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LOWER KIMMERIDGIAN BIOSTRATIGRAPHY IN POLAND

(with 4 Figures and 7 Tables)

Abstract. The present study of Lower Kimmeridgian biostratigraphy in Poland is based on the following ammonites: *Ataxioceras, Nebrodites, Katroliceras, Glochiceras, Streblites, Taramelliceras, Idoceras, Sutneria, Orthosphinctes, Lithacoceras, Aspidoceras, Amoeboceras, Ringsteadia, Rasenia, Pictonia,* and *Zonovia.* The analysis of this fauna confirms that the Lower Kimmeridgian sediments in Poland, also in its northern parts, have rightly been subdivided into the following three zones: the lower one — *Sutneria platynota,* the middle one — *Ataxioceras hypselocyclum,* and the upper one — *Katroliceras divisum* (partly).

The Lower Kimmeridgian basin in Poland belonged entirely to the Submediterranean province, with a slightly marked boreal influence in the northern part of the country (*Amoeboceras, Ringsteadia, Pictonia, Zonovia*). This basin had a good connection with the Tethyan Sea, but its connection with the basin in north-western Europe was difficult and with that in the East quite impossible.

The ammonites and the accompanying fauna confirm the fact that the Lower Kimmeridgian sediments in Poland were deposited in a sublitoral environment, in a basin that was, in general, not deep.

GENERAL PART

Lower Kimmeridgian sediments have been recorded in a large area of Poland, except for the Łeba Elevation, most of the Fore-Sudetic area, the Sudetes, and part of the eastern areas of the country (Fig. 1 and R. Dadlez, J. Dembowska, 1965; L. Malinowska, 1986 — fig. 1; T. Niemczycka, W. Brochwicz-Lewiński — Archiv record).

The boundary between the Lower Kimmeridgian and the Upper Kimmeridgian has not been determined yet on the basis of fauna. In sections Kcynia IG IV (Mogilno Basin) and Środa IG 1 (Fore-Sudetic area), which are the fullest of those known so far, the upper zone, *K. divisum*, has also been preserved in fragments, and is overlain directly by Palaeogene deposits. On the basis of general geological data (J. Dembowska, 1964) we can assume that symptoms of erosion may occur at the boundary between the Lower and Upper Kimmeridgian.

The occurrence of Lower Kimmeridgian sediments in the Cracow area is a controversial problem. It has been widely discussed in litera-

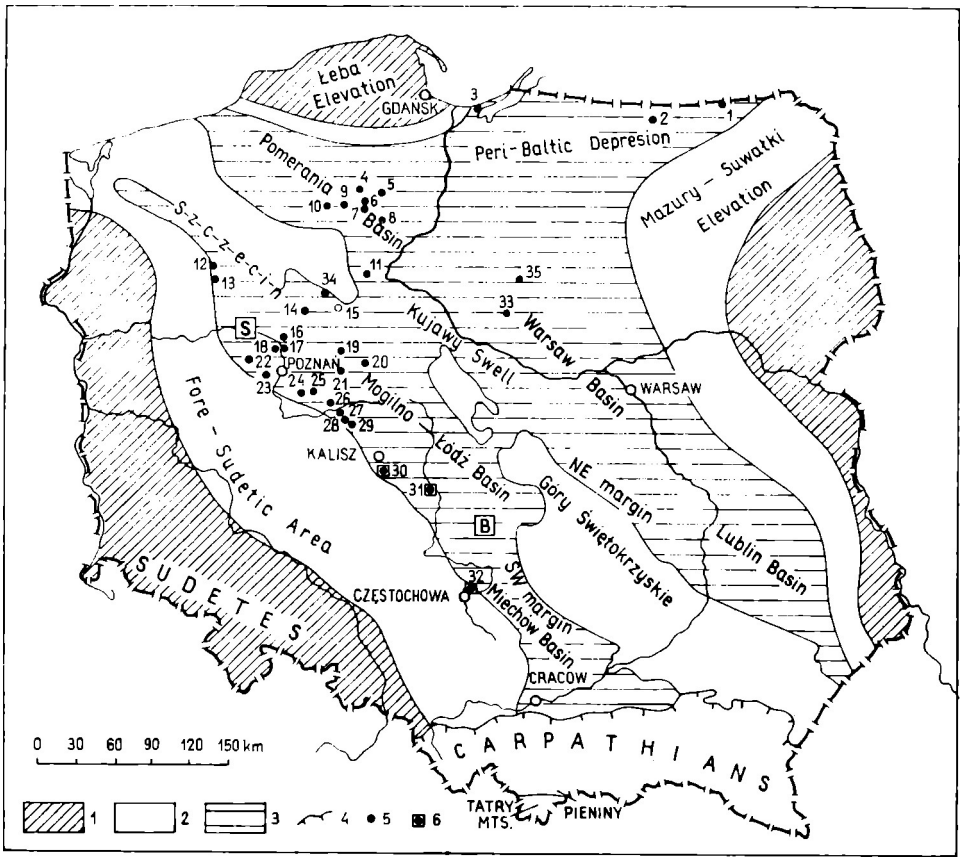

Fig. 1. Localization of outcrops and borehole sections of Lower Kimmeridgian sediments in Poland (range of the basin after W. Brochwicz-Lewiński and T. Niemczycka — Materials in the Archives of the Geological Institute)

1 — mainly denuded areas, *2* — areas without Lower Kimmeridgian rocks, *3* — present range of Lower Kimmeridgian rocks, *4* — Carpathian Overthrust, *5* — boreholes with ammonite sites: 1 — Gołdap IG 1, 2 — Bartoszyce IG 1, 3 — Krynica Morska IG 1, 4 — Kłosnowo IG 1, 5 — Lutom 1, 6 — Stobno 3, 7 — Stobno 2, 8 — Tuchola IG 1, 9 — Chojnice 3, 10 — Charzykowy IG 1, 11 — Nietuszkowo 23/77, 12 — Człopa 2, 13 — Człopa 3, 14 — Wągrowiec IG 1, 15 — Janowice 2, 16 — Ludomy 1, 17 — Parkowo 1, 18 — Poznań IG 1, 19 — Kłecko 3, 20 — Dębnica 1, 21 — Myślęcin 1, 22 — Bytyń 2, 23 — Lusowo, 24 — Środa IG 1, 25 — Środa IG 2, 26 — Czeszewo IG 1, 27 — Gąsiorów 81/74, 28 — Konstancin 77/78, 29 — Kretków 73/82, 33 — Żuromin 1, Żuromin 5, 34 — Kcynia IG IV, 35 — Sierpc; *6* — outcrops: 30 — Trojanów, 31 — Burzenin, 32 — Mstów; S — Szamotuły region (Dołęga 1, Zielątkowo 32), B — Bełchatów region (Chorzenice 62/1, Żłobnica 3/78, Faustynów Duży 52/17, Folwark 66/26, Folwark 81/82, Leśna Niwa 40/15, Bełchatów 38/20, borehole 38/22 — Łódź Basin)

ture and a search for faunal evidence pointing to the occurrence of these sediments there is still in progress. Although S. Bukowy (1962) described ammonites of the genus *Ataxioceras*, this fact is still being discussed (J. Głazek, A. Wierzbowski, 1972). Other authors (R. Dadlez, J. Kopik, 1975) claim that during the Kimmeridgian there was good connection with the Tethyan Sea and so the occurrence of sediments with characteristic fauna in quite possible in the Cracow area.

In the Carpathian area, Lower Kimmeridgian fauna has been recorded in detached blocks, embedded in flysch rocks of various age (M. Książkiewicz, 1956), from the Klippen succession of the Pieniny Klippen Belt and from outcrops in the Tatra Mountains (W. A. Nowak, K. Birkenmajer, J. Lefeld, in Geology of Poland, 1976). Since it is difficult to obtain index macrofauna in this area, it is not easy to determine the age of sediments in all the regions and, the more so, to distinguish the particular zones.

Numerous ammonites of the genus *Ataxioceras* are known mainly from the axial part of the basin, i. e., in the sediments of a calcareous--marly-silty facies; they are less frequent in the silty-marly rocks occurring in Northern Poland. In the remaining area (Lublin Basin, north--western part of the Szczecin Basin, north-eastern margin of the Góry Świętokrzyskie, Mazury-Suwałki Elevation), i. e. in sediments of a calcareous-marly facies with oolites, the Lower Kimmeridgian index fauna has not been recorded so far, and biostratigraphy has been established on the basis of other genera of ammonites, foraminifers, and — above all — bivalves (T. Niemczycka in Geology of Poland, 1976; A. Wilczyński, 1962; L. Karczewski, 1960, 1974, 1976; W. Barczyk, 1961, 1969; Z. Dąbrowska, 1953, 1984).

It may be assumed that this zonality in the occurrence of ammonites of the genus *Ataxioceras* is connected with the character of the environment (L. Malinowska, 1986).

The present bibliography contains only selected works. A full bibliography is listed in Geology of Poland I, Stratigraphy 2 (1976).

The ammonites discussed here are in the Museum of the Geological Institute in Warsaw. Photographs of these ammonites were made by Mrs. Janina Modrzejewska.

The author wishes to thank Prof. dr. W. Pożaryski and Prof. dr. R. Dadlez for their valuable comments.

BIOSTRATIGRAPHY

The subdivision of the Lower Kimmeridgian, typical of the Submediterranean province, has been adopted here for the whole area of Poland. This fully applies to the lower zone, *S. platynota*, and the middle zone, *A. hypselocyclum*. There is still no faunal evidence for the whole upper zone, *K. divisum*; thus it has not been possible so far to assign it unmistakably to this province. Yet, on the basis of the fauna recorded in the lower parts of these sections, it may be assumed that just as in the case of the other zones this part of the *K. divisum* Zone is of Submediterranean character.

The occurrence of boreal fauna in Lower Kimmeridgian sections of Northern Poland is so minimal that it cannot be assigned to the Subboreal Province. This conclusion is confirmed also by the occurrence of Submediterranean ammonites in the northern areas of the country (L. Malinowska, 1986 — fig. 2).

The data quoted in the works by L. M. Rotkyté (1982) and A. A. Grigelis and L. M. Rotkyté (1971) indicate that *Katroliceras* may occur in the southern part of the Baltic Shield, i. e. in an area situated far to the north (L. Malinowska, 1986).

Table 1

Correlation of ammonite zones in Lower Kimmeridgian rocks in Europe

South-Western part of the South German Jurassic (F. O. Geyer, 1961)				Poland		Soviet Union (North) (M. S. Mesezhnikov, G. Romm, 1973; G. I. Krimholz, 1972)		England (B. M. Cox, R. W. Gallois, 1981)	
Quenstedt's Subdivision	Beds		Zone	Zone	Characteristic fauna	Zone		Zone	
γ_3	with *Ataxioceras*	with *Katroliceras*	*K. divisum*	*K. divisum*	*Perisphinctes praenuntians, Ataxioceras involutum, Idoceras balderum, Zonovia thurrelli, Katroliceras tenuicostatum, Lithacoceras lictor, Aspidoceras acanthicum, A. uhlandi, Nebrodites hospes hospes, N. teres, Taramelliceras pseudoflexuosum*	*Rasenia borealis*	Lower Kimmeridgian	*Rasenia cymodoce*	Lower Kimmeridgian (pars)
γ_2		with *Ataxioceras* sensu stricto	*A. hypselocyclum*	*A. hypselocyclum*	*Ataxioceras genuinum, A. hypselocyclum, A. polyplocum, A. discobolum, A. effrenatum, A.* cf. *nendingenense, A. eudiscinum, A. suberinum, A. discoboloides, A. lothari, A. inconditum, A. planulatum, Rasenia moeschi*				
γ_1		with *Sutneria*	*S. platynota*	*S. platynota*	*Aspidoceras altenense, Taramelliceras kobyi wegelei, Ringsteadia weinlandi, Ataxioceras desmoides, Amoeboceras bauhini*	*Rasenia involuta*		*Pictonia baylei*	
β Upper			Oxfordian	Oxfordian		Oxfordian		Oxfordian	

Similar opinions concerning the faunal provincionality of Lower Kimmeridgian are shared by J. Kutek (1986) in relation to the western margin of the Góry Świętokrzyskie and by A. Wierzbowski (1966) in the case of the Wieluń Upland.

The subdivision adopted in the present paper (Table 1) can be generally correlated with those that are use in England and the USSR (B. M. Cox, R. W. Gallois, 1981; G. I. Krimholz, 1972; M. S. Mesezhnikov, G. Romm, 1973).

In addition to ammonites of the genus *Ataxioceras*, the following ammonites have been recorded in the sections: *Zonovia*, *Nebrodites*, *Idoceras*, *Ringsteadia*, *Pictonia*, *Rasenia*, *Katroliceras*, *Sutneria*, *Glochiceras*, *Taramelliceras*, *Streblites*, *Aspidoceras* (Table 2). As far as the occurrence of the particular genera of ammonites is concerned, the Carpathian area does not differ essentially from the central parts of the country, except perhaps for a larger number of species within the particular genera, such as *Idoceras*, *Lithacoceras*, *Aspidoceras*, and *Taramelliceras*.

Thus three zones can be distinguished in the area of Poland: the lower one — *S. platynota*, the middle one — *A. hypselocyclum*, and the upper one — *K. divisum*. These three zones of Lower Kimmeridgian sediments are not equally well evidenced by fauna. The youngest Lower Kimmeridgian rocks (boreholes Kcynia IG IV, Środa IG 1), assigned to the *K. divisum* Zone, were partly denuded as a result of pre-Tertiary erosion. The best evidenced zone is the middle one, *A. hypselocyclum*. The great frequency and the large n[illegible]b[illegible] [illegible] [illegible]n[illegible] spec[illegible]e[illegible] [illegible]n [illegible]s zone confirm the conclusions reached by many authors who emphasize the rich development of fauna in this period.

Lower Kimmeridgian deposits occurring in Poland were formed in a sublittoral environment, in a basin that can be generally described as not deep (Fig. 2). There were different deep zones in the basin, often of local character. The axial part consisted of the Fore-Sudetic area and the Szczecin—Mogilno—Łódź Basin.

The Polish Lower Kimmeridgian basin had a good connection with the Tethyan, a limited connection with the basin in north-western Europe, and no connection with the East.

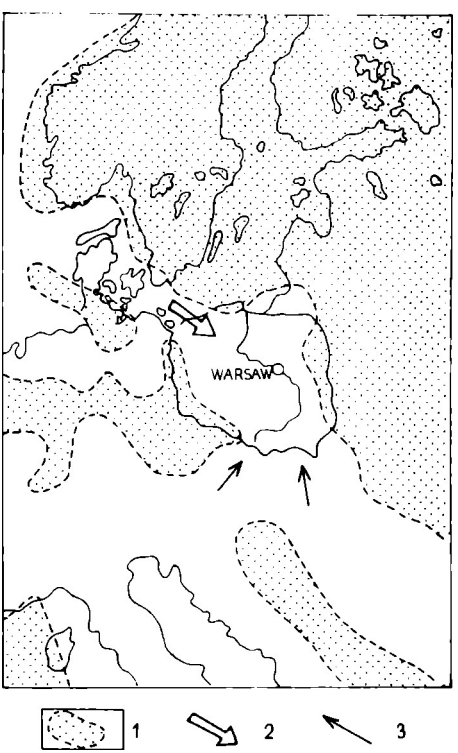

Fig. 2. Palaeogeography of the Lower Kimmeridgian in Poland

1 — continental areas, *2* — influence of boreal [illegible], *3* — [illegible]n[illegible] [illegible]f s[illegible]h[illegible]n [illegible]na

LOWER ZONE — *SUTNERIA PLATYNOTA*

Although its index species, *Sutneria platynota* (Reinecke), has not been reported so far (in Poland), this zone is especially well evidenced in boreholes Środa IG 1 (Fore-Sudetic area, Fig. 3), Kcynia IG IV (Mogilno Basin), Bartoszyce IG 1 and Krynica Morska IG 1 (Peri-Baltic Depression) on the basis of characteristic species whose stratigraphic range is known from other sections in Europe. Owing to the fragmentary character of material in the remaining sections of the Polish Lowlands, it was possible to identify there only those species that confirm the possibility of the occurrence of the *S. platynota* Zone there. In the Carpathian area (the Pieniny Klippen Belt), the occurrence of sediments of this age is indicated by *Aspidoceras* (*Physodoceras*) *altenense* (d'Orbigny) (G. Karve-Corvinus, 1966) and *Aspidoceras* (*Physodoceras*) *circumspinosum* (Quenstedt). This zone has also been recorded in outcrops in the margin of the Góry Świętokrzyskie, in the Radomsko Jurassic, and in the Częstochowa—Wieluń Jurassic.

The maximal thicknes of the sediments of the *S. platynota* Zone, observed in the section of Środa IG 1, is about 40 m. The bottom of these deposits was drilled and evidenced by fauna in boreholes Środa IG 1 and Kcynia IG IV. It seems that in borehole Myślęcin 1 (Mogilno Basin) the lower boundary is delimited by *Amoeboceras* (*Amoebites*) cf. *pulchrum* Mesezhnikov, Romm. A definite boundary between the Oxfordian and the Lower Kimmeridgian has been located in borehole Kcynia IG IV. The species *Amoeboceras* (*Amoebites*) *bauhini* (Oppel), occurring there at a depth of 338.30—339.0 m, has been defined as a Lower Kimmeridgian species and not an Upper Oxfordian one, as it was previously claimed (J. Dembowska, 1964).

Sediments of the *S. platynota* Zone are developed in the north in a calcareous-marly-silty facies, while calcareous rocks predominate towards the south. A striking feature of this zone is a small number of specimens of *Ataxioceras* (Table 2) in comparison with the younger zone, *A. hypselocyclum*. A particularly important species is *Ataxioceras* (*Parataxioceras*) *desmoides* Wegele. In the sections of Southern France this species is an index form not only of the horizon but also of a subzone within the *S. platynota* Zone (F. Atrops, 1982). It also determines the lowest zone of the Lower Kimmeridgian in Bulgaria (I. G. Sapunov, 1979).

Some specimens, identified in the *S. platynota* Zone in Poland, can be assigned to the subgenus *Schneidia*. The species of this genus are typical of this zone in Lower Kimmeridgian deposits in Southern France. Some of the specimens occurring among the fauna of the *S. platynota* Zone have been assigned by the present author to the *Pictonia*. Since literature concerning small specimens of this genus is not available, the author has not been able to provide a closer and more detailed specific determination.

An important stratigraphic group are ammonites of *Taramelliceras*, subgenus *Metahaploceras* (Table 2), including *Taramelliceras* (*Metahaploceras*) *kobyi wegelei* Schairer, described from the *S. platynota* Zone of the Szczecin Basin and the Peri-Baltic Depression. These species from an assemblage quoted in the works by L. Wegele (1929) and G. Schairer (1972), an assemblage that is typical of the Franconian Jurassic.

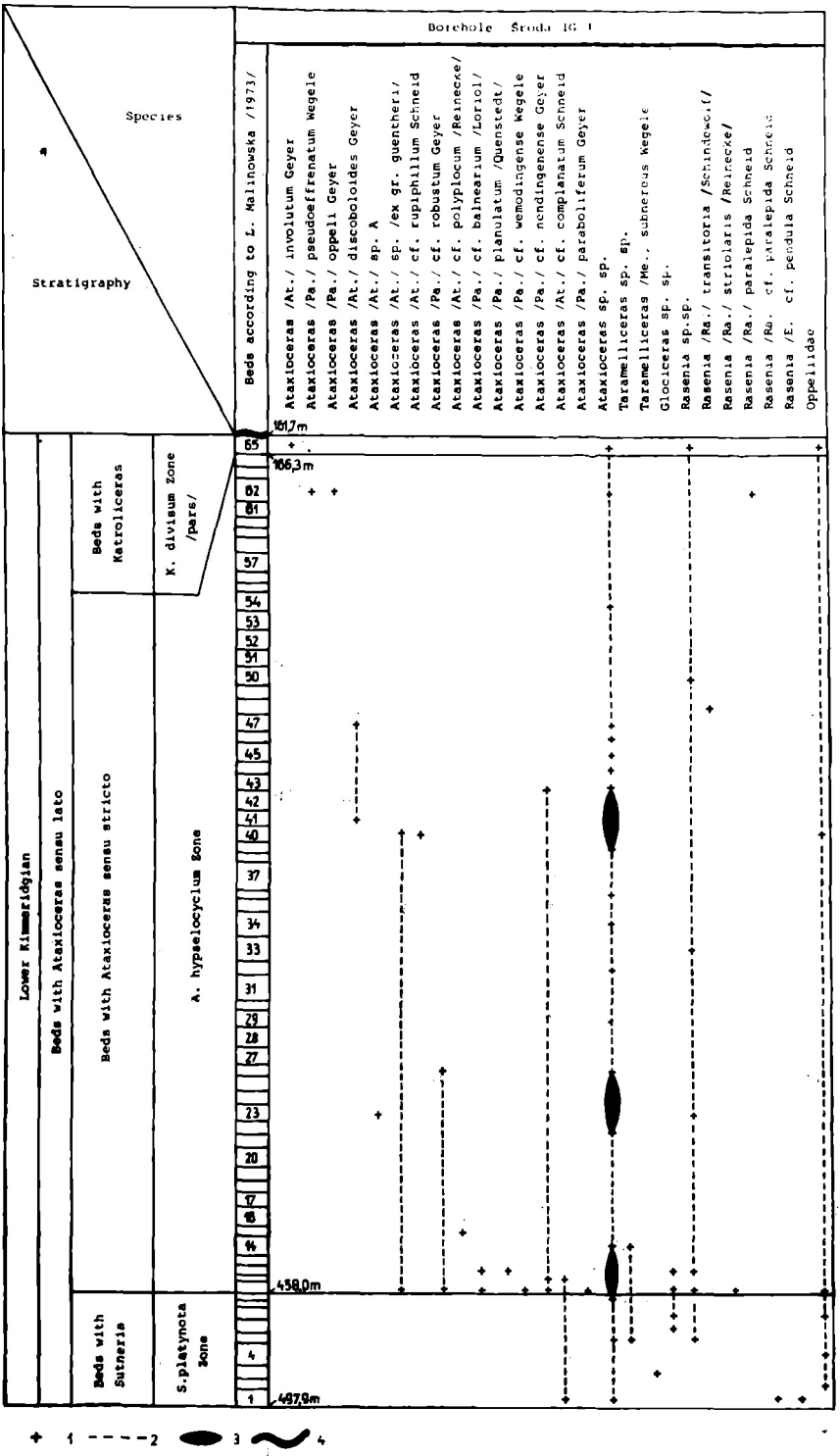

Fig. 3. Ammonites in borehole section Środa IG 1

1 — occurrence of specimens, 2 — probable range of species, 3 — mass occurence, 4 — erosion boundary

Table 2

Ammonite species in Lower Kimmeridgian rocks in Poland

Localization	Species	Lower Kimmeridgian		
		S. platynota Zone	*A. hypselocyclum* Zone	*K. divisum* Zone (lower part)
1	2	3	4	5
31	*Perisphinctes (O.) praenuntians* (Fontannes)			+
G, R	*Perisphinctes (O.) pseudobreviceps* Wegele		+	
15, 24	*Ataxioceras (Pa.)* cf.*balnearium* (Loriol)		+	
14, Cz	*Ataxioceras (P.) desmoides* Wegele[x]	+		
Cz	*Ataxioceras (P.)* cf. *desmoides* Wegele	+		
W, 30	*Ataxioceras (Pa.) effrenatum* (Fontannes)		+	
W	*Ataxioceras (Pa.) hoelderi* Geyer		+	
31, 30	*Ataxioceras (Pa.) inconditum* (Fontannes)		+	
3, 21, 34	*Ataxioceras (Pa.)* cf. *inconditum* (Fontannes)[ox]	+	+	
23, 30, 31	*Ataxioceras (Pa.) lothari* (Oppel)[o] wariant A wg F. Atropsa 1982		+	
G, M	*Ataxioceras (Pa.)* cf. *lothari* (Oppel)		+	
B, 4	*Ataxioceras (Pa.)* sp. (ex gr. *lothari*)		+	
B, 24, 29, 34	*Ataxioceras (Pa.)* cf. *nendingenense* Geyer[ox]		+	
15	*Ataxioceras (Pa.) nudocrassatum* Geyer[o]		+	
8, 12, 19, 21, 24	*Ataxioceras (Pa.) oppeli* Geyer[ox]		+	+
15	*Ataxioceras (Pa.)* cf. *oppeli parvum* Atrops[x]		+	
24	*Ataxioceras (Pa.) paraboliferum* Geyer[o]		+	
19, 24	*Ataxioceras (Pa.) planulatum* (Quenstedt)		+	
15, 23, 24	*Ataxioceras (Pa.) pseudoeffrenatum* Wegele[ox]		+	
24	*Ataxioceras (Pa.)* cf. *robustum* Geyer		+	
34	*Ataxioceras (Pa.)* cf. *schneidi* Geyer[x]	+	+	
15, 24, 34	*Ataxioceras (Pa.)* cf. *wemodingense* Wegele[x]	+	+	
6	*Ataxioceras (Pa.)* sp. A[o]		+	
30, 34	*Ataxioceras (Pa.)* B[o] (= *A. hippolytense* Atrops, 1982)		+	

Table 2 (continued)

1	2	3	4	5
21, 24, 34	*Ataxioceras* (*At.*) cf. *complanatum* Schneid	+	+	
G, 25, 30	*Ataxioceras* (*At.*) *discobolum* (Fontannes)°		+	
24, 26	*Ataxioceras* (*At.*) *discoboloides* Geyer°ˣ		+	
15	*Ataxioceras* (*At.*) *eudiscinum* Schneid°		+	
15, 17, 18, 30	*Ataxioceras* (*At.*) *genuinum* Schneid°ˣ		+	
S, G	*Ataxioceras* (*At.*) cf. *guentheri* (Oppel)		+	
30	*Ataxioceras* (*At.*) *guentheri* (Oppel)		+	
G, 5, 10, 24	*Ataxioceras* (*At.*) sp. (ex gr. *quentheri*)		+	
30	*Ataxioceras* (*At.*) *hypselocyclum* (Fontannes)		+	
B, M, 15	*Ataxioceras* (*At.*) cf. *hypselocyclum* (Fontannes)		+	
G, 24, 34	*Ataxioceras* (*At.*) *involutum* Geyer°ˣ		+	+
18	*Ataxioceras* (*At.*) *prominens* Schneid			+
K, 30	*Ataxioceras* (*At.*) *polyplocum* (Reinecke)		+	
M, 18, 24, 31, 34	*Ataxioceras* (*At.*) cf. *polyplocum* (Reinecke)ˣ		+	
B, 18, 28, 30	*Ataxioceras* (*At.*) cf. *pulchellum* Schneidˣ		+	
24	*Ataxioceras* (*At.*) cf. *rupiphillum* Schneid		+	
G, M, 31	*Ataxioceras* (*At.*) cf. *semistriatum* Schneid		+	
1, 2, 23, 25, 30	*Ataxioceras* (*At.*) *suberinum* (Ammon)ˣ		+	
M, 10	*Ataxioceras* (*At.*) sp. (ex gr. *suberinum*)		+	
K	*Ataxioceras* cf. *stromeri* Wegele		+	
G, 31	*Ataxioceras* (? *At.*) cf. *barbatum* Schneid		+	
M	*Ataxioceras* (? *At.*) cf. *didimum* Schneid		+	
24	*Ataxioceras* (*At.*) sp. Aᵒˣ		+	
34	*Ataxioceras* (*At.*) sp. Bˣ	+		
34	*Ataxioceras* (*Schneidia*) sp.°ˣ	+		
33, 35	?*Ataxioceras* sp.		+	
K	*Idoceras balderum* (Oppel)			+
K	*Idoceras* cf. *sautieri* Fontain			+
12, 34	*Idoceras* sp.			+
12	?*Idoceras* sp.ˣ			+
R, G	*Pictonia constricta* Schneid	+	+	
3	*Pictonia* sp.	+		
3	*Ringsteadia weinlandi* (Fischer)°ˣ	+		
3	*Ringsteadia* sp. ex gr. *glabella*)	+		
B, G, 3	*Ringsteadia* sp. sp.	+		
1, 2, 4, 6	*Zonovia* sp. sp.ˣ		+	

Table 2 (continued)

1	2	3	4	5
6, 8	*Zonovia thurrelli* (Arkell, Callomon)°x			+
1	*Rasenia* (*E.*) cf. *conspicua* Schneidx		+	
6	*Rasenia* (*E.*) *engeli* Geyer		+	
G	*Rasenia* (*E.*) *gothica* Schneid		+	
G	*Rasenia* (*E.*) *pendula* Schneid	+ ?	+	
24	*Rasenia* (*E.*) cf. *pendula* Schneidx	+		
B	*Rasenia* (*E.*) sp. (ex gr. *pendula*)		+	
G	*Rasenia* (*E.*) *rolandi* (Oppel)		+	
G, B	*Rasenia* sp. (cf. *trimera*)		+	
R, G	*Rasenia* (*E.*) *vernacula* Schneid		+	+
31	*Rasenia* (*E.*) sp.			+
R, G, 31, K	*Rasenia* (*I.*) *involuta* (Quenstedt)		+	+
2	*Rasenia* (*I.*) sp.		+	
G, 3, 6, 8	*Rasenia* (*P.*) *heeri heeri* (Moesch)x	+	+	
B	*Rasenia* (*P.*) cf. *heeri heeri* (Moesch)		+	
1, 4, 26, B, R	*Rasenia* (*P.*) *heeri quenstedti* Schairerx	+	+	
3, 4	*Rasenia* (*Ra.*) *hossingensis* (Fischer)x	+	+	
6, 9, 24	*Rasenia* (*Ra.*) *paralepida* Schneid	+	+	
24	*Rasenia* (*Ra.*) cf. *paralepida* Schneid	+	+	
24	*Rasenia* (*Ra.*) *striolaris* (Reinecke)x		+	
24	*Rasenia* (*Ra.*) *transitoria* (Schindewolf)		+	
2	*Rasenia* (*S.*) *moeschi* (Oppel)°		+	
B	*Rasenia* (*Se.*) cf. *thermarum* (Oppel)		+	
B	*Rasenia* cf. *coronata* Mesezhnikov°		+	
34	?*Rasenia* sp. Ax			+
12	?*Rasenia* sp. B	+		
R, 6, 12, 16	*Katroliceras* sp. sp.			+
8, 30	*Katroliceras* (*T.*) sp. Ax		+ ?	
2	?*Katroliceras* sp.			+
G	*Katroliceras tenuicostatus* Geyer			+
32	*Katroliceras* (*C.*) cf. *crusoliense* (Fontannes)			+
K, 31	*Aspidoceras acanthicum* (Oppel)			+
K	*Aspidoceras* (*Ph.*) *altenense* (d'Orbigny)	+		
K	*Aspidoceras* (*Ph.*) *circumspinosum* (Quenstedt)	+		
11	*Aspidoceras* (*Ph.*) sp. (ex gr. *circumspinosum*)x	+		
K, G, 31	*Aspidoceras uhlandi* (Oppel)			+
2, 10, 34	*Aspidoceras* sp. sp.		+	+
34	*Sutneria* sp. (ex gr. *cyclodorsata*)		+	
K, 15	*Nebrodites* (*N.*) cf. *doublieri* (d'Orbigny)°x		+	
12	*Nebrodites* (*N.*) cf. *hospes minor* (Neumayr)x			+
12	*Nebrodites* (*N.*) *hospes hospes* (Quenstedt)°			+
K	*Nebrodites* (*N.*) *teres* (Neumayr)			+

Table 2 (continued)

1	2	3	4	5
G, 12	*Nebrodites* (*Mesosimoceras*) sp.[x]			+
12	?*Nebrodites* sp.			+
3, 12	*Taramelliceras* (*Me.*) *kobyi wegelei* Schairer[o]	+		
K	*Taramelliceras pseudoflexuosum* (Favre)			+
34	*Taramelliceras* (*Me.*) *rigidum* Wegele[x]	+		
K	*Taramelliceras* (*Me.*) *strombecki* (Oppel)		+	
B, 6, 8, 24	*Taramelliceras* (*Me.*) *subnereus* Wegele[o]	+	+	
K	*Taramelliceras trachynotum* (Oppel)			+
2, 4, 24	*Taramelliceras* (*Me.*) sp.[x]	+	+	
34	*Streblites tenuilobatus* (Oppel)[o]			+
15	*Streblites* sp.		+	
M	*Glochiceras* (*Li.*) cf. *nimbatum* (Oppel)	+		
6, 14	*Glochiceras* (*Li.*) sp.[o]		+	
6, 24	*Glochiceras* sp. sp.	+	+	
4, 14	*Amoeboceras* sp. sp.[o]	+	+	
34	*Amoeboceras* (*A.*) *bauhini* (Oppel)[x]	+		
Wa	*Amoeboceras* (*A.*) sp. (cf. *kapffi*)	+		
3, 8	*Amoeboceras* (*A.*) *kapffi* (Oppel)[xo]	+	+	
M	*Amoeboceras* (*A.*) cf. *kitchini* (Salfeld)	+		
Wa, 2, 8	*Amoeboceras* (*A.*) sp. (ex gr. *kitchini*)[x]	+	+	
2	*Amoeboceras* (*A.*) cf. *modestum* Mesezhnikov		+	
21	*Amoeboceras* (*A.*) cf. *pulchrum* Mesezhnikov, Romm[x]	+		
31	*Amoeboceras* (*A.*) sp. (ex gr. *alticarinatum*)		+	
G	*Lithacoceras* (*L.*) *evolutum* (Quenstedt)	+		
G	*Lithacoceras* (*L.*) *subachilles* (Wegele)	+		
G	*Lithacoceras* (*L.*) *lictor* (Fontannes)			+
G	*Lithacoceras* (*L.*) *ernesti* Loriol			+
24, 34	Oppelidae		+	+

Abbreviations used in the table:
1—35 — explanations as in Figure 1, x — illustrated specimens, o — specimens illustrated in the work by L. Malinowska (1986), K — Carpathian area, W — Wieluń Jurassic, Cz — Częstochowa Jurassic, M — Mogilno Basin (data from literature), R — Radomsko Jurassic, G — margin of the Góry Świętokrzyskie, Wa — Kujawy Swell, B — Bełchatów region, S — Szamotuły region. Names of subspecies: *O.* — *Orthosphinctes*, *Pa.* — *Parataxioceras*, *At.* — *Ataxioceras*, *E.* — *Eurasenia*, *I.* — *Involuticeras*, *P.* — *Prorasenia*, *Ra.* — *Rasenioides*, *Se.* — *Semirasenia*, *T.* — *Torquatisphinctes*, *C.* — *Crussoliceras*, *Ph.* — *Physodoceras*, *N.* — *Nebrodites*, *Me.* — *Metahaploceras*, *Li* — *Lingulaticeras*, *A.* — *Amoebites*, *L.* — *Lithacoceras*.

A separate group are *Rasenia* ammonites, which are numerous in this time interval (Table 2). The stratigraphic position of the specimen described by the present author as *Rasenia* (*Eurasenia*) cf. *pendula* Schneid from this zone corresponds to that quoted by F. O. Geyer (1961), who described one of the specimens from Aalen (F. O. Geyer, 1961 — Pl. 19, Fig. 4), from the *S. platynota* Zone.

Many specimens of *Ringsteadia* have been recorded in the particular sections of the Peri-Baltic Depression, the margin of the Góry Świętokrzyskie, and the Bełchatów Jurassic.

An important role among the ammonites in the *S. platynota* Zone is played by the genus *Amoeboceras*, including *Amoeboceras* (*Amoebites*) *bauhini* (Oppel), *Amoeboceras* (*Amoebites*) cf. *pulchrum* Mesezhnikov, Romm, *Amoeboceras* sp. (ex gr. *kapffi*), and *Amoeboceras* sp. (ex gr. *kitchini*). These ammonites have been recorded from sections that are situated in the northern parts of Poland. Of particular stratigraphic importance is *Amoeboceras* (*Amoebites*) *bauhini* (Oppel), whose appearance may be regarded as marking the boundary between the Oxfordian and the Kimmeridgian. According to F. Atrops (1982), ammonites of the genus *Amoeboceras* from the lowest horizon within the *S. platynota* Zone in the area of the Franconian Jurassic. This position differs considerably from the range of *Amoeboceras* in the Polish, English, and North-Siberian Jurassic, where the genus *Amoeboceras* occurs in the lower and middle zones of the Lower Kimmeridgian.

Few specimens of *Glochiceras* and, probably, of *Sutneria* have also been found in sediments of the *S. platynota* Zone. A correlation of the species, made on the basis of literature, shows that representatives of *Lithacoceras* and the more numerous *Aspidoceras* also occur within the *S. platynota* Zone. *Aspidoceras* (*Physodoceras*) sp. (ex gr. *circumspinosum*) has been described from the Szczecin Basin.

In the *S. platynota* Zone there are large accumulations of bivalves; in some cases they form coquinas. They include representatives of *Astarte* (abundant), *Pseudomonotis* (scarce), *Macrodon, Pecten, Exogyra, Pinna, Chlamys, Goniomya, Ostrea,* and others. Other fossils include brachiopods (*Septaliphoria*), gastropods (*Nerinella*), serpulids (*Cycloserpula*), crinoid stems, crab remains, echinoid spines, spicules of sponges, and flora.

MIDDLE ZONE — *ATAXIOCERAS HYPSELOCYCLUM*

The occurrence of this zone has been confirmed on the basis of macrofauna in nearly the whole area of Poland. It is best evidenced in the continuous sequence in boreholes Środa IG 1 (Fore-Sudetic area) and Kcynia IG IV (Mogilno Basin) (Fig. 4). The maximal thickness of this zone, recorded in borehole Środa IG 1, reaches 286 m. In the remaining sections only few specimens have been encountered, yet their occurrence indicates that this zone might have extended over large areas. This zone is developed in a calcareous-marly-siltstone facies in the north, and in a calcareous facies in the south.

In the *A. hypselocyclum* Zone one observes an exceptionally rich development of *Ataxioceras*, with the abundant subgenera *Parataxioceras* and *Ataxioceras*. There are also representatives of *Rasenia*, including *Rasenia* cf. *coronata* Mesezhnikov, known from the *R. borealis* Zone (Chatanga Depression — Northern Siberia) (M. S. Mesezhnikov, 1969).

Specimens of *Zonovia* sp. sp. have an important stratigraphic position. They have been described for the first time from the *A. hypselocyclum* Zone of the Lower Kimmeridgian sediments in the Pomeranian Basin and the Peri-Baltic Depression. Data obtained from literature show that the genus *Zonovia* occurs in the upper part of the *R. cymodoce* Zone.

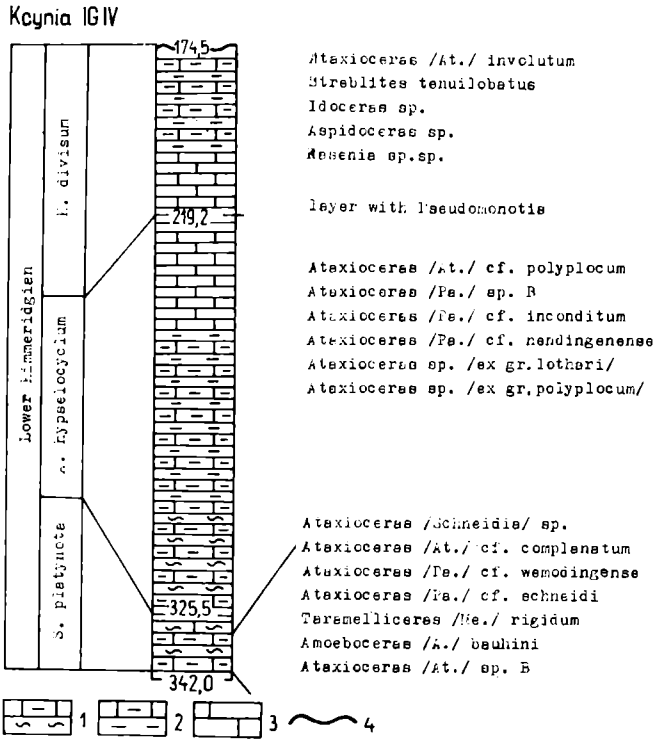

Fig. 4. Lower Kimmeridgian fauna in borehole section Kcynia IG 1
1 — calcareous-marly-silty rocks with intercalations of marly shales, *2* — calcareous-marly rocks, *3* — pelitic limestones, *4* — erosion boundary

Thus some of the specimens from Poland could be regarded as older representatives of this genus.

The occurrence of the genus *Amoeboceras* is also important since its stratigraphic position corresponds to that in the northern areas of the Soviet Union (G. J. Krimholz, 1972). Specimens of this genus are not very well preserved, yet it was possible to determine the group to which they belong.

Sutneria sp. (ex gr. *cyclodorsata*) has also been found to occur in the *A. hypselocyclum* Zone. In the whole section, and also in its fragments, there are a few specimens which can be assigned to *Aspidoceras, Taramelliceras, Katroliceras,* with the subgenera *Torquatisphinctes, Pictonia,* and also *Perisphinctes,* with the subgenus *Orthospinctes.*

Abundant bivalves occurring in the *A. hypselocyclum* Zone and forming coquinas there include: *Entolium, Trichites, Barbatia, Lima, Chlamys, Macrodon, Modiola, Anisocardia, Pleuromya, Pholadomya, Gervillia, Arcomya, Cardium, Lucina, Mytilus, Goniomya, Pinna, Ostrea, Camptonectes, Astarte* and *Exogyra.* Of particular importance are large accumulations of *Astarte* and bed-like accumulations of *Exogyra.*

There are numerous crinoid stems of the species *Balanocrinus pentagonalis* Goldfuss, *B. gillierioni* Loriol, *B. subteres* Muenster, *B. subteroides* Quenstedt (L. Malinowska, 1974) and also echinoid spines (*Echinus, Cidaris*). The remaining fauna is represented by gastropods (*Nerinea Nerinella, Pseudonerinea, Pleurotomaria, Alaria*), brachiopods (*Septaliphoria, Zeilleria, Goniothyris*), serpulids (*Cycloserpula*) and crab remains.

UPPER ZONE — *KATROLICERAS DIVISIUM*

Sediments of this zone in two sections examined by the present author (Kcynia IG IV and Środa IG 1) are eroded and covered by Palaeogene deposits. This is a symptom of late epigenetic erosion. Yet, in the case of both sections, it cannot be established whether early epigenetic erosion, observed in Western Europe (P. Hantzperque, 1984), occurred here at the boundary between the Upper and the Lower Kimmeridgian.

The maximal, yet incomplete thickness of the sediments of this age (45 m) was recorded in borehole Kcynia IG IV. The bottom beds of *K. divisum* Zone have been determined relatively well in borehole Kcynia IG IV on the basis of a specimen of *Idoceras* sp., which seems to be of considerable stratigraphic importance for this zone, and was encountered there at a depth of 212.35—219.20 m. At the same depth there are accumulations of *Pseudomonotis* bivalves previously referred to by J. Dembowska (1964), who established the occurrence of local concentrations of these bivalves on the surface of marls and marly shales. According to H. Hölder (1964, p. 240), these bivalves form bed-like accumulations in the lower part of the *K. divisum* Zone in the deposits occurring in the southern part of the south-German Jurassic (gamma 3).

The genus *Ataxioceras* is represented only by a few specimens in those parts of the sections which have been examined.

The species *Zonovia thurrelli* (Arkell, Callomon) has been identified in sediments of the Pomeranian Basin. This genus calls for further detailed studies as it has not been reported previously from Lower Kimmeridgian rocks in Poland.

Katroliceras and *Nebrodites* play an important role in the *K. divisum* Zone. Other forms represented here are *Streblites*, *Aspidoceras* sp. (ex gr. *acanthicum*), and *Rasenia*. There are more representatives of *Lithacoceras* in the southern parts of Poland, and more *Taramelliceras* in the Carpathian area.

In addition to accumulations of *Pseudomonotis* there are numerous *Exogyra*, which form coquinas, and rare *Astarte*, *Entolium*, *Pecten*, *Macrodon*, *Corbula*, *Nucula*, *Leda*, *Ostrea*, *Gervillia*, *Pinna*, and *Aucella*, the last-named form identified in borehole Kcynia IG IV (Mogilno Basin). Brachiopods (*Septaliphoria*) and echinoid spines (*Echinus*) also occur in this zone.

Translated by Wiesław Furmańczyk

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BIOSTRATYGRAFIA DOLNEGO KIMERYDU POLSKI

Streszczenie

Do opracowania biostratygrafii dolnego kimerydu w Polsce wykorzystane zostały amonity: *Ataxioceras, Nebrodites, Katroliceras, Glochiceras, Streblites, Taramelliceras, Idoceras, Sutneria, Orthosphinctes, Lithacoceras, Aspidoceras, Amoeboceras, Ringsteadia, Rasenia, Pictonia* i *Zonovia.* Analiza faunistyczna potwierdziła słuszność wydzielania w kimerydzie dolnym Polski, także w północnych jej regionach, trzech poziomów: dolnego — *Sutneria platynota,* środkowego — *Ataxioceras hypselocyclum* i górnego — *Katroliceras divisum* (częściowo).

Zbiornik dolnokimerydzki Polski należał w całości do prowincji submedyterańskiej ze słabo zaznaczonymi wpływami borealnymi w północnych częściach kraju (*Amoeboceras, Ringsteadia, Pictonia, Zonovia*). Miał on swobodne połączenie z Tetydą, ze zbiornikiem północno-zachodniej Europy kontakt ten był utrudniony, a ze wschodem całkowicie niemożliwy.

Amonity i fauna towarzysząca potwierdzają, że osady dolnego kimerydu Polski tworzyły się w środowisku sublitoralnym, w zbiorniku ogólnie niegłębokim.

EXPLANATIONS OF PLATES

PLATE I

Fig. 1. *Ataxioceras* (*Parataxioceras*) *oppeli* Geyer, MUZ IG (Museum of the Geological Institute), 1563.II.1, borehole Środa IG 1 (Fore-Sudetic area), depth 176.6 m, bed 62, *A. hypselocyclum* Zone
Fig. 2. *Amoeboceras* (*Amoebites*) sp. (ex gr. *kitchini*), MUZ IG 1563.II.2, borehole Tuchola IG 1 (Pomeranian Basin), depth 1,265.5 m, *A. hypselocyclum* Zone
Fig. 3. *Amoeboceras* (*Amoebites*) *kapffi* (Oppel), MUZ IG 1563.II.3, borehole Tuchola IG 1 (Pomeranian Basin), depth 1,265.5 m, *A. hypselocyclum* Zone

Fig. 4. *Amoeboceras* (*Amoebites*) *bauhini* (Oppel), × 2, MUZ IG 441.II.358, borehole Kcynia IG IV (Mogilno Basin), depth 338.0 m, *S. platynota* Zone
Fig. 5. *Amoeboceras* (*Amoebites*) cf. *pulchrum* Mesezhnikov, Romm, × 2, MUZ IG 1563.II.4, borehole Myślęcin 1 (Mogilno Basin), depth 1,066.6 m, *S. platynota* Zone
Fig. 6. *Amoeboceras* (*Amoebites*) *bauhini* (Oppel), × 2, MUZ IG 441.II.359, borehole Kcynia IG IV (Mogilno Basin), depth 338.0 m, *S. platynota* Zone
Fig. 7. *Ataxioceras* (*Parataxioceras*) cf. *vemodingense* (Wegele), MUZ IG 1563.II.5, borehole Kcynia IG IV (Mogilno Basin), depth 330.0 m, *S. platynota* Zone

PLATE II

Fig. 1. *Ataxioceras* (*Ataxioceras*) cf. *polyplocum* (Reinecke), MUZ IG 1563.II.6, borehole Środa IG 1 (Fore-Sudetic area), depth 436.0 m, bed 15, *A. hypselocyclum* Zone
Fig. 2. *Ataxioceras* (*Parataxioceras*) *desmoides* Wegele, MUZ IG 1563.II.7, borehole Wągrowiec IG 1 (Mogilno Basin), depth 912.6 m, *S. platynota* Zone
Fig. 3. *Ataxioceras* (*Schneidia*) sp., MUZ IG 441.II.216, borehole Kcynia IG IV (Mogilno Basin), depth 316.4 m, *S. platynota* Zone
Fig. 4. *Ataxioceras* (*Ataxioceras*) cf. *pulchellum* Schneid, MUZ IG 1563.II.8, borehole Konstancin 77/78 (Fore-Sudetic area), depth 102.7 m, *A. hypselocyclum* Zone
Fig. 5. *Ataxioceras* (*Parataxioceras*) *pseudoeffrenatum* Wegele, MUZ IG 1563.II.9, borehole Środa IG I (Fore-Sudetic area), depth 176.6 m, bed 62, *A. hypselocyclum* Zone
Fig. 6. *Ataxioceras* (*Parataxioceras*) cf. *inconditum* (Fontannes), MUZ IG 1563.II.10, borehole Kcynia IG IV (Mogilno Basin), depth 324.4 m, *A. hypselocyclum* Zone

PLATE III

Fig. 1. *Ataxioceras* (*Ataxioceras*) cf. *hypselocyclum* Fontannes, MUZ IG 1563.II.11, borehole Janowiec 2 (Mogilno Basin), depth 830.4 m, *A. hypselocyclum* Zone
Fig. 2. *Ataxioceras* (*Parataxioceras*) cf. *schneidi* Geyer, MUZ IG 441.II.332, borehole Kcynia IG IV (Mogilno Basin), depth 332.3 m, *S. platynota* Zone
Fig. 3. *Nebrodites* (*Mesosimoceras*) sp., × 2, MUZ IG 1563.II.12, borehole Człopa 2 (Szczecin Basin), depth 968.7 m, *K. divisum* Zone
Fig. 4. *Taramelliceras* (*Metahaploceras*) sp., MUZ IG 1563.II.13, borehole Krynica Morska IG 1 (Peri-Baltic Depression), depth 517.0 m, *S. platynota* Zone
Fig. 5. *Ataxioceras* (*Parataxioceras*) cf. *oppeli parvum* Atrops, MUZ IG 1563.II.14, borehole Janowiec 2 (Mogilno Basin), depth 830.4 m, *A. hypselocyclum* Zone
Fig. 6. *Ataxioceras* (*Ataxioceras*) sp. B., MUZ IG 441.II.313, borehole Kcynia IG IV (Mogilno Basin), depth 330.0 m, *S. platynota* Zone

PLATE IV

Fig. 1. *Ataxioceras* (*Ataxioceras*) *suberinum* (Ammon), MUZ IG 1563.II.15, borehole Gołdap IG 1 (Peri-Baltic Depresion), depth 483.9 m, *A. hypselocyclum* Zone
Fig. 2. *Ataxioceras* (*Ataxioceras*) sp. A., MUZ IG 1563.II.16, borehole Środa IG 1 (Fore-Sudetic area), depth 396.2 m, bed 25, *A. hypselocyclum* Zone
Fig. 3. *Rasenia* (*Prorasenia*) *heeri heeri* (Moesch), MUZ IG 1563.II.17, borehole Krynica Morska IG 1 (Peri-Baltic Depression), depth 517.0 m, *A. hypselocyclum* Zone
Fig. 4. *Rasenia* (*Prorasenia*) *heeri quenstedti* Schindewolf, MUZ IG 1563.II.18, borehole Tuchola IG 1 (Pomeranian Basin), depth 1,319.0 m, *A. hypselocyclum* Zone
Fig. 5. *Nebrodites* (*Nebrodites*) cf. *hospes hospes* (Neumayr), MUZ IG 1563.II.19, borehole Człopa 2 (Szczecin Basin), depth 969.0 m, *K. divisum* Zone
Fig. 6. *Ataxioceras* (*Ataxioceras*) *discoboloides* Geyer, MUZ IG 1563.II.20, borehole Czeszewo IG 1 (Fore-Sudetic Basin), depth 216,4 m, *A. hypselocyclum* Zone
Fig. 7. *Nebrodites* (*Nebrodites*) cf. *doublieri* (d'Orbigny), MUZ IG 1563.II.21, borehole Janowiec 2 (Mogilno Basin), depth 830.9 m, *A. hypselocyclum* Zone
Fig. 8. *Nebrodites* (*Nebrodites*) cf. *hospes hospes* (Neumayr), MUZ IG 1563.II.22, borehole Człopa 2 (Szczecin Basin), depth 969.0 m, *K. divisum* Zone

PLATE V

Figs. 1, 2. *Ringsteadia weinlandi* (Fischer) *1* — MUZ IG 1563.II.23, *2* — MUZ IG 1563.II.24, borehole Krynica Morska IG 1 (Peri-Baltic Depression), depth 517.2 m, *S. platynota* Zone

Fig. 3. *Rasenia* (*Rasenioides*) *hossingensis* (Fischer), MUZ IG 1563.II.25, borehole Krynica Morska IG 1 (Peri-Baltic Depression), depth 504.3 m, *S. platynota* Zone

Fig. 4. *Rasenia* (*Prorasenia*) *heeri heeri* (Moesch) × 1.5, MUZ IG 1563.II.26, borehole Stobno 3 (Pomeranian Basin), depth 1,175.5 m, *A. hypselocyclum* Zone

Fig. 5. *Rasenia* (*Rasenioides*) *striolaris* (Reinecke), MUZ IG 1563.II.27, borehole Środa IG 1 (Fore-Sudetic area), depth 457.0 m, bed 10, *A. hypselocyclum* Zone

Fig. 6. *Ataxioceras* (*Parataxioceras*) cf. *nendingenense* Gayer, MUZ IG 1563.II.28, borehole Bełchatów 38/20, 5 (Łódź Basin) depth 218.3 m, *A. hypselocyclum* Zone

Fig. 7. *Taramelliceras* (*Metahaploceras*) *rigidum* (Wegele), MUZ IG 441.II.300, borehole Kcynia IG IV (Mogilno Basin), depth 327.3 m, *S. platynota* Zone

Fig. 8. ? *Idoceras* sp., MUZ IG 1563.II.29, borehole Człopa 2 (Szczecin Basin), depth 969.0 m, *K. divisum* Zone

PLATE VI

Fig. 1. *Aspidoceras* (*Physodoceras*) sp. (ex gr. *circumspinosum*), MUZ IG 1563.II.30, borehole Nietuszkowo 23/77 (Pomeranian Basin), depth 163.0 m, *S. platynota* Zone

Fig. 2. ? *Rasenia* sp. A, × 2, MUZ IG 1563.II.31, borehole Kcynia IG IV (Mogilno Basin), depth 202.9 m, *K. divisum* Zone

Fig. 3. *Ataxioceras* (*Ataxioceras*) *involutum* Geyer, MUZ IG 441.II.278, borehole Kcynia IG IV (Mogilno Basin), depth 325.4 m, *A. hypselocyclum* Zone

Fig. 4. *Ataxioceras* (*Ataxioceras*) *genuinum* Schneid, MUZ IG 1563.II.32, borehole Janowiec 2 (Mogilno Basin), depth 829.9 m, *A. hypselocyclum* Zone

Fig. 5. *Rasenia* (*Eurasenia*) cf. *pendula* Schneid, MUZ IG 1563.II.37, borehole Środa IG 1 (Fore-Sudetic area), depth 491.2 m, bed 1, *S. platynota* Zone

PLATE VII

Fig. 1. *Zonovia thurrelli* (Arkell, Callomon), MUZ IG 1563.II.33, borehole Stobno 3 (Pomeranian Basin), depth 1,179.2 m, *K. divisum* Zone

Fig. 2. *Zonovia thurrelli* (Arkell, Callomon), MUZ IG 1563.II.34, borehole Tuchola IG 1 (Pomeranian Basin), depth 1,264.7 m, *K. divisum* Zone

Fig. 3. *Zonovia* sp., MUZ IG 1563.II.35, borehole Klosnowo IG 1 (Pomeranian Basin), depth 1,170,2 m, *A. hypselocyclum* Zone

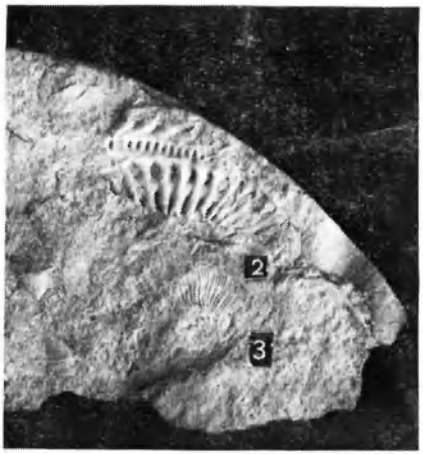
Fig. 4. *Rasenia* (*Eurasenia*) cf. *conspicua* (Schneid), MUZ IG 1563.II.36, borehole Gołdap IG 1 (Peri-Baltic Depression), depth 487.0 m, *A. hypselocyclum* Zone

Fig. 5. ? *Ataxioceras* sp., MUZ IG 1009.II.42, borehole Chojnice 3 (Pomeranian Basin), depth 1,285.0 m, *A. hypselocyclum* Zone

Fig. 6. *Zonovia* sp. MUZ IG 1563.II.38, borehole Bartoszyce IG 1 (Peri-Baltic Depression), depth 523.2 m, *A. hypselocyclum* Zone

Fig. 7. *Katroliceras* (*Torquatisphinctes*) sp. A, MUZ IG 1563.II.39, borehole Tuchola IG 1 (Pomeranian Basin), depth 1,318.5 m, *A. hypselocyclum* Zone

Fig. 8. *Ataxioceras* (*Ataxioceras*) *discoboloides* Geyer, MUZ IG 1563.II.40, borehole Środa IG 1 (Fore-Sudetic Basin), depth 289.4 m, bed 41, *A. hypselocyclum* Zone (latex cast)



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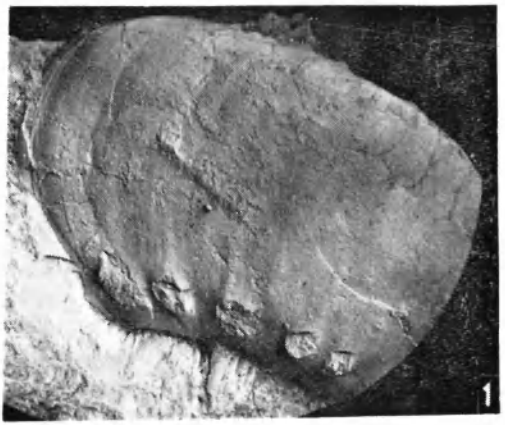
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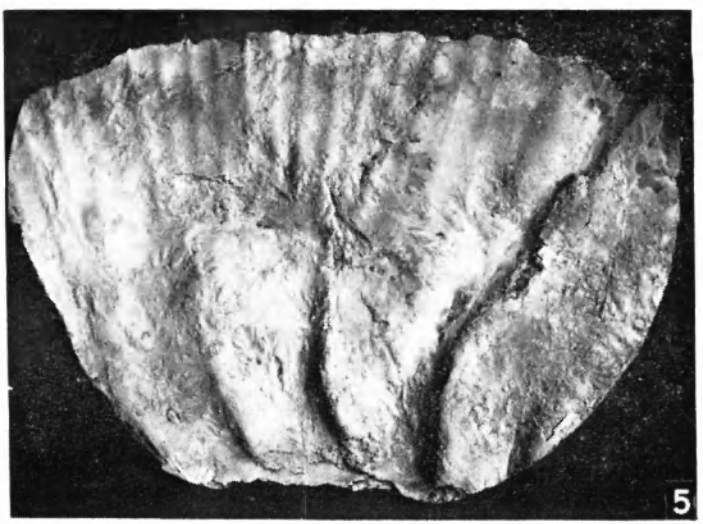
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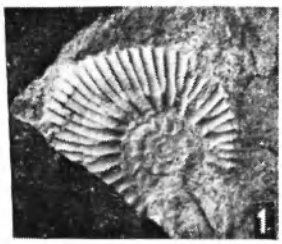

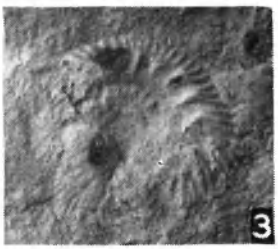

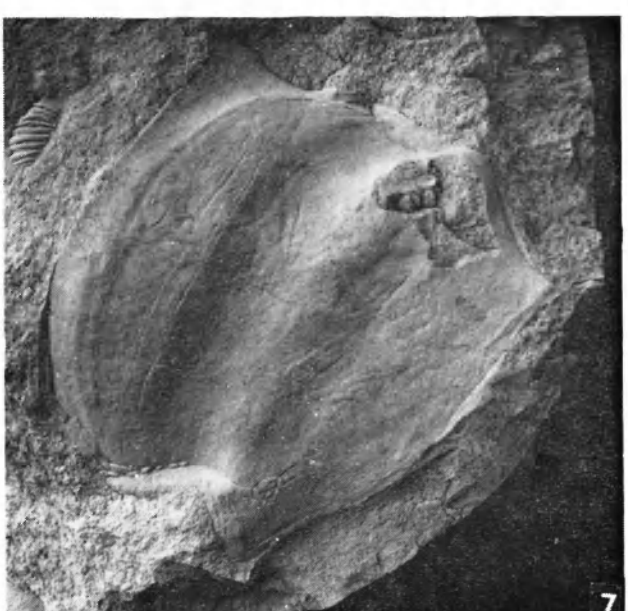

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