm, 1925; Richter, 1931), lecz koralu stąd paleontologicznie nie opisano, poprzestając na wymienieniu ich w spisach fauny (tabela 1).

W kamieniołomie w Czarnogłowach, który dziś zalany jest wodą, odsłaniały się utwory górnego oksfordu, kimerydu i wołgu, wykształcone jako osady margliste i wapienne z domieszką piasku kwarcowego, z oolitami, glaukonitem oraz piaskowce (Wilczyński, 1962). Opisano stąd liczną faunę: amonity (Dohm, 1925; Wilczyński 1962), jeżowce (Kongiel, 1962), małże i ślimaki (Dmoch, 1970) oraz brachiopody (Richter, 1934). Korale znane są z niedużego odcinka profilu, który według Wilczyńskiego należy do dolnej części górnego kimerydu (środkowy kimeryd autorów niemieckich), do poziomu *Aulacostephanus pseudomutabilis*. Wyróżniony tu 19-gatunkowy zespół wykazuje ściśle powinowactwo z zespołami z górnego oksfordu i dolnego kimerydu i nawiązuje do zespołów z górnego kimerydu i z tytonu Europy. W stosunku do nich jest on uboższy przede wszystkim o gatunki o koloniach płokoidalnych, przez co podrząd *Stylinina* jest słabo reprezentowany. Duży udział mają tu korale o koloniach rozgałęzionych, które stanowią trzecią część ogólnej liczby gatunków. Korale z Czarnogłowów nie tworzyły ławic, lecz występowały jako kolonie rozproszone na dnie.

Większość gatunków z Czarnogłówów to formy bardzo rozpowszechnione geograficznie i długowieczne. Występowanie ich w wapieniach zapiaszczonych (około 2% domieszki piasku głównie kwarcowego, frakcja 0,01—0,1 mm przeważająca) świadczy o tolerancji na zawartość drobnego materiału klastycznego unoszonego okresowo w wodzie.

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