



**PRACE
PAŃSTWOWEGO
INSTYTUTU GEOLOGICZNEGO**

CXXXV

LIDIA MALINOWSKA

**BOREAL FAUNA INFLUENCES
IN UPPER OXFORDIAN
IN NORTH AND CENTRAL POLAND**

**BOREALNE WPŁYWY FAUNISTYCZNE W GÓRNYM OKSFORDZIE
POLSKI PÓŁNOCNEJ I CENTRALNEJ**

(with 4 Figs. and 11 Plates)

WARSZAWA 1991

ISSN 0866 – 9465

**Akceptował do druku dnia 21 11 1990 r.
dyrektor Państwowego Instytutu Geologicznego
prof. dr hab. Krzysztof JAWOROWSKI**

Tłumaczył mgr Jacek Kasiński

© Copyright by Państwowy Instytut Geologiczny, Warszawa, 1991

Opracowała w redakcji komputerowej Zakładu Publikacji PIG mgr Janina Małecka

**Wydanie I. Nakład 400+45 egz. Ark. wyd. 6,2
Format A4. Oddano do redakcji komputerowej dnia 9. 06. 1990 r.
Podpisano do druku we wrześniu 1991 r.
Druk ukończono w październiku 1991 r.**

Druk ARGRAF, zam. nr 44/91

Contents

Introduction	5
History of investigations	7
Ammonite zones of Upper Oxfordian in Poland	8
Material and methods of work	8
Detail characteristics of the Upper Oxfordian zones	8
<i>Perisphinctes cautisnigrae</i> Zone (sensu lato)	8
<i>Amoeboceras glosense</i> and <i>Amoeboceras serratum</i> Subzones	14
<i>Ringsteadia pseudocordata</i> Zone	15
<i>Amoeboceras regulare</i> and <i>Amoeboceras lineatum</i> Subzones	16
Biostratigraphical correlations with European subdivisions	16
General remarks on paleoecology	17
Systematic part	20
Class Cephalopoda Cuvier, 1797	20
Order Ammonitida Zittel, 1884	20
Family Cardioceratidac Siemiradzki, 1891	20
Genus <i>Amoeboceras</i> Hyatt, 1900	20
References	20
Streszczenie	22
Explanations of plates	25

Abstract. Macrofauna defined by the author in 58 boreholes located in the Polish Lowland area, in the Cracow-Wieluń Upland exposures and at the margin of the Góry Świętokrzyskie Mts. was a base to elaborate the detail biostratigraphical units confirming appurtenance of the main part of the Polish Upper Oxfordian basin to the subboreal province. This author's point of view presented first time in 1968 is supported by the detail definition of the boreal ammonites of the genera: *Amoeboeras*, *Ringsteadia*, *Microbiplices*, *Decipia*, *Rasenia*, *Prorasenia*, *Eurasenia*

and *Sutneria*. Correlations with England, Germany, France and the European part of the USSR were also carried out.

The sediments of Upper Oxfordian occurred in the Extra-Carpathian part of Poland in a shallow basin in sublitoral environment. Thermal climatic factors of environment took a great part in faunistic areal differentiation and biocoenosis development.

Poland is a very interesting and important area considering mixing of the southern and northern influences recorded in a faunistic spectrum.

INTRODUCTION

This paper is prepared on a base of study of the fauna, collected by the author during the 1963–1977 period in 58 boreholes located in the Extra-Carpathian part of Poland and from more than a dozen exposures from the Cracow-Wieluń Upland and the Góry Świętokrzyskie margin (Fig.1).

Author has defined 2584 specimens and, in this number, 1500 ammonites classified to the individual species and studied a lot of ammonite shells fragments from borehole cores. Faunistic data presented in the former author's publications were also applied to the general biostratigraphical conclusions. Materials presented in the paper edited in 1972 were particularly important, because the subboreal ammonite zones of Upper Oxfordian were defined first time in the Cracow-Wieluń Upland on a base of described and defined fauna from the exposures.

Works of other authors describing the Upper Oxfordian fauna from the Cracow-Wieluń Upland, Góry Świętokrzyskie margins, East Poland and West Pomerania (vide: *Stratygrafia, Mezozoik*, 1973 and *Atlas skamieniałości*..., 1980) were taking into consideration for comparison.

Many authors examined the Upper Oxfordian deposits in the Cracow-Wieluń Upland and compiled sometimes the fauna lists. However, these lists did not make possible to elaborate faunistic differences what was necessary for the paleoecological and biostratigraphical conclusions.

The borehole profiles from the Szamotuly area were correlated basing on the fauna defined from the 6 bo-

rholes. Unfortunately, the fauna defined by the author in 1962 has been lost in the Przedsiębiorstwo Poszukiwań Naftowych in Piła and, therefore, that fauna is not illustrated by photos in this paper. It was necessary to base the biostratigraphic correlation of the zones on the earlier author's definition.

A list of the specimens defined by the author of the fauna from the Bełchatów area, in the most part non-ammonitic, was presented in the collective paper on an outline of stratigraphy and tectonics of the southern part of the Łódź Depression (A. Błaszkiewicz and others, 1968) and in *Przewodnik 52 Zjazdu ...*, (1980). Generally, the fauna is not useful for the detail palaeontological studies and may be applicable for the biostratigraphical conclusions only.

Fauna samples taking into consideration in this paper proceeded mostly from the author's collection presented in a museum of the State Geological Institute in Warsaw.

Author thanks particularly the assistant-professor dr J. Dembowska for the hearty and friendly discussions and, at first, for the many-years long cooperation creating the rich fauna collection of the author useful in this elaboration. There is necessary to mention in this place Mrs Danuta Oleksiak, who has made the fauna photos.

A few problems in this paper needed more discussion and, therefore, I ought to thank dr M. S. Mesezhnikov, dr L. Rotkylé, dr N. Schulgina and dr W. Brochwicz-Lewiński for their friendly comments.

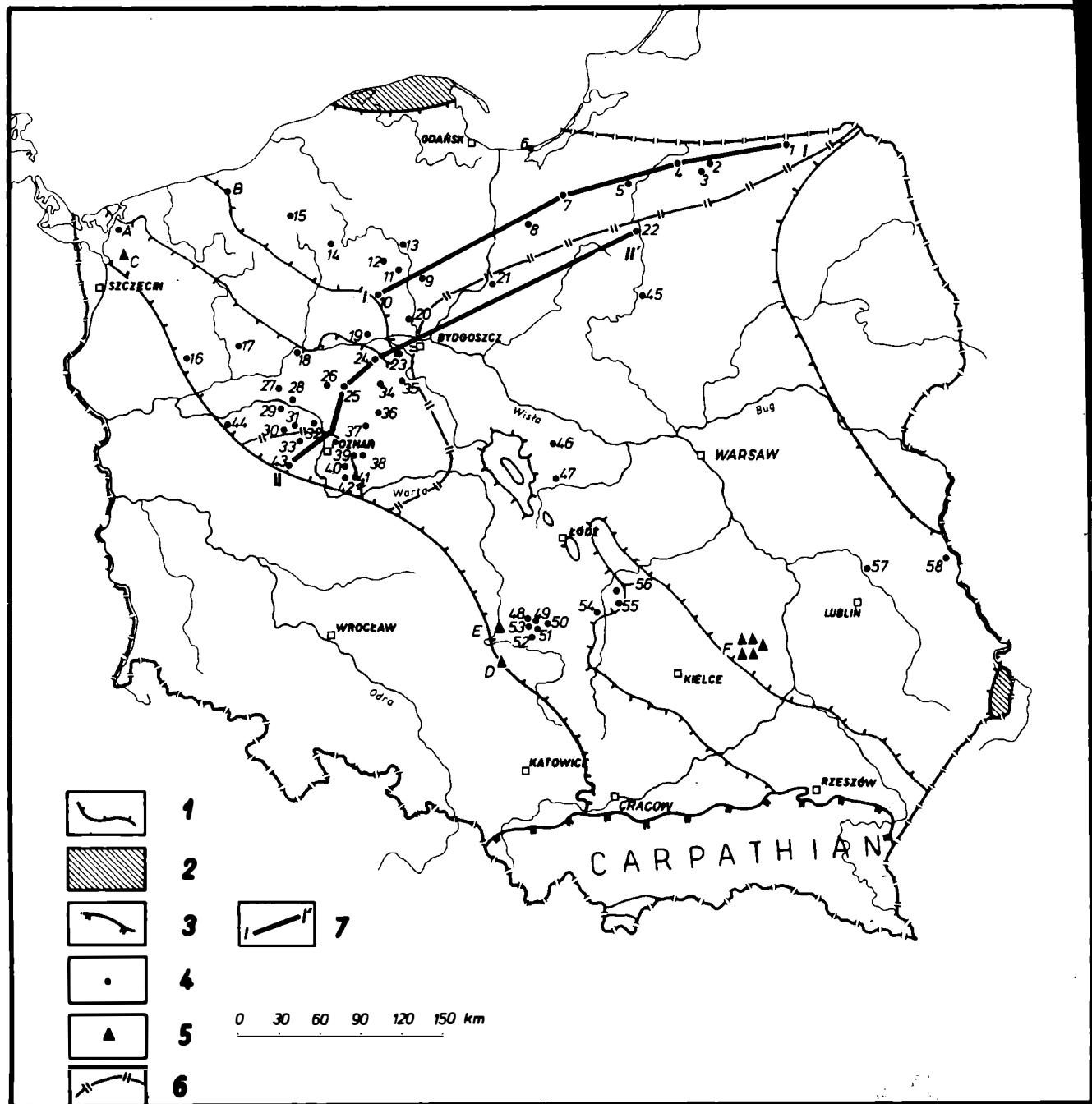


Fig. 1. Localization of the exposures and boreholes with the Upper Oxfordian sediments in the Extra-Carpathian part of Poland

1 — recent extent of the Upper Oxfordian sediments; 2 — areas with majority of denudation; 3 — Carpathian Overthrust; 4 — boreholes: A, B — Kłodzino, Strzegowo, Benice, Kopłino, Stójkowo, Rusewo, Kiełpino (R. Dadlez, J. Dembowska, 1965), 1 — Gołdap IG 1, 2 — Lesieniec 1, 3 — Kętrzyn 1, 4 — Bartoszyce IG 1, 5 — Dębowiec Warmiński, 6 — Krynica Morska IG 1, 7 — Pasłęk IG 1, 8 — Prabuty IG 1, 9 — Tuchola IG 1, 10 — Wiśniewa, 11 — Człuchów IG 2, 12 — Chojnice 3, 13 — Kłosnowo IG 1, 14 — Brda 7, 15 — Miastko 2, 16 — Radęcin 1, 17 — Człopa 2, 18 — Mirosław 2, 19 — Śmiłowo Kolonia 31/93, 20 — Samsieczno, 21 — Grudziądz IG 1, 22 — Olsztyn IG 1, 23 — Rynarzewo 1, 24 — Kcynia IG IV, 25 — Wągrowiec IG 1, 26 — Gościerewo 1, 27 — Szamotuły 17, 28 — Szamotuły 26, 29 — Szamotuły 11, 30 — Szamotuły 6, 31 — Szamotuły 12, 32 — Szamotuły 7, 33 — Bytyń 2, 34 — Janowiec 2, 35 — Barcin 1, 36 — Recz 1, 37 — Waliszewo 1, 38 — Siekierki Wielkie 1, 39 — Rokietnica 1, 40 — Nieczajna 50, 41 — Środa IG 2, 42 — Środa 1, 43 — Piekarz IG 1, 44 — Międzychód, 45 — Nidzica IG 1, 46 — Gostynin IG 1, 47 — Goliszew KT 5, 48 — Stawek 72/21, 49 — Folwark 80/81, 50 — Piaski 2/86, 51 — Łękińsko 85/13, 52 — Ławki 74/12, 53 — borehole 38/22, 54 — Wymysłów XI/4, 55 — Paradyż 2, 56 — Józefów 1, 57 — Kolechowice 1, 58 — Włodawa IG 4; 5 — exposures: C — Świętoszewo, Czarnogłów, Kłoby (B. Dohm, 1925 and others), D — Działoszyn, Placzki, Zawady, Doly koło Miedzna, Miedzno Stare, Wapiennik koło Miedzna, Opatów, Kołaczkowice S, Kołaczkowice W, Kołaczkowice Góra Wapiennik, Łobodno E, Rębielice Królewskie, Antoniów, Radostków (I. Malinowska 1972), E — Pajęczno, Prusicko, F — Rudka Bałtowska, Bałtów 4, Stoki Stare 2, Zarzecze; 6 — facies extent (NW — silty facies, SE — carbonate facies); 7 — correlation lines of the selected borehole profiles (I—I', II—II').

HISTORY OF INVESTIGATIONS

Upper Oxfordian fauna was investigated to this time mostly in the exposed areas of the Cracow-Wieluń Upland and on the north-east and west margins of the Góry Świętokrzyskie. The fauna exploitation in these areas was relatively easy because of the convenient approach to the rocks. Different opinions according to the palaeozoogeographical position of the Cracow-Wieluń Upland were presented during the many-years period. A. Wierzbowski (1978) fixed the fine differences between the fauna from the described region and the fauna from South German Jurassic. Moreover, this author explained these differences as a result of belonging of the Cracow-Wieluń Upland to the southernmost part of the subboreal province and he mentioned in this area boreal genera of ammonites: *Ringsteadia*, *Pomerania*, *Prorasenia*, *Amoeboceras*. The A. Wierzbowski's paper from 1970 concerning to occurrence of the genus *Ringsteadia* in the Upper Oxfordian deposits of the Cracow-Wieluń Upland is related to this question, too. The two *Amoeboceras* invasions in Submediterranean Late Oxfordian noted B. A. Matyja and A. Wierzbowski (1988) in Central Poland.

Appurtenance of the Cracow-Wieluń Upland to the subboreal province was a subject of papers of L. Malinowska (1968, 1972) and M. Wiśniewska-Żelichowska (1971).

Investigations at the north-east and west margins of the Góry Świętokrzyskie showed connections between Upper Oxfordian deposits and the boreal province; it may be proved by the defined ammonites belonging to the genus *Ringsteadia* (J. Dembowska, 1953; S. Z. Różycki, 1953).

There were collected many new faunistic data concerning to the Upper Jurassic sediments rocks in boreholes from the north-east part of the Upper Silesian Coal Basin during the last years. The data concerning to the south part of this area were collected and presented in the paper concerning to the biostratigraphical questions (L. Malinowska, 1989). The author pays also attention for an important paper of A. Gąsiewicz (1981) where were described ammonites belonging to the species *Amoeboceras ex gr. freboldi* from the Olkusz region (Słoszów and Racławice vicinity). These ammonites might confirm an appurtenance of this area to the boreal province. Also J. Znosko (1952, 1953) showed an occurrence of the boreal genera in the Upper Oxfordian sediments in this area and admitted possibility of the connections of them with the boreal province.

Fauna from the Upper Oxfordian sediments of the Sudetic Foreland might be defined not earlier than the nineteen-sixty years in the result of drillings. Ammonites belonging to the genera *Ringsteadia*, *Amoeboceras*, *Raseinia* and others in the fauna spectrum defined in the borehole cores of the drillings Poznań IG 1 and Piekarz IG 1 (L. Malinowska, 1960) might point at the strong boreal influences in this area.

Fauna investigations in West Pomerania, started at the nineteen-twenty years and they were a base for the correct

palaeozoogeographical interpretation (A. Wilczyński, 1962, see references).

A paper edited in the frames of activity of the "Research Working Group Upper Jurassic" of the Geological Sciences Committee Stratigraphy Commission (L. Malinowska, 1980) recommended application for the Poland area two biostratigraphical subdivisions: mediterranean one in the south part of Poland and subboreal one in its central and north part. This concept has corresponded to the specific character of the Polish late Jurassic basin. The regional subboreal biostratigraphical subdivision prepared by the author on a base of the faunistic material collected in the exposures in the central part of Poland and, at first, in the teens of drillings from the North Poland (L. Malinowska, 1980) has been especially important and its preliminary data were presented already earlier during the 1-st Jurassic Colloquium in Poland (L. Malinowska, 1967). The stratigraphical subdivision using in the submediterranean province have been adapted in the south part of Poland (J. Kutek and others, 1977).

Correlation between the Polish Upper Oxfordian ammonite zones and the standardized zones in the several palaeozoogeographical provinces should be possible. The Upper Oxfordian subdivision applied in the South Poland and being an adaptation of the standard mediterranean stratigraphical subdivision do not bring correlation difficulties in comparison to the subdivisions from the Southwest Europe. However, it do not take into consideration an absence of characteristic ammonitic genera and index species (as e.g. *Epipeltoceras bimammatum*) and stratigraphical gaps (D. Marchand, W. Brochwicz-Lewiński, 1980) specific for Upper Oxfordian in Poland.

The correlation between regional subboreal subdivision in the North and Central Poland area, defined on a base of species really occurring in the sediments there (L. Malinowska, 1980) with the standard English subdivision is a little more difficult. However, it shows the biostratigraphical individuality of this area for the reason of possibility of emphasis of the faunistic differences in the regional subdivisions in the small intervals only. The regional subdivision of Upper Oxfordian in the north and central parts of Poland is particularly important because it was prepared on a base of fauna consist of the boreal (Cardioceratidae) and submediterranean elements (Perisphinctidae). Both of them occur in the silty sediments as well in the carbonate ones, though with different relations.

Remarks corresponding to the subboreal stratigraphical subdivision topic also recently were present in the published proceedings of the 1-st Jurassic Colloquium in Poland already (I Jurajskie..., 1967). J. Kutek (p. 197) proposed there to recognize the top of the *Ringsteadia pseudocordata* Zone as the Oxfordian upper boundary. W. C. Kowalski (p. 198) thought the non-exactly defined Oxfordian beds ought to be named *Ringsteadia* beds and after J. Znosko (p. 198) that was Upper Oxfordian with emphasis

on the term *Ringsteadia-Amoebooceras* Oxfordian. One of the paragraphs of the project resolution of the 1-st Jurassic Colloquium in Poland (p. 230) is also very important and we can find there a suggestion to define at the future Upper Oxfordian as an individual stage characterized by the ammonites belonging to the genera *Amoebooceras* and *Ringsteadia* — after finding of the adequate stratotype.

The South European stratigraphical subdivision is preferred in the published ammonite lists but they do not oppose, from the qualitative point of view, than the subboreal zones in the Central Poland are possible to set apart. Moreover, the quantitative data concerning to the

genera: *Idoceras*, *Ringsteadia*, *Prorasenia*, *Decipia*, *Amoebooceras*, *Epieltoceras*, *Microbiplices*, *Orthosphinctes*, *Dichotomoceras* just confirm that subboreal zones only ought to be defined there. The species *Epieltoceras bimammatum* (Quenstedt), typical for the submediterranean subdivision, and specimens from the genera *Clambites* and *Lytoceras* are not known in Poland, what ought to be pointed with emphasis. The genera *Epieltoceras* and *Idoceras*, characteristic for the submediterranean area (where they are most frequent) are not so frequent in the Upper Oxfordian sediments rocks in the central Poland.

AMMONITE ZONES OF UPPER OXFORDIAN IN POLAND

MATERIAL AND METHODS OF WORK

On a base of studies of macrofauna, occurrence of the Oxfordian sediments is confirmed in North Poland in the borehole profiles: Gołdap IG 1, Bartoszyce IG 1, Kętrzyn 1, Krynica Morska IG 1, Pasłęk IG 1, Wiśniewa, Człuchów IG 2, Tuchola IG 1, Chojnice 3, Kłosnowo IG 1, Brda 7, Miastko 2, Lesieniec 1, Dębowiec Warmiński 2 and Prabuty IG 1 (Fig.1).

The same age sediments have been known also at the Kamień Pomorski and Kołobrzeg vicinities (Fig.1, A, B) in the borehole profiles: Kłodzino, Strzegowo, Benice, Koplinno, Stójkowo, Rusewo, Kiełpino (R. Dadlez, J. Dembowska, 1965) and in the Świętoszewo, Czarnogłów and Kłęby exposures (Fig. 1, C) (A. Wilczyński, 1962 – with references, W. Bielecka, Z. Dąbrowska, 1958).

From all the boreholes mentioned above, where stratigraphy is fixed by the author, only the borehole profiles: Gołdap IG 1, Bartoszyce IG 1, Pasłęk IG 1 and Wiśniewa supplied fauna specimens in longer intervals (Fig.1 — correlation line I—I'). This fauna allowed to characterize the ammonite zones.

Upper Oxfordian sediments have been confirmed also in the area between Radęcin, Samsieczno and Nidzica at the North.

The maximal density of the boreholes is noted at the Poznań and Bydgoszcz vicinities. Faunistic material was defined there by the author in the boreholes: Radęcin 1, Człopa 2, Miroslaw 2, Śmilowo Kolonia 31/93, Samsieczno, Grudziądz IG 1, Olsztyn IG 1, Rynarzewo 1, Siekierki Wielkie 1, Kcynia IG IV, Wągrowiec IG 1, Gościejewo 1, Szamotuly Geo 17, 26, 11, 6, 12, 7; Bytyń 2, Janowiec 2, Barcin 1, Waliszewo 1, Rokietnica 1, Środa IG 2, Środa 1, Piekary IG 1, Międzychód, Nieczajna 50, Nidzica IG 1, Gostynin IG 1, Goliszew KT-5 (Fig.1).

The biostratigraphical profiles were made on a base of the selected boreholes, where the fauna occurred in longer intervals. There were as follows: Wągrowiec IG 1, Kcynia IG IV, Olsztyn IG 1 and Piekary IG 1 (Fig.1 — correlation line II—II') and also six boreholes from the Szamotuly vicinity (Fig.2).

The Częstochowa-Wieluń Upland and the borehole Włodawa IG 4 in the Radom – Lublin area are the easternmost part of author's interest area.

The faunistic material collected and defined by the author (see Fig.1) may be a starting point to discuss on regional biostratigraphical zones of Upper Oxfordian:

- in the north-west part of the Częstochowa Upland (exposures (D): Działoszyn, Płaczki, Zawady, Dolne near Miedźno, Miedźno Stare, Wapiennik near Miedźno, Opatów, Kołaczkowice S, Kołaczkowice W, Kołaczkowice, Góra Wapiennik, Łobodno E, Rębielice Królewskie, Antoniów, Radostków, (L.Malinowska, 1972);

- in the Wieluń Upland (exposures (E): Pajęczno, Prusicko);

- at the Belchatów area (boreholes: Stawek 72/21, Piaski 2/86, Łękińsko 85/13, Folwark 80/81, Ławki 74/12, drill 38/22);

- at the north-west margin of the Góry Świętokrzyskie (boreholes: Józefów 1, Paradyż 2, Wymysłów XI/4);

- at the east margin of the Góry Świętokrzyskie (exposures (F): Rudka Bałtowska, Bałtów 4, Bałtów 5, Stoki Stare 2, Zarzecze);

- in the Radom – Lublin area (boreholes: Kolechowice 1, Włodawa IG 4);

- the fauna collection of the Museum of the Earth Sciences of the Polish Academy of Sciences in Warsaw (exposures: Nawojowa Góra, Buczna Góra, Ryczówka-Kwaśniów, Jaroszowiec) non-closely localized in the lithological columns and useful for comparison only.

DETAIL CHARACTERISTICS OF THE UPPER OXFORDIAN ZONES

Perisphinctes cautisnigrae Zone (sensu lato)

The species *Perisphinctes* (*Perisphinctes*) *cautisnigrae* Arkell in the Upper Oxfordian sediments in the Częstochowa Upland was a base to the definition of the *P. cautisnigrae* Zone in Poland (L. Malinowska, 1968). W. J. Arkell (1935–1948) paid first time attention on this possibility. The composition of additional fauna belonging to the

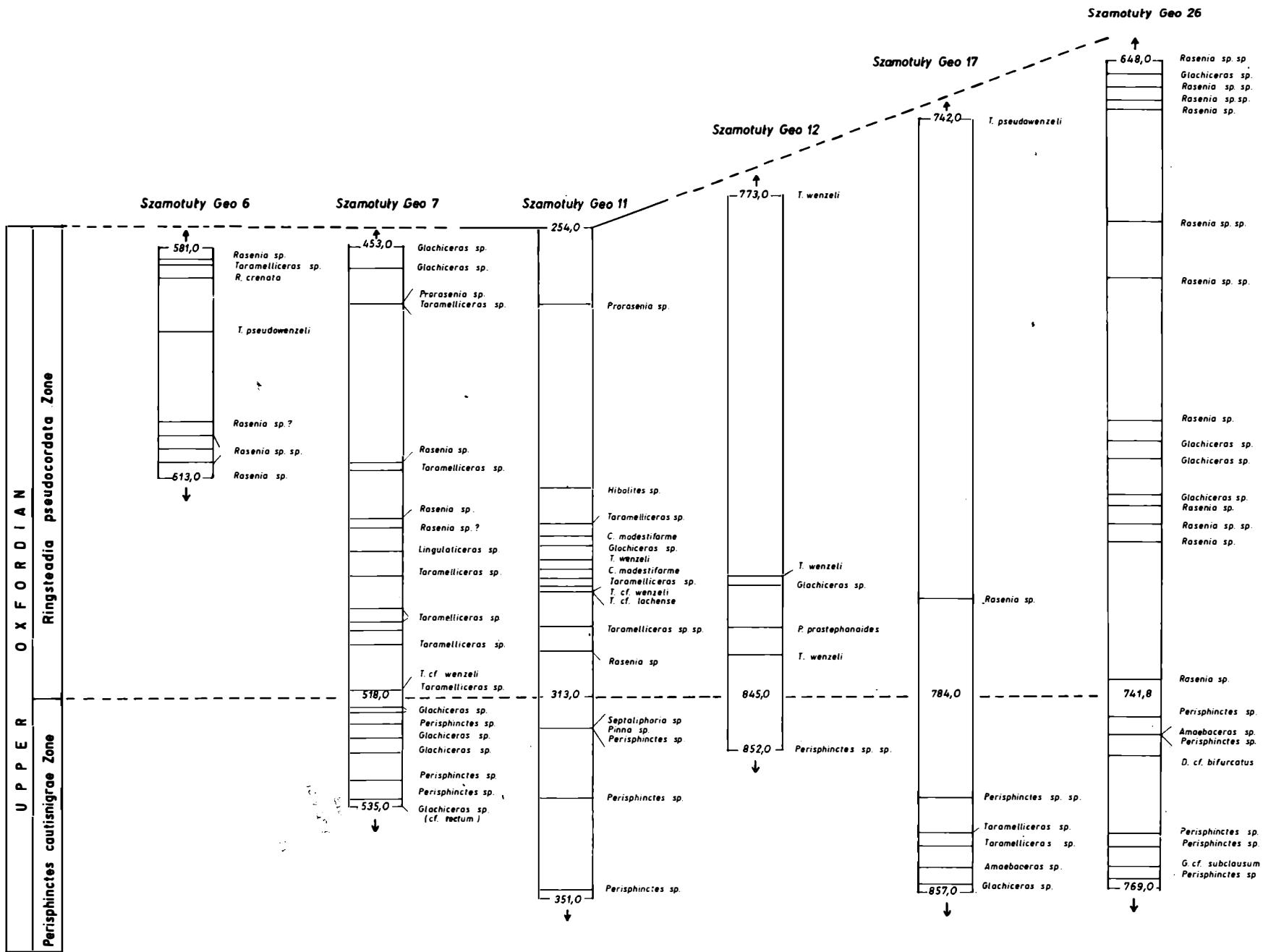


Fig. 2. Correlation of the biostratigraphical profiles of Upper Oxfordian at the Szamotuly vicinity (L. Malinowska, 1979 — archival materials).

families Cardioceratidae and Perisphinctidae, closely defined in the classic profiles, allows to divide this zone in both the north and central areas.

Many ammonites belonging to this species are known in Upper Jurassic sediments in Poland (W. Brochwicz-Lewiński, 1980).

Thickness of the Upper Oxfordian lower defined on a base of borehole profiles oscillates from 9 (e.g. in the Wiśniewa profile) to 43 m (in the borehole Kcynia IG IV). This zone is known in the silty sediments, occurred mostly in North Poland and also in the carbonate sediments, occurred more to the South. Its lower boundary is closely defined only in borehole cores in the point of appearance of ammonites belonging to the families: Cardioceratidae (*Amoeboceras*) and Perisphinctidae (*Orthosphinctes*, *Dichotomoceras*). The upper boundary of this zone is defined in the lowermost part of occurrence of specimens belonging to the genus *Rasenia* (sensu lato). In the exposures, the age is defined on a base of characteristic fauna, but somewhere both the bottom and the top of this zone is impossible to define.

Generally, number of specimens of the genus *Amoeboceras* in the Upper Oxfordian sediments decreases to the South, but content of specimens of the family Perisphinctidae increases in this direction. Ammonites of both these families may be observed in both the described kinds of deposits but with the different relations; it makes possible a correlation.

The faunistic succession in the described zone is very well visible in the borehole cores from North and Central Poland (Figs 3 and 4). Marly siltstone and silty marl, somewhere with sand addition, overcrowded by spicules and/or fragments of sponges, with dispersed muscovite, sprinklings of pyrite, irregular phosphatic concretions, glauconite and not frequent oolites builds the lower zone of Upper Oxfordian. Great concentration of ammonites belonging to the genus *Amoeboceras* (and the additional fauna) were observed somewhere in the borehole profiles as follows: Gołdap IG 1, Olsztyn IG 1, Wiśniewa, Bartoszyce IG 1, Kcynia IG IV and ammonites from the family Perisphinctidae — int. al. in the borehole Wągrowiec IG 1; these concentrations are related to the silty marly sediments with sponges everywhere.

The lower zone of Upper Oxfordian in the north and central areas was a suitable place to observation of ammonites generally belonging to the family Perisphinctidae (Table 1). These ammonites formed the amassments, e.g. in the borehole profiles Olsztyn IG 1, Wiśniewa, Wągrowiec IG 1. In this group: *Dichotomoceras bifurcatoides* Enay, *D. bifurcatus* (Quenstedt), *Orthosphinctes virgulatus* (Quenstedt) and *O. polygyratus* (Reinecke) might be define.

The separated specimens represent the family Aspidoceratidae in the *Perisphinctes cautisnigrae* Zone only. They belong to the genera: *Epipeltoceras* (borehole Wągrowiec IG 1) and *Aspidoceras* (boreholes Rokietnica 1 and Bartoszyce IG 1).

Individual ammonites belonging to the genus *Ochetoceras* and numerous ones from the genus *Taramelliceras*

Table 1

Stratigraphical extent of the Upper Oxfordian ammonites in borehole profiles from North and Central Poland

Species	Upper Oxfordian				
	<i>P. cautisnigrae</i> Zone		<i>R. pseudocorda-</i> <i>data</i> Zone		
	glosen- se	serra- tum	regula- re	line- atum	
1	2	3	4	5	
Cardioceratidae					
<i>Amoeboceras</i> sp. B	x				
<i>Amoeboceras damoni</i> Spath	x				
<i>Amoeboceras</i> sp. (ex gr. <i>damoni</i>)	x				
<i>Amoeboceras</i> sp. E	x				
<i>Amoeboceras</i> sp. H	x				
<i>Amoeboceras glosense</i> (Bigot et Brasil)	x				
<i>Amoeboceras</i> sp. (ex gr. <i>glosense</i>)	x				
<i>Amoeboceras schlosseri</i> (Wegele)	x				
<i>Amoeboceras wrighti</i> sp.nov.	x				
<i>Amoeboceras</i> sp. A		x			
<i>Amoeboceras</i> sp. C		x			
<i>Amoeboceras</i> sp. D		x			
<i>Amoeboceras koldeweyense</i> Sykes et Callomon		x			
<i>Amoeboceras</i> cf. <i>koldeweyense</i> Sykes et Callomon		x			
<i>Amoeboceras leucum</i> Spath	x				
<i>Amoeboceras</i> cf. <i>leucum</i> Spath	x				
<i>Amoeboceras</i> aff. <i>leucum</i> Spath	x				
<i>Amoeboceras lorioli</i> (Oppenheimer)	x				
<i>Amoeboceras mansoni</i> Pringle	x				
<i>Amoeboceras</i> cf. <i>mansoni</i> Pringle	x				
<i>Amoeboceras</i> cf. <i>ovale</i> (Quenstedt)	x				
<i>Amoeboceras</i> sp. (ex gr. <i>ovale</i>)	x				
<i>Amoeboceras</i> cf. <i>prebauhini</i> (Salfeld)	x				
<i>Amoeboceras</i> cf. <i>pseudocaelatum</i> Spath	x				
<i>Amoeboceras reichenbachense</i> (Salfeld)	x				
<i>Amoeboceras</i> cf. <i>reichenbachense</i> (Salfeld)	x				
<i>Amoeboceras</i> sp. (ex gr. <i>reichenbachense</i>)	x				
<i>Amoeboceras reclinatoalternans</i> (Nikitin)	x				
<i>Amoeboceras</i> cf. <i>reclinatoalternans</i> (Nikitin)	x				
<i>Amoeboceras serratum</i> (Sowerby)	x				
<i>Amoeboceras</i> cf. <i>serratum</i> (Sowerby)	x				
<i>Amoeboceras</i> sp. (ex gr. <i>serratum</i>)	x				
<i>Amoeboceras</i> cf. <i>schulginae</i> Mesezhnikow	x				
<i>Amoeboceras</i> sp. F	x		x		
<i>Amoeboceras</i> sp. (ex gr. <i>leucum</i>)	x		x		
<i>Amoeboceras</i> sp. (ex gr. <i>schulginae</i>)	x		x	x	
<i>Amoeboceras ravnii</i> Spath		x			
<i>Amoeboceras</i> cf. <i>freboldi</i> Spath		x			
<i>Amoeboceras regulare</i> Spath		x			
<i>Amoeboceras pectinatum</i> Mesezhnikow		x			
<i>Amoeboceras</i> lineatum (Salfeld)				x	
<i>Amoeboceras</i> cf. <i>lineatum</i> (Salfeld)				x	
<i>Amoeboceras</i> sp. (ex gr. <i>lineatum</i>)				x	
<i>Amoeboceras piecarum</i> Malinowska				x	
<i>Amoeboceras crenulatum</i> Buckmann				x	
<i>Amoeboceras</i> sp. (ex gr. <i>crenulatum</i>)				x	
<i>Amoeboceras</i> sp. G				x	
<i>Amoeboceras</i> sp. (ex gr. <i>marsionense</i>)				x	

1	2	3	4	5
<i>Amoeboceras sp. I</i>				x
<i>Amoeboceras sp. (ex gr. quadratolineatum)</i>				x
<i>Amoeboceras sp. sp.</i>	x	x	x	x
Perisphinctidae				
<i>Microbiplices cf. microbiplex</i> (Quenstedt)	x			
<i>Orthosphinctes polygyrus</i> (Reinecke)	x			
<i>Orthosphinctes</i> sp. (ex gr. <i>polygyrus</i>)	x			
<i>Dichotomoceras bifurcatum</i> (Quenstedt)	x			
<i>Dichotomoceras cf. bifurcatum</i> (Quenstedt)	x			
<i>Dichotomoceras bifurcatoides</i> Enay	x	x		
<i>Orthosphinctes</i> sp. sp.	x	x		
<i>Orthosphinctes virgulatus</i> (Quenstedt)		x		
<i>Dichotomoceras</i> sp. sp.		x		
<i>Prorasenia crenata</i> (Quenstedt)			x	
<i>Prorasenia</i> cf. <i>witteana</i> (Oppel)			x	
<i>Prorasenia</i> cf. <i>stephanoides</i> (Oppel)			x	
<i>Prorasenia</i> cf. <i>bathyschista</i> Koerner			x	
<i>Eurasenia trimera</i> (Oppel)			x	
<i>Rasenioides transitorius</i> (Schindewolf)			x	
<i>Rasenioides</i> cf. <i>transitorius</i> (Schindewolf)			x	
<i>Ringsteadia weinlandii</i> (Fischer)			x	
<i>Ringsteadia salfeldi</i> Dorn	x	x		
<i>Rasenioides</i> sp. sp.		x	x	
<i>Prorasenia</i> cf. <i>quenstedti</i> Schindewolf		x	x	
<i>Ringsteadia</i> sp. sp.		x	x	
<i>Decipia</i> sp.			x	
<i>Sumeria</i> sp.		x	x	
Oppeliidae				
<i>Taramelliceras tricristatum</i> (Oppel)	x			
<i>Taramelliceras</i> cf. <i>tricristatum</i> (Oppel)	x			
<i>Taramelliceras costatum</i> (Quenstedt)		x		
<i>Taramelliceras rigidum</i> (Wegele)	x			
<i>Taramelliceras</i> sp. (ex gr. <i>pseudowenzeli</i>)	x			
<i>Taramelliceras ausfeldi</i> (Wuerli)		x		
<i>Taramelliceras</i> cf. <i>externodosum</i> Dorn		x		
<i>Taramelliceras</i> cf. <i>trachynorum</i> (Oppel)		x		
<i>Taramelliceras</i> cf. <i>pseudowenzeli</i> (Wegele)		x		
<i>Taramelliceras pichleri</i> (Oppel)		x		
<i>Taramelliceras wenzeli</i> (Oppel)		x	x	
<i>Taramelliceras</i> sp. (ex gr. <i>wenzeli</i>)		x	x	
<i>Taramelliceras pseudowenzeli</i> (Wegele)		x	x	
<i>Taramelliceras tenuinodosum</i> (Wegele)		x	x	
<i>Taramelliceras litocerum</i> (Oppel)		x	x	
<i>Taramelliceras</i> sp. (ex gr. <i>litocerum</i>)		x	x	
<i>Taramelliceras</i> cf. <i>wenzeli</i> (Oppel)		x	x	
<i>Ochetoceras</i> sp. sp.	x	.	x	
Haploceratidae				
<i>Glochiceras</i> sp. sp.	x	x	x	x
<i>Coryceras subclausum</i> (Oppel)	x			
<i>Coryceras canale</i> (Quenstedt)	x			
<i>Coryceras</i> sp. (ex gr. <i>canale</i>)	x			
<i>Lingulaticeras</i> cf. <i>lingulatum</i> (Quenstedt)	x			
<i>Lingulaticeras</i> sp. sp.	x	x		
<i>Lingulaticeras sculptatum</i> (Ziegler)		x		
<i>Lingulaticeras crenosum</i> (Quenstedt)		x		
<i>Lingulaticeras lingulatum</i> (Quenstedt)		x	x	x
<i>Coryceras modestiforme</i> (Oppel)		x	x	
Aspidoceratidae				
<i>Epipeltoceras</i> sp.	x	x		
<i>Aspidoceras</i> sp. sp.	x	x		x

represent the family Oppeliidae, particularly in the uppermost part of the *P. cautisnigrae* Zone (borehole Kcynia IG IV). It seems, the species: *Taramelliceras tricristatum* (Oppel) and, perhaps, *T. costatum* (Quenstedt) and *T. rigidum* (Wegele) occur in the described zone only.

The family Haploceratidae is represented mainly by the genera: *Glochiceras* (sensu lato), *Coryceras* and *Lingulaticeras*. The first one is known from the whole sequence and its great concentration is observed in the borehole profiles: Kcynia IG IV and Środa IG 2. It seems, non-numerous species as e.g. *Coryceras* cf. *subclausum* (Oppel), C. sp. (ex gr. *canale*) and *Lingulaticeras* cf. *lingulatum* (Quenstedt) are limited to this zone only.

The pelecypods: (*Pinna*, *Lima*, *Pholadomya*, *Oxytoma*, *Lopha*, *Protocardia*, *Chlamys*, *Astarte*, *Myoconcha*, *Paralelodon*, *Ostrea*, *Goniomya*, *Pecten*, *Gervillia*, *Entolium*) represent an additional fauna in the most part (Table 2) in silty-marly and sandy sediments. The pelecypods belonging to the genus *Entolium* are particularly frequent there (e.g. in the Wiśniewa borehole). The genera *Pleurotomaria* and *Alaria* represent gastropods. Brachiopods, in the main part belonging to the genera *Lacunosella*, *Septaliphoria* and *Juralina*, are frequent there, too.

There was not possible to separate sponges from the rock and, therefore, specimens were not responsible to be closely defined. Crinoid stems (*Balanocrinus*) are relatively frequent in sediments in the same area and they form concentrations somewhere (e.g. in the Bartoszyce IG 1).

Specimens belonging to the genera *Plegiocidaris*, *Echinobrissus* and *Rhabdocidaris* represent echinoids. Moreover, the scaphopods (*Dentalium*), worms (*Serpula*), individual corals and bryozoans (*Spiropora*) and also fragments of the crab remains (*Prosoponidae*) are observed in these sediments.

As it was mentioned above, sediments in the lower zone of Upper Oxfordian occurred in carbonate facies. After the biostratigraphical lists related to Jurassic in the Belchatów and Lublin areas, frequency of ammonites decreases there to the South-east.

Both the top and bottom boundaries of the *Perisphinctes cautisnigrae* Zone are difficult to define in this area. For the reason of fragmentary exposures in this area, there is only possible, on a base of the characteristic fauna, to classify the sediments as belonging to this zone.

The borehole profiles: Waliszewo 1, Środa IG 2 and Piekarz IG 1, as the nearest to the described area, were used to better definition of Upper Oxfordian biostratigraphy. Particularly the borehole Piekarz IG 1 has been a starting-point to correlation the Central and South Poland areas.

The family Cardioceratidae is not so frequent in this area in the Upper Oxfordian sediments, as regards the number of specimens and as well the number of species. The species belonging to the group "ovale" are most frequent here. We can observe a rich assemblage of the well-preserved ammonites belonging to the family Perisphinctidae (L. Malinowska, 1972) and in this group: *Perisphinctes cautisnigrae* Arkell, *Microbipllices anglicus* Arkell, *Perisphinctes* (*Perisphinctes*) sp. A, *Discosphinctes richei* (Loriol), *Platysphinctes ovalis* Malinowska, *Dichotomoceras bifur-*

Fig. 3. Correlation of the borehole profiles along the I-I' correlation line (Fig. 1).

1 — marly siltstone and/or silty marl, 2 — marly and sandy siltstone, 3 — limy sandstone, 4 — sandy siltstone, 5 — marly siltstone, somewhere dolomitic, 6 — claystone, 7 — silty limestone and/or limy siltstone, 8 — silty shale, 9 — reef limestone, 10 — marl, 11 — limestone, 12 — separated oolites, 13 — plants, 14 — phosphatic concretions, 15 — sponges

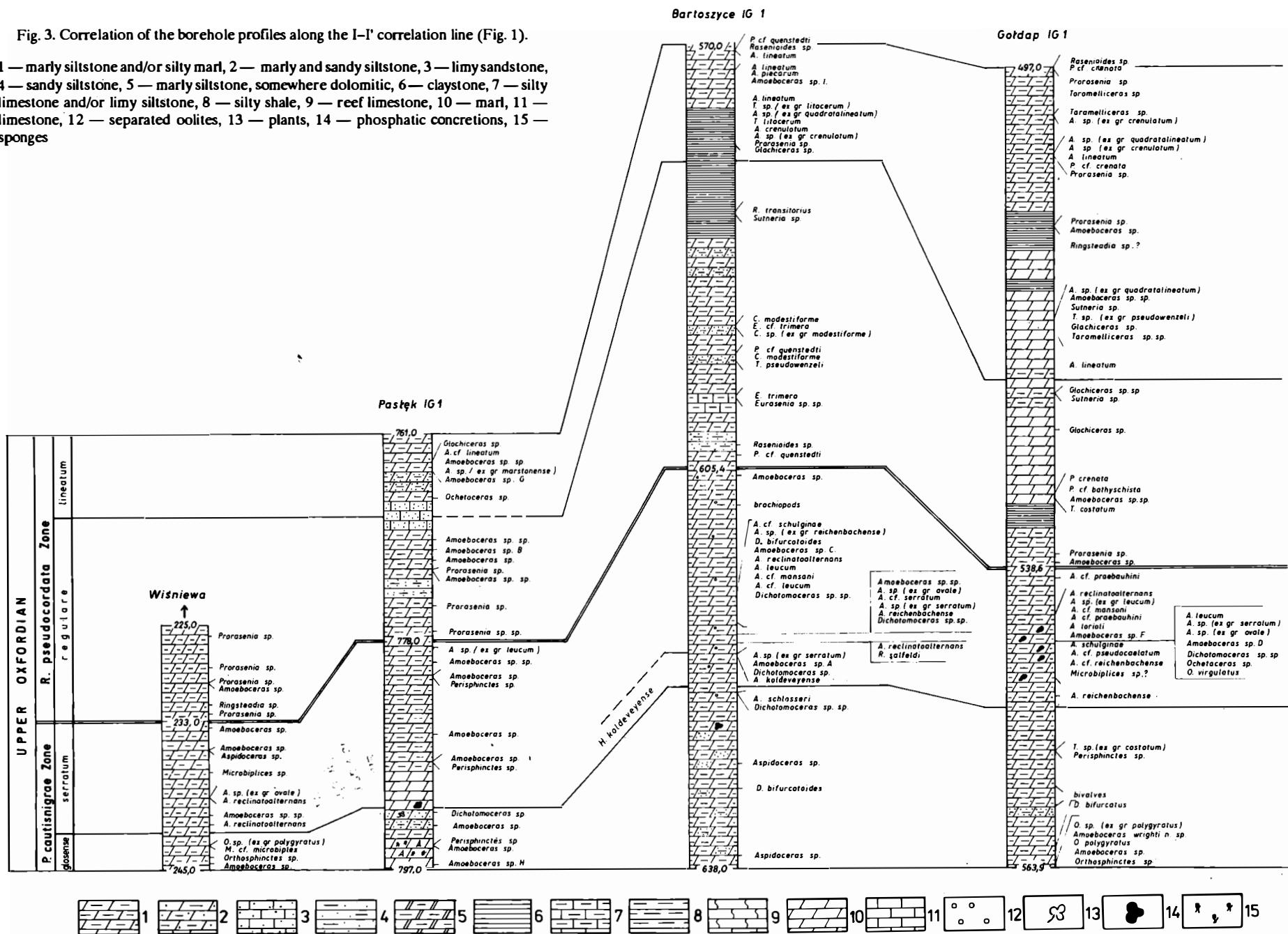
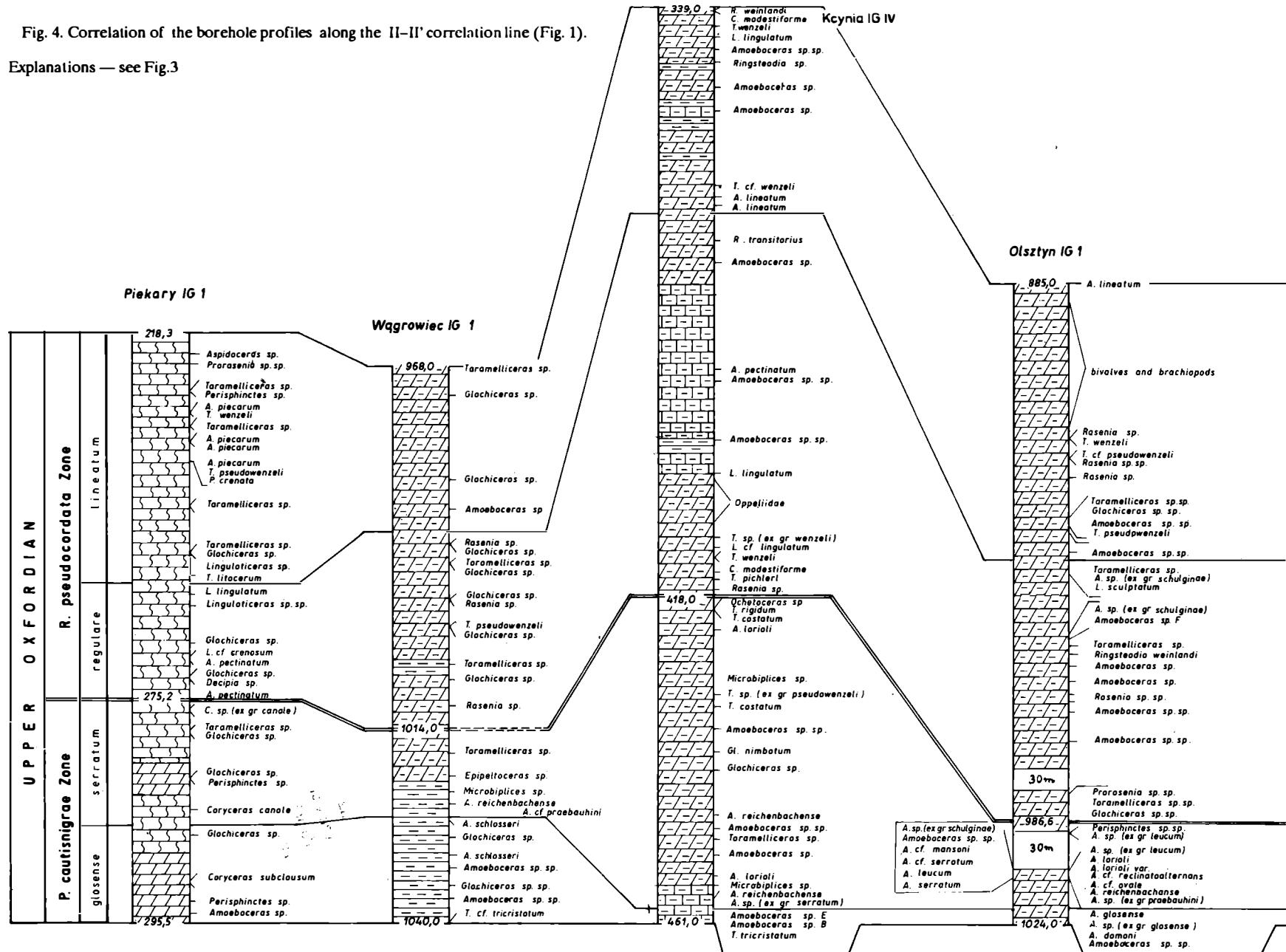


Fig. 4. Correlation of the borehole profiles along the II-II' correlation line (Fig. 1).

Explanations — see Fig.3



Additional fauna of the Upper Oxfordian sediments
in North and Central Poland

Table 2

Species	P. cautis- nigrae Zone	R. pseudo- cordata Zone
1	2	3
Bivalvia	x	
<i>Lima</i> cf. <i>alternicosta</i> Buvignier	x	
<i>Pholadomya</i> cf. <i>canaliculata</i> Roemer	x	
<i>Oxytoma</i> cf. <i>expansa</i> (Sowerby)	x	
<i>Lopha</i> cf. <i>hastellata</i> (Sowerby)	x	
<i>Protocardia</i> cf. <i>dyonisae</i> Buvignier	x	
<i>Myoconcha</i> sp. sp.	x	
<i>Pecten</i> sp. sp.	x	
<i>Gervillia</i> sp. sp.	x	
<i>Nanogrya</i> sp.	x	
<i>Isognomon</i> sp.	x	
<i>Thracia</i> sp.	x	
<i>Pinna lanceolata</i> (Sowerby)	x	x
<i>Cucullaea</i> sp.	x	x
<i>Chlamys</i> sp. sp.	x	x
<i>Astarte</i> sp. sp.	x	x
<i>Paralellodon</i> sp. sp.	x	x
<i>Ostrea</i> sp. sp.	x	x
<i>Goniomya</i> sp. sp.	x	x
<i>Entolium</i> sp. sp.	x	x
<i>Pholadomya</i> cf. <i>zittelii</i> (Buvignier)	x	
<i>Astarte sauvagei</i> (Loriol)	x	
<i>Gervillia aviculoides</i> (Sowerby)	x	
<i>Entolium denissimum</i> (Phillips)	x	
<i>Trigonia</i> sp.	x	
<i>Arcomya</i> sp.	x	
<i>Trichites</i> sp.	x	
<i>Diceras</i> sp.	x	
<i>Eodiceras eximium</i> (Bayle)	x	
<i>Lucina</i> cf. <i>substriata</i> Roemer	x	
<i>Ctenostreon</i> sp.	x	
<i>Cercomya</i> sp.	x	
<i>Spondylopecten</i> sp.	x	
<i>Mactromya</i> sp.	x	
Gastropoda		
<i>Pseudomelania</i> sp.	x	
<i>Pleurotomaria muensteri</i> Roemer	x	
<i>Pleurotomaria</i> sp. sp.	x	x
<i>Alaria</i> sp. sp.	x	x
<i>Apporhais</i> sp.	x	
<i>Nerinea</i> cf. <i>mariae</i> d'Orbigny	x	
<i>Ptygnatis</i> sp.	x	
<i>Ptygnatis bruntrutiana</i> (Thurmann)	x	
Brachiopoda		
<i>Cheirothyris</i> sp.	x	
<i>Dictyothyris</i> sp.	x	
<i>Epithyris</i> sp.	x	
<i>Lacunosella cracoviensis</i> (Quenstedt)	x	x
<i>Lacunosella</i> cf. <i>cracoviensis</i> (Quenstedt)	x	x
<i>Juralina</i> sp. sp.	x	x
<i>Septaliphoria pinquis</i> (Roemer)	x	x
<i>Zeilleria humeralis</i> (Roemer)	x	x
<i>Zeilleria</i> sp. sp.	x	x

1	2	3
Echinodermata		
<i>Balanocrinus subteres</i> (Muenster)	x	
<i>Balanocrinus subteroides</i> (Quenstedt)	x	
<i>Balanocrinus pentagonalis</i> (Goldfuss)	x	
Frequent trochites	x	
<i>Plegiocidaris</i> cf. <i>ornata</i> Roemer	x	
<i>Echinobrissus</i> sp. sp.	x	x
<i>Rhabdocidaris</i> sp. sp.	x	x
Fragments of echinoid spines	x	x
<i>Millericrinus</i> sp.		x
Non-frequent trochites		x
Reinforcing fauna		
Sponges (<i>Cnemidiastrum</i>)	x	
Spicules of sponges	x	
Scaphopods (<i>Dentalium</i>)	x	x
Worms (<i>Serpula</i> , <i>Cycloserpula</i>)	x	x
Crab remains (Prosoponidae)	x	x
Bryozoans (<i>Spiropora</i>)	x	x
Separated corals	x	x
Fish scales		x

catooides Enay, *D. crassus* Enay, *Perisphinctes* (*Perisphinctes*) *panthieri polonicus* Malinowska, *Perisphinctes zawadensis* Malinowska and *Decipia lintonensis* Arkell; the last one occurs not only in the Upper Oxfordian lower zone.

Description of the other fauna characteristic for the studied area may be find in the papers of A. Wierzbowski (1978), A. Gąsiewicz (1981), W. Brochwicz-Lewiński (1980) and M. Wiśniewska-Żelichowska (1971).

An additional fauna assemblage of the Upper Oxfordian sediments in the southern part of Central Poland consists of pelecypods (*Nanogrya*, *Chlamys*, *Isognomon*, *Oxytoma*, *Cucullaea*, *Gervillia*, *Thracia*, *Astarte* — frequent), brachiopods (*Lacunosella*, *Cheirotthyris*, *Septaliphoria*, *Dictyothyris*, *Juralina*, *Zeilleria*, *Epithyris*), gastropods (*Pseudomelania*, *Pleurotomaria*), sponges (*Cnemidiastrum*), worms, *Probalanus*, echinoid spines, crabs belonging to the family Prosoponidae (*Pithonotus*) and corals (Table 2).

Amoeboceras glosense and *Amoeboceras serratum* Subzones

The numerous specimens belonging to the genus *Amoeboceras* have been find in the sequence of the *Perisphinctes cautisnigrae* Zone; it makes possible to divide two subzones there: the lower one — *Amoeboceras glosense* and the upper one — *Amoeboceras serratum* (Table 1).

The *Amoeboceras glosense* Subzone has been especially closely defined in the borehole profiles as follows: Olsztyn IG 1, Gołdap IG 1, Bartoszyce IG 1, Pasłęk IG 1, Środa IG 2, Wągrowiec IG 1, Kcynia IG IV, Wiśniewa (Figs. 2 and 3). *Amoeboceras serratum* Subzone with numerous guide fauna has been defined in the borehole profiles: Olsztyn IG 1, Gołdap IG 1, Bartoszyce IG 1, Pasłęk IG 1, Środa IG 2, Wągrowiec IG 1, Kcynia IG IV, Wiśniewa, Piekarzysko IG 1, Prabuty IG 1, Nieczajna 50, Rynarzewo 1, Samsieczno, Gościeszewo 1, Waliszewo 1 and Rokietnica 1. It is worth to

point than the *Amoeboceras koldeweyense* Horizon was possible to be defined in the borehole profiles Bartoszyce IG 1 and Prabuty IG 1; the *Amoeboceras* sp. A has been defined there besides the typical species. The mentioned horizon has a subzone rank in the boreal subdivision (R. M. Sykes, J. H. Callomon, 1979) and has been defined in the typical exposure at Staffin and in the North-east Greenland in the lowermost part of the *Amoeboceras serratum* Subzone.

Ringsteadia pseudocordata Zone

Definition of the *Ringsteadia pseudocordata* Zone in the individual areas of Poland has got a long-time tradition. The ammonites characteristic for this zone particularly these belonging to the genus *Ringsteadia* have been known in both the areas: Polish Jurassic Upland (J. Kutek and others, 1977; M. Wiśniewska-Żelichowska, 1971) and north-east margin of the Góry Świętokrzyskie (J. Dembowska, 1953; S. Z. Różycki, 1953) but especially in the West Pomerania sediments (A. Wilczyński, 1962).

We can confirm recently, after the published data, a few tens of specimens belonging to the genus *Ringsteadia* and other specimens typical for the *Ringsteadia pseudocordata* Zone have been observed there. Undoubtedly, this group needs the more detail palaeontological studies. The species defined in the borehole profiles in North and Central Poland on a base of more than a dozen of additional specimens supplied the biostratigraphical data related to the upper zone of Upper Oxfordian in Poland.

On a base of the data from borehole profiles, the described zone is from 17 m in the borehole Pasłęk IG 1 to 100 m thick in the borehole Olsztyń IG 1.

The upper zone of Upper Oxfordian has been defined in both the sedimentary facies: silty sediments widespread in North and North-west Poland and carbonate sediments occurred in remaining areas.

The lower boundary of the described zone has been closely defined in the borehole profiles at the place where representatives of the genus *Rasenia* (sensu lato) were appearing. The upper zone boundary has been defined at the place where the ammonites belonging to the genus *Ataxioceras* (characteristic for Lower Kimmeridgian) appeared (L. Malinowska, 1988).

We can know the detail faunistic succession inside the described zone mostly on a base of borehole profiles from North and Central Poland (Table 1). The sediments in this area and, particularly, in its western part, in the most part consist of siltstone and chalky siltstone, more and more sandy to the North. They contain phosphatic concretions (borehole Bartoszyce IG 1) and iron oxide-marly ones (borehole Chojnice 3).

Occurrence of the ammonites belonging to the genera: *Taramelliceras* and *Glochiceras* in this area is very interesting. Besides these genera, what are noted in the whole sequence profile, concentrations of the ammonites defined as *Taramelliceras* sp. sp. have been observed in the upper part of the lower zone and in the lower part of the upper one in the borehole profiles Kcynia IG IV and Środa IG 2.

The family Perisphinctidae is mostly represented by the species belonging to the genera: *Prorasenia*, *Eurasenia*, *Rasenoides*, *Ringsteadia*, *Microiplices*, *Sutneria* (borehole Gołdap IG 1). The species: *Sutneria galar* (Oppel) and *Sutneria praecursor* (Dietrich) (A. Zeiss, 1979) have been known from the upper parts of the Upper Oxfordian sedimentary sequence; the species from North Poland might belong to this group.

There was only one specimen defined in the north-west area (borehole Piekary IG 1); it belongs to the genus *Aspidoceras*.

An additional fauna is represented by the non-numerous species (Table 2). Their preservation have been not sufficient to be closely defined in taxonomy. The genera *Pinna* and *Pholadomya* represent pelecypods. The specimens belonging to the genus *Pinna* are particularly frequent and they contain concentrations somewhere (e.g. in the borehole profile Wiśniewa 1). Moreover, the pelecypods belonging to the genera: *Chlamys*, *Astarte*, *Paralellodon*, *Ostrea*, *Trigonia*, *Goniomya*, *Gervillia*, *Entolium*, *Arcomya*, *Cucullaea*, *Trichites*, *Diceras*, *Eodiceras*, *Lucina* are also observed there. The genera: *Pleurotomaria*, *Alaria*, *Apporhais*, *Ptygmatis* and *Nerinea* represent gastropods and *Lacunosella*, *Septaliphoria*, *Zeilleria* and *Juralina* — brachiopods. Spicules of sponges are not observed and crinoid elements are not frequent, but worms, bryozoans, scaphopods and single corals are described there.

Carbonate sediments occur in a few borehole profiles in the described area (int. al. in the boreholes: Piekary IG 1, Środa 1, Środa IG 2, Nidzica IG 1, Kłosnowo IG 1). They are dominated by the oolite limestone cemented with mud, the pisolitic and nodular limestone (with single corals frequently) and even by the rocky limestone. Undoubtedly, the ammonites belonging to the genus *Amoeboceras* are not so frequent and the genera *Taramelliceras*, *Glochiceras* and the family Perisphinctidae are more differentiated there.

An additional fauna in the carbonate sediments is rather numerous, particularly in the profiles of boreholes located more distant to the East, e. g. Nidzica IG 1. The pelecypods (*Pholadomya*, *Astarte*, *Trigonia*, *Trichites*, *Lucina*, *Diceras*, *Eodiceras*, *Paralellodon*), gastropods (*Nerinea*, *Ptygmatis*, *Alaria*, *Pleurotomaria*) and brachiopods (*Zeilleria*, *Lacunosella*, *Septaliphoria*, *Juralina*) take a main part there. Crinoid stems, fragments of echinoid spines, worms (*Serpula*), single corals and bryozoans are observed there, too.

Carbonate sediments occur more distant to the South, in area of the Upper Oxfordian exposures.

In the northern part of the Częstochowa Upland the same age sediments are originated as chalky limestone, somewhere with clasts of spongy limestone; oncolites of Cyanophyceae are present there, too. Light-cream-coloured hard limestone (somewhere marly and containing cherts) occurs more distant to the East, in the Belchatów area. Cream-coloured marly limestone, substantially recrystallized cavernous limestone (a little dolomitic) and oolitic limestone predominate also in the Góry Świętokrzyskie area.

The *Ringsteadia pseudocordata* Zone has been defined mostly on a base of ammonites belonging to the family Perisphinctidae. A few specimens have been defined and described in the sequence of this zone. There are as follows: *Decipia decipiens* (Sowerby), *Decipia latecostata* Dohm, *Glochiceras cf. canale* (Quenstedt), *Lingulaticeras crassum* Ziegler, *Taramelliceras wenzeli* (Wegele), *Prorasenia crenata* (Quenstedt), *Orthosphinctes polygratus* (Reinecke) (L. Malinowska, 1972). The other species we can find in the A. Wierzbowski's paper (1978).

An additional fauna is mostly represented by brachiopods (*Juralina*, *Septaliphoria*, *Terebratella*, *Epithyris*, *Lacunosella*, *Dictyothyris*), pelecypods (*Ctenostreon*, *Lima*, *Pecten*, *Ostrea*, *Protocardia*, *Goniomya*, *Cercomya*, *Astarte*, *Pholadomya*, *Trigonia*, *Diceras*, *Lima*, *Chlamys*, *Spondylpecten*, *Mactromya*, *Oxytoma*), numerous sponges, echinoid spines (*Plegiocidaris*), great number of worms, scaphopods (*Dentalium*), representatives of the genus *Probalanus* and crinoid stems (*Millericrinus*).

Amoeboceras regulare and *Amoeboceras lineatum* Subzones

Numerous species of the genus *Amoeboceras* have been defined inside the *Ringsteadia pseudocordata* Zone (Table 1). They made possible to divide two subzones there: the lower one — *Amoeboceras regulare* and the upper one — *Amoeboceras lineatum* (Figs. 3 and 4). The *Amoeboceras regulare* Subzone has been particularly closely defined in the following borehole profiles: Bartoszyce IG 1, Gołdap IG 1, Środa IG 2, Wągrowiec IG 1, Olsztyn IG 1, Kcynia IG IV, Wiśniewa, Pasłęk IG 1, Piekary IG 1, Waliszewo 1, Rokietnica 1, Międzychód, Śmilowo Kolonia 31/39, Miastko 2, Środa 1, Miroslaw 2, Lesieniec 1, Krynica Morska IG 1, Człuchów IG 2, Dębowiec Warmiński 2.

The *Amoeboceras lineatum* Subzone has been confirmed by the fauna assemblage in the following borehole profiles: Olsztyn IG 1, Gołdap IG 1, Środa IG 2, Wągrowiec IG 1, Bartoszyce IG 1, Kcynia IG IV, Pasłęk IG 1, Piekary IG 1, Waliszewo 1, Goliszew KT-5, Nidzica IG 1, Siekierki Wielkie 1, Bytyń 2 (Table 1).

BIOSTRATIGRAPHICAL CORRELATIONS WITH EUROPEAN SUBDIVISIONS

Upper Oxfordian sediments in North and Central Poland have been included to the subboreal province on a base of their characteristic fauna assemblage. South England, France (Normandy, Boulonnais), North Germany and the European part of the USSR belong to the same province.

There is necessary to pay attention for an absence of the representatives of the genera typical for the submediterranean province, e. g. *Idoceras*, *Larcheria*, *Passendorferia*, *Amphilia*, *Subnebrodites*, *Epipeltoceras* in North and North-east Poland and the index species *Epipeltoceras bimammatum* (Quenstedt) — in Central Poland. Species belonging to the genera: *Lytoceras* and *Trimarginites* have not been known as well. However, such genera as *Epipeltoceras* and *Idoceras*, typical for the submediterranean province and predominating there are also not frequent in the Upper Oxfordian sediments in South Poland.

The representatives of the Oppeliidae and Haploceratidae are present in both North and Central Poland. These ammonites ought to be recognized as transitional form between South and North European paleozoogeographical provinces.

Previous data as regards possibility of appurtenance of the Upper Oxfordian sediments in North and Central Poland into the subboreal province were presented earlier by the author of this paper during the 1-st Jurassic Colloquium in Poland in 1967. In her paper from 1968, the author showed that the typical English Jurassic subdivision ought to be a starting-point for the biostratigraphical correlation.

The author applied for general conclusions regarding Upper Oxfordian also the faunistic data from her other

papers, mostly those published in 1968 and 1972. The subboreal ammonitic zones in sediments occurred in carbonate facies especially the *Perisphinctes cautisnigrae* Zone in the northern part of the Częstochowa Upland had been defined first time in this last paper. Besides the index species, also species *Perisphinctes (Perisphinctes) panthieri polonicus* Malinowska and *Dichotomoceras crassus* Enay have been defined in this zone. Moreover, the specimen particularly interesting from the point of view of its morphological features has been also observed there; it takes a place between the genera *Dichotomoceras* and *Dichotomosphinctes*.

The lower boundary of the *Perisphinctes cautisnigrae* Zone is well-defined by a phylogenetic transition between both the genera mentioned above, what has been provided after this review.

J. Kutek (1962) paid attention to possibilities of distinguish of the *Ringsteadia pseudocordata* Zone at the margin of the Góry Świętokrzyskie, E. Roniewicz (1966), J. Dembowska (1953) and S. Z. Różycki (1953) took up the same question. A. Wilczyński (1962) defined the *Ringsteadia pseudocordata* Zone in West Pomerania and A. Gąsiewicz (1981) have found at the margin of the Upper Silesian Coal Basin numerous ammonites belonging to the group *Amoeboceras freboldi*.

An analysis of the extent of the species being important from the stratigraphical point of view in the borehole profiles from North and Central Poland allowed to estimate the defined earlier zones in individual areas in Poland. It made also possible to estimate their applicability to the biostratigraphical correlation with other European countries (Table 3). After studies of correlative possi-

Biostratigraphical correlation of the Middle and Upper Oxfordian of Poland with other areas

Table 3

Boreal province			Subboreal province (North, North-west and Central Poland)		Submediterranean province
<i>pseudocordata</i>	<i>rosenkrantzi</i>		<i>lineatum</i>	<i>pseudocordata</i>	<i>planula</i>
	<i>regulare</i>		<i>regulare</i>		<i>bimammatum</i>
<i>cautisnigrae</i>	<i>serratum</i>	<i>serratum</i>	<i>serratum</i>	<i>cautisnigrae*</i>	<i>bifurcatus</i>
		<i>koldeweyense</i>			
<i>transversarium</i>	<i>nunningtonense</i>	<i>glosense</i>	<i>glosense</i>	<i>wariæ</i>	<i>parandieri</i>
		<i>ilovaiskii</i>	<i>alemans</i> s. polonico		
<i>plicatilis</i>	<i>antecedens</i>	<i>tenuiserratum</i>	<i>blakei</i>	<i>antecedens</i>	<i>antecedens</i>
			<i>Cardioceras gap</i>		
		<i>tenuiserratum</i>	<i>tenuiserratum</i>		
		<i>densiplicatum</i>	<i>maltonense</i>	<i>excavatum</i>	
			<i>vertebrale</i>		<i>vertebrale</i>

* L. Malinowska, 1972

bilities, the lower boundary of the *Perisphinctes cautisnigrae* Zone (sensu polonico) seems to be conformable with the lower boundaries of the *Amoeboeras glosense* Zone in the boreal province and the *Dichotomoceras bifurcatus* Zone in the submediterranean province.

Two subzones: the lower one — *Perisphinctes cautisnigrae* and the upper one — *Perisphinctes variocostatus* may be divided inside the *Perisphinctes cautisnigrae* Zone in the southern area. Definition of the first of them was suggested first time by W. Brochwicz-Lewiński (1976).

Correlation of the *R. pseudocordata* Zone in the whole area of the subboreal province was not difficult. Appearance of ammonites belonging to the genus *Ringsteadia* was reckoned as diagnostic for the lower boundary of this zone during long time. However, the lower boundary of this zone was defined approximately by predominance of the ammonites of the genus *Rasenia*, what the author observed in borehole profiles from North and central Poland.

F. O. Geyer pointed a sudden evolutional development of the genus *Rasenia* in his work (1961). The author maintained this genus had been defined in older sediments rocks as well. Two ammonites of the genus *Rasenia* defined in the *Perisphinctes cautisnigrae* Zone (L. Malinowska, 1972)

seem to belong to transitional forms or to be first harbingers of this genus. It is an interesting question, because great concentration of the representatives of the genus *Rasenia* (sensu lato) in borehole profiles suggested the possibilities of a new close subdivision of this Zone. This fact did not exclude, of course, the possibilities of division of the *Ringsteadia pseudocordata* Zone to the subzones on a base of genus *Ringsteadia*, but that may be a subject of other research works.

Two subzones: *Amoeboeras regulare* and *Amoeboeras lineatum* may be divided inside of the *Ringsteadia pseudocordata* Zone in the borehole profiles from North and Central Poland. The last one deviated particularly the boreal subdivision and may be recognized as characteristic for the subboreal province. The species: *Amoeboeras* sp. (ex gr. *schulginae*), *A. piecarum* Malinowska, *A. crenulatum* Buckmann, *A. sp.* (ex gr. *quadratolineatum*), *Amoeboeras* sp. *G*, *Amoeboeras* sp. *J* occur in this subzone besides the index species.

These described species are known also in the Kostroma and Kaliningrad areas (L. Rotkytė, 1987) and some of them are noted as well in the Swabian Jurassic (B. Ziegler, 1977; H. Salsfeld, 1915).

GENERAL REMARKS ON PALEOECOLOGY

Characteristics of the environmental conditions of Upper Oxfordian fauna life and development in Poland needs a short explanation. Paleoecological conclusions are limited, of necessity, only to the description of relations between fauna frequency or/and preservation and character of the sediments including this fauna. Detail data related to the position of the fauna in the sediments, definition of animals in life position (it is especially important for the benthonic fauna study) and preservation of individual organisms were not taking into consideration. Fauna was exploited from the borehole cores by many geologists, who did not always think about its applicability for further paleoecological interpretation.

Upper Oxfordian deposits widespread in Poland (Fig. 1). The Upper Oxfordian basin was easily connected with the neighboring basins at the East, West and South. There were a dry lands: Łeba Elevation at the North and — the second one — the Lublin-Wołyń Continent at the South-East. Recent extent of the described sediments is a result of denudation. The Upper Oxfordian sediments in the North and Central Poland profiles oscillate in thickness from 140 m in the borehole Olsztyn IG 1 to 37 m in the borehole Pasłęk IG 1.

Facies distribution is generally similar in both the Upper Oxfordian zones (Fig. 1). The silty deposits predominate at

the North and North-West and the carbonate ones occur at the South and South-east.

Upper Oxfordian sediments originated in a shallow basin in a sublitoral environment. The sedimentary conditions were connected with numerous factors and, in this number, with a bottom topography, shore configuration, stream system, tidal processes, climatic conditions etc. Undoubtedly, these factors influenced horizontal facies differentiation and origin of the various ecosystems in differentiated conditions.

Interpretation of the fauna in the borehole profiles from North and Central Poland and the exposures in South Poland implied an important conclusion about a main influence of temperature variability on faunistic horizontal differentiation in the Upper Oxfordian sediments. In fact, Poland is very interesting and important, because it is area where mixed the southern and northern influences have been recorded in the faunistic spectrum.

Ammonites belonging to the genus *Amoebooceras* predominate in the silty sediments in the northern and north-western part of the country. These ammonites, characteristic for the boreal area, displaced to the South and adapted to changing environment temperature, what influenced quantitative and qualitative changes in this cephalopods group. A significant decreasing of numbers of specimens and species may be observed in the southern area. There is also important to pay attention for ammonites of the genus *Amoebooceras ex gr. ovale* occurred in the southern part of Poland, which proved as the best adapted for changeable temperature.

A small size of the ammonites belonging to the genera *Taramelliceras* and *Glochiceras* occurring in the Upper Oxfordian sediments in North and Central Poland may be the next example of the environment temperature influenced organisms development. There is possible than these ammonites which found optimal conditions in warm submediterranean water, spreading to the North met colder water and their number and special differentiation substantially decreased; this conclusion is confirmed by ammonites size, more variegated shell sculpture and special differentiation.

An analysis of the specimen *Taramelliceras wenzeli* (Oppel) makes possible to conclude the individual species depended on the basin deepness and temperature. This species has been not known in North Poland.

Examples of relation between spreading of the organisms in different zones and temperature conditions may be multiplied; occurrence of the mediterranean ammonites of the genus *Idoceras* only in South Poland may be one of them. The ammonite fragment which might be included to this genus on a base of its external side characteristic sculpture, was found in the borehole Piekary IG 1 (Central Poland); it was only one case in the numerous analyzed profiles.

Faunistic material collected in the Upper Oxfordian sediments in Poland seems to partly explain also origin of various biocoenosis in this area. There was paid to little

attention to this differentiation jointing this event with the zonal distribution only.

An analysis of the individual boreholes showed then the biocoenosis with fauna dominated by the ammonites belonging to the genus *Amoebooceras* might exist in the North and Central Poland areas. It is interesting then they always occurred simultaneously with concentration of crinoid stems.

Paleoecological conclusions regarding the Upper Oxfordian basin in Poland, prepared only on a base of ammonites, should be not complete without taking into consideration a benthonic fauna occurred in carbonate sediments in Central Poland; there are e. g. thick-shell pelecypods (*Rudistae*), gastropods (*Ptygmatis*), corals and foraminifers.

Observation of the fauna in individual profiles in North Poland seemed to explain the relation between the benthonic fauna abundant development and characteristics of a basin bottom; the pelecypods belonging to the genus *Pinna* might be a good example of it. Specimens of this genus were very frequent in the silty-sandy sediments occurred in a nearshore area of the Late Oxfordian Basin in North Poland. Their position showed they had needed for their development shallow and mobile water, suitable planktonic food and, perhaps, considerable insolation. This conclusion is conformable to the results of observations of F. T. Fuersich regarding the Oxfordian faunistic material from South England and North France (F. T. Fuersich, 1976).

An appearance in a mass in the Upper Oxfordian sediments in the Góry Świętokrzyskie margin the pelecypods Rudistae, which fastened their right shell to the basement, shows, after L. Karczewski (1969), gradually climatecooling during Upper Oxfordian. This author maintained it as a result of the adaptative radiation: the Rudistae fastened their right shell might develop more extensively in colder water.

A small size and thin whorl-walls of the gastropods belonging to the genus *Ptygmatis* and occurred in the Upper Oxfordian carbonate sediments in the Góry Świętokrzyskie margin showed these features substantially influenced by environment temperature (L. Karczewski's oral information); it is extremely visible in comparison with size to 30 cm and massive whorl-walls of representatives of the same genus from the Crimea, Caucasus Mts. and Balkan Peninsula sediments.

Also W. Bielecka (1980) maintained then mediterranean foraminifers, e. g. belonging to the genera: *Pfenderia*, *Kornubia* and *Anchispirocyclina* did not occur in Upper Oxfordian in the Polish Lowland.

Upper Jurassic corals also did not find the optimal condition for reef-building. They occurred in dispersing or in small concentrations only and did not form elevations on a basin bottom (E. Roniewicz, P. Roniewicz, 1971; E. Roniewicz, 1966).

Analysis of ammonites of the genus *Amoeboceras*
(*Amoeboceras* sp. A — *Amoeboceras* sp. I)

Species	<i>Amoeboceras</i> sp. A	<i>Amoeboceras</i> sp. B	<i>Amoeboceras</i> sp. C	<i>Amoeboceras</i> sp. D	<i>Amoeboceras</i> sp. E	<i>Amoeboceras</i> sp. F	<i>Amoeboceras</i> sp. G	<i>Amoeboceras</i> sp. H	<i>Amoeboceras</i> sp. I
Shell elements	PL. II Figs 5 and 6	PL. I Fig. 14	PL. II Fig. 20	PL. II Fig. 17	Pl. I Fig. 19	Pl. II Figs 11 and 12 Pl. VIII Fig. 12	Pl. X Fig. 9	Pl. I Fig. 1	PL. X Figs 15–20
Diameter	19 mm	20 mm	a whorl fragment	13 mm	45 mm	30 mm	25 mm	23 mm	16 mm
Primary ribs	in 1 cm–16 r. wavy	in 1 cm – 8 r. bent to the back	— almost straight si- de tubercles at the end	in 1 cm – 10 r. almost straight si- de tubercles elon- gated	in 1 cm – 11 r. straight (a living chamber)	in 1 cm – 9 r. almost straight si- de tubercles elon- gated	in 1 cm – 15 r. almost straight si- de tubercles feb- ble elongated	in 1 cm – 10 r. a little bent , more thick	in 1 cm – 8 r. a little bent more febble in the cen- tral part at the side
Secondary ribs	fine, tripartite	rather strong bipar- tite	strong bipartite	bipartite	mostly single more thick at the end	mostly bipartite and single	mostly bipartite and single	bipartite	well-visible mainly at the outside mar- gin
Keel	high, fine tubercu- lated in 1 cm – 25 t.	low, fine denticula- ted in 1 cm – 18 d.	destroyed	high, fine denticu- lated in 1 cm – 10 d.	high, fine denticu- lated in 1 cm – 10 d.	high, fine denticu- lated in 1 cm – 16 d.	high, finely serra- ted in 1 cm – 14 s.	high, fine denticu- lated in 1 cm – 17 d.	low, fine tubercu- lated in 1 cm – 12 t.
Occurrence	Bartoszyce IG 1 <i>A. serratum</i> Subz.	Kcynia IG IV <i>A. glosense</i> Subz.	Bartoszyce IG 1 <i>A. serratum</i> Subz.	Gołdap IG IV <i>A. serratum</i> Subz.	Kcynia IG IV <i>A. glosense/A. serratum</i> Subz.	Olsztyn IG 1 <i>A. regulare</i> Subz. Gołdap IG 1 Rynarzewo IG 1 <i>A. serratum</i> Subz.	Pasłek IG 1 <i>A. lineatum</i> Subz.	Pasłek IG 1 <i>A. glosense</i> Subz.	Bartoszyce IG 1 <i>A. lineatum</i> Subz.

SYSTEMATIC PART

Class CEPHALOPODA Cuvier, 1797

Order AMMONITIDA Zittel, 1884

Family Cardioceratidae Siemiradzki, 1891

Genus *Amoeboceras* Hyatt, 1900

Variability of the defined species belonging to the genus *Amoeboceras* is very significant; from the one side, species occurred here were typical for the boreal area, however from the other side — for central European areas. This special mixture, from the paleozoological point of view important and interesting, has done Polish Upper Oxfordian basin a particularly important area for all the faunistic correlations. The ammonites of the genus *Amoeboceras* were the important biostratigraphical elements in North and Central Poland. Their rich concentration showed the marly-siltstone sedimentary environment was an optimal environment for development of this group. This conclusion opposed the general opinion about the position of Poland as an integral part of the submediterranean area, where the ammonites of the genus *Amoeboceras* might be found only occasionally or additionally (R. M. Sykes, J. H. Callomon, 1979; J. Kutek, B. A. Matyja, A. Wierzbowski, 1984).

Ammonites belonging to the genus *Amoeboceras* exploited in the selected borehole profiles of Poland allowed to define more closely the stratigraphical extent of the individual species often non-precisely interpreted before. It regarded particularly the species *Amoeboceras bauhini*

(Oppel) which was, after the last data, characteristic for Lower Kimmeridgian.

Ammonites belonging to the genus *Amoeboceras* are not so frequent in carbonate sediments. Generally, ammonites of this genus have rather small size in the borehole profiles from North and Central Poland, excluding non-numerous exceptions. There are even the specimens 13 mm wide in diameter in this group. The species non-useful for comparison with the data published earlier are presented in the Table 4 in this paper.

Amoeboceras wrighti sp. nov.

Pl. I, Fig. 13

Holotypus: Pl. I, Fig. 13.

Stratum typicum: *P. cauñsnigrae* Zone, *A. glosense* Subzone.

Locus typicus: borehole Gołdap IG 1 (North Poland), depth 563.90 m.

Derivatio nominis: according to the name of J. K. Wright, an expert of Upper Jurassic in Yorkshire (England).

1972 *Amoeboceras* sp.; J. K. Wright, Pl. 14, Fig. 2.

Collection: MUZ IG, coll. L. Malinowska.

Description: The shell about 35 mm in diameter, evolute. Primary ribs in number 8 on 1 cm are bent to the back at the umbilical margin and in a little bending to front go to 2/3 of the side height. They partite in this place to two second-order ribs. A single rib is visible.

Occurrence: North Poland (borehole Gołdap IG 1), *A. glosense* Subzone; Newbridge Quarry (Yorkshire), *P. cauñsnigrae* Zone.

Translated by Jacek Kasirski

REFERENCES

- ARKELL W. J., 1935–1948 — A Monograph on the Ammonites of the English Carallian Beds. *Palaentogr. Sc.*, Part I–XIII, v. 88–89. London.
- ATLAS skamieniałości przewodnich i charakterystycznych, 1980. Budowa geologiczna Polski, T. III, 2b. Inst. Geol., Warszawa.
- BIELECKA W., 1980 — Foraminifera. In: Atlas skamieniałości przewodnich i charakterystycznych. Budowa geologiczna Polski, T. III, 2b, Inst. Geol., Warszawa.
- BIELECKA W., DĄBROWSKA Z., 1958 — Uwagi o stratygrafii malmu Pomorza Zachodniego okolic Kamienia Pomorskiego. *Biuł. Inst. Geol.*, 142, Warszawa.
- BŁASZKIEWICZ A., CIEŚLIŃSKI S., DĄBROWSKA Z., KARCZEWSKI L., KOPIK J., MALINOWSKA L., 1968 — Zarys stratygrafii i tektoniki południowej części niecki łódzkiej (rejon Bełchatowa). *Kwart. Geol.*, T. 12, nr 2, Warszawa.
- BROCHWICZ-LEWIŃSKI W., 1976 — Oxfordian of the Częstochowa area. Part I: Biostratigraphy. *Bull. Acad. Pol. Sci., Sér. Sci. de la Terre*, v. 24, nr 1, Warszawa.
- BROCHWICZ-LEWIŃSKI W., 1980 — Perisphinctids proper (Ammonoidea) of the Częstochowa Oxfordian. *Bull. Acad. Pol. Sci., Sér. Sci. de la Terre*, v. 27, nr 3–4, Warszawa.
- DADLEZ R., DEMBOWSKA J., 1965 — Budowa geologiczna paratyklinorium pomorskiego. *Prace Inst. Geol.*, 40, Warszawa.
- DEMBOWSKA J., 1953 — Góra jura między Radomiem i Jastrzębiem. *Biuł. Inst. Geol.*, 15, Warszawa.
- FUERSICH F.T., 1976 — Trace fossils as environmental indicators in the Corallian of England and Normandy. *Lethaia*, v. 8, nr 2, Oslo.
- GĄSIEWICZ A., 1981 — Oksford okolic Olkusza. *Kwart. Geol.*, T. 25, nr 4, Warszawa.
- GEYER O.F., 1961 — Monographie der Perisphinctidae des unteren Unterkimmeridgium (Weisser Jura Gamma Badenerschichten) in süddeutschen Jura. *Palaeontogr.*, Abt. A, v. 106, Stuttgart.
- KARCZEWSKI L., 1969 — Upper Jurassic Rudistae of margin of the Holy Cross Mountains, Poland. *Acta Palaeont. Pol.*, v. 14, nr 3, Warszawa.
- KUTEK J., 1962 — Osuwiska podmorskie i krzemienie w dolnokimerydzkich wapieniach okolic Małogoszcza. *Acta Geol. Pol.*, v. 12, nr 3, Warszawa.
- KUTEK J., MATYJA B. A., WIERZBOWSKI A., 1984 — Late Jurassic biogeography in Poland and its stratigraphical implications. Int. Symp. on Jurassic Stratigraphy, Erlangen, v. 3, Copenhagen.
- KUTEK J., WIERZBOWSKI A., BEDNAREK J., MATYJA B. A., ZAPAŚNIK T., 1977 — Z problematyki stratygraficznej osadów górnourajskich Jury Polskiej. *Przegl. Geol.*, 8–9, Warszawa.
- MALINOWSKA L., 1960 — Fauna malmu w otworze wiertniczym Piekary (koło Poznania). *Kwart. Geol.* T. 4, nr 2, Warszawa.

- MALINOWSKA L., 1967 — Remarks on the stratigraphy of the Extra-Carpathian Upper Jurassic in Poland. *Biul. Inst. Geol.*, 203, Warszawa.
- MALINOWSKA L., 1968 — Poziomy amonitowe oksfordu górnego w Jurze Częstochowskiej. *Kwart. Geol.*, T. 12, nr 3, Warszawa.
- MALINOWSKA L., 1972 — Środkowy i górny oksford w północno-zachodniej części Jury Częstochowskiej. *Biul. Inst. Geol.*, 233, Warszawa.
- MALINOWSKA L., 1980 — Regional Biostratigraphic Subdivision of the Oxfordian of Extra-Carpathian Poland. *Bull. Acad. Pol. Sci., Sér. Sci. de la Terre*, v. 28, nr 1, Warszawa.
- MALINOWSKA L., 1988 — Lower Kimmeridgian biostratigraphy in Poland. *Biul. Inst. Geol.*, 359, Warszawa.
- MALINOWSKA L., 1989 — Makrofaunistyczna charakterystyka osadów jury górnej północno-wschodniego obrzeżenia Górnosłąskiego Zagłębia Węglowego (GZW). *Acta Univ. Wratislaviensis*, nr 1113, Wrocław.
- MARCHAND D., W. BROCHWICZ-LEWIŃSKI, 1980 — Lacune stratigraphique à la limite Oxfordien inférieur - Oxfordien moyen dans la chaîne jurassique Polonaise. *Przegl. Geol.*, 5, Warszawa.
- MATYJA B. A., WIERZBOWSKI A., 1988 — The two *Amoeboceras* invasions in Submediterranean Late Oxfordian of Central Poland. 2-nd Intern. Symp. on Jurassic Stratigraphy, Lisboa.
- I JURAJSKIE Kolokwium w Polsce (collective work), 1967, *Biul. Inst. Geol.* 203, Warszawa.
- PRZEWODNIK 52 Zjazdu Polskiego Towarzystwa Geologicznego — Bełchatów (collective work), 1980. Warszawa.
- RONIEWICZ E., 1966 — Les Madréporaires du Jurassique supérieur de la bordure des Monts de Sainte-Croix, Pologne. *Acta Palaeont. Pol.*, v. 11, nr 2, Warszawa.
- RONIEWICZ E., RONIEWICZ P., 1971 — Upper Jurassic coral assemblages of the central Polish Uplands. *Acta Geol. Pol.*, v. 21, nr 3, Warszawa.
- ROTKYTÉ L., 1987 — Ammonity i zonalnaja stratigrafia wierchniejur-skich otloženii Pribaltiki. Mokslas, Vilnius.
- RÓŻYCKI S.Z., 1953 — Górný dogger i dolny malm Jury Krakowsko-Częstochowskiej. *Pr. Inst. Geol.*, 17, Warszawa.
- SALFELD H., 1915 — Die Cardioceraten des oberen Oxford und Kimmeridge. *Zeitschr. Deutsch. geol. Ges.*, v. 67, nr 3, Berlin.
- STRATYGRAFIA. Mezozoik, 1973. Budowa geologiczna Polski, T. I, 2, Inst. Geol., Warszawa.
- SYKES R.M., CALLOMON J. H., 1979 — The *Amoeboceras* zonation of the boreal Upper Oxfordian. *Palaeontology*, v. 22, nr 4, London.
- WIERZBOWSKI A., 1970 — Some Upper Jurassic ammonites of the genus *Ringsteadia* Salfeld, 1913, from Central Poland. *Acta Geol. Pol.*, v. 28, nr 2, Warszawa.
- WIERZBOWSKI A., 1978 — Ammonites and stratigraphy of the Upper Oxfordian of the Wieluń Upland, Central Poland. *Acta Geol. Pol.*, v. 28, nr 3, Warszawa.
- WILCZYŃSKI A., 1962 — Stratygrafia górnej jury w Czarnogłowach i Świętoszewie. *Acta Geol. Pol.*, v. 12, nr 1, Warszawa.
- WIŚNIEWSKA-ŻELICHOWSKAM., 1971 — Fauna bioherm jurajskich w Rudnikach pod Częstochową. *Biul. Inst. Geol.*, 243, Warszawa.
- WRIGHT J.K., 1972 — The stratigraphy of the Yorkshire Corallian. Proceed. Yorkshire, *Geol. Soc.*, v. 39, part 2, nr 12.
- ZEISS A., 1979 — Neue Sutnerien-Funde aus Ostafrika, ihre Bedeutung fuer Taxonomie und Phylogenie der Gattung. *Paleont. Zeitschr.*, v. 53, Stuttgart.
- ZIEGLER B., 1977 — The "White" (Upper) Jurassic in Southern Germany. *Stutt. Beitr. Naturkunde*, Ser. B, nr 26, Stuttgart.
- ZNOSKO J., 1952 — Uwagi o niektórych przedstawicielach fauny borealnej w Jurze Krakowsko-Częstochowskiej. *Roczn. Pol. Tow. Geol.*, T. 21, z. 3, Kraków.
- ZNOSKO J., 1953 — Budowa geologiczna okolic Błędowa i Niewogonic kolo Olkusza. *Biul. Inst. Geol.*, 74, Warszawa.

BOREALNE WPŁYWy FAUNISTYCZNE W GÓRNYM OKSFORDZIE POLSKI PÓŁNOCNEJ I CENTRALNEJ

STRESZCZENIE

Abstrakt. Borealne wpływy faunistyczne w osadach górnego oksfordu Polski północnej i centralnej zostały stwierdzone tak w otworach wiertniczych, jak i w odsłonięciach (Niż Polski, Wyżyna Częstochowsko-Wieluńska, obrzeże Górz Świętokrzyskich). Makrofauna, a przede wszystkim amonity, pozwoliła na wyznaczenie właściwych poziomów i podpoziomów dla prowincji subborealnej. Są to: dolny poziom *Perisphinctes caulinigræ* (sensu lato) z podpoziami *Amoeboeras glosense* i *Amoeboeras serratum* i górny *Ringsteadia pseudocordata* z podpoziami *Amoeboeras regulare* i *Amoeboeras lineatum*.

Analiza zasięgu ważnych stratygraficznie amonitów (*Amoeboeras*, *Ringsteadia*, *Microbiplices*, *Decipia*, *Rasenia*, *Eurasenia*, *Prorasenia*, *Sutneria*), w otworach wiertniczych Polski północnej i centralnej, pozwoliła na

ocenę dotychczas wyróżnianych poziomów w poszczególnych obszarach Polski i możliwość ich stosowania przy biostratygicznnej korelacji z krajami europejskimi.

Osady górnego oksfordu omawianej strefy tworzyły się w zbiorniku płytkim, w środowisku sublitoralnym. Panujące w tym środowisku warunki zależne były między innymi od ukształtowania dna, konfiguracji brzegów, układu prądów, temperatury itp. Mialo to niewątpliwie wpływ na powstanie, w odmiennych warunkach sedymentacyjnych, różnych obocznie osadów i wykształcenie różnych ekosystemów. Czynniki termiczne środowiska odegrały dużą rolę przy wytwarzaniu faunistycznej strefowości.

Wprowadzenie i historia badań

Makrofauna określona przez autorkę z 58 otworów wiertniczych na Niżu Polskim, z odsłonięć obszaru Wyżyny Częstochowsko-Wieluńskiej i obrzeżenia Górz Świętokrzyskich, dala podstawę do szczegółowych wydzielin biostratygicznych w górnym oksfordzie. Została potwierdzona przynależność polskiego basenu górnooksfordzkiego w przeważającej części do prowincji subborealnej. Ten punkt widzenia autorki, datujący się od 1968 r., poparty został w niniejszym opracowaniu szczegółowym określeniem borealnych amonitów rodzaju: *Amoeboeras*, *Ringsteadia*, *Microbiplices*, *Decipia*, *Rasenia*, *Prorasenia*, *Eurasenia* i *Sutneria*.

W ramach działania grupy roboczej JURA-GÓRNA w obrębie Komisji Stratygrafii Komitetu Nauk Geologicznych opublikowany został artykuł (L. Malinowska, 1980), w którym zalecano stosowanie dwóch podziałów biostratygicznych: submedyterańskiego dla strefy południowej Polski i subborealnego dla centralnych i północnych części Polski. Takie ujęcie oddawało specyfikę polskiego basenu górnourajskiego, który w pewnym interwale, a w omawianym przypadku w oksfordzie górnym, pozostawał tak pod wpływami borealnymi jak i medyterańskimi.

Szczególnie ważny okazał się opracowany przez autorkę, na podstawie materiału faunistycznego uzyskanego nie tylko z odsłonięć Polski centralnej, ale przede wszystkim z kilkudziesięciu wiercen z obszaru Polski północnej, po-

dział regionalny – subborealny (L. Malinowska, 1980). Wstępne dane na ten temat zostały już wcześniej przedstawione (L. Malinowska, 1967) na I Jurajskim Kolokwium w Polsce.

Korelacja poszczególnych poziomów amonitowych górnego oksfordu ze standardowymi poziomami typowymi dla odpowiednich prowincji paleozoogeograficznych okazała się możliwa do przeprowadzenia. Stosowany dla Polski południowej (J. Kutek i inni, 1977) podział górnego oksfordu jest adaptacją standardowego podziału dla strefy submedyterańskiej.

Korelacja poziomów podziału regionalnego subborealnego przyjętych dla Polski północnej i centralnej (L. Malinowska, 1980), a wyznaczonych na podstawie gatunków faktycznie występujących w osadach, ze standardowym podziałem angielskim, jest bardziej skomplikowana. Oddaje ona biostratygiczną specyfikę omawianego obszaru przez uwypuklenie drobnych nawet różnic w określonych interwałach. Podział regionalny górnego oksfordu Polski północnej i centralnej jest tym bardziej ważny, gdyż opracowany został na podstawie fauny, która zawiera tak elementy borealne (Cardioceratidae) jak i submedyterańskie (Perisphinctidae), występujące w osadach mułowcowych i węglanowych, chociaż w odmiennych proporcjach. Już w opublikowanych materiałach I Jurajskiego Kolokwium w Polsce (1967) przewijają się stwierdzenia aktualne do dzisiaj, nawiązujące do podziału subborealnego. J. Kutek (str. 197) proponuje aby strop poziomu *Ringsteadia pseudo-*

cordata uznać za górną granicę oksfordu, W.C. Kowalski (str. 198) uważa, że niezdefiniowane jeszcze dokładnie najwyższe warstwy oksfordzkie należałoby nazwać ringstediowymi, a według J. Znoski (str. 198) należałoby przyjąć gorny oksford z zaznaczeniem, że jest to oksford ringstediowo-amebocerasowy. Wiele też znaczący jest ustęp projektu uchwały I Jurajskiego Kolokwium w Polsce (str. 230), w którym znajdujemy propozycję aby w przyszłości gorny oksford wyodrębnić jako osobne piętro scharakteryzowane przez amebocerasy i ringstedie — po znalezieniu odpowiedniego stratotypu.

Zestawienia amonitów zamieszczone w pracach prefe-rujących podział południowoeuropejski, pod względem ja-kościowym, nie przeczą wydzielaniu poziomów subborealnych w Polsce centralnej. Natomiast ilościowe dane do-tyczące takich rodzajów jak: *Idoceras*, *Ringsteadia*, *Prorase-nia*, *Decipia*, *Amoeboceras*, *Epipeltoceras*, *Microbiplices*, *Orthosphinctes*, *Dichotomoceras* — właśnie potwierdzają fakt, że tylko poziomy subborealne powinny być wyróżniane. Trzeba tu z całym naciskiem podkreślić, że w Polsce brak jest przedstawicieli typowego dla podziału submedyterńskiego gatunku *Epipeltoceras bimammatum* (Quenstedt), brak także okazów rodzaju *Clambites*, nie zostały stwierdzone gatunki rodzaju *Lytoceras*. Natomiast takie rodzaje jak *Epipeltoceras* i *Idoceras*, typowe dla strefy submedyterńskiej i występujące tam w przeważającej liczbie, w osadach górnego oksfordu Polski centralnej spotykane są mniej licznie.

Poziomy i podpoziomy górnego oksfordu

Poziom *Perisphinctes cautisnigrae* (sensu lato) został wy-odrębniony w Polsce (L. Malinowska, 1968) na podstawie obecności okazów gatunku *Perisphinctes (Perisphinctes) cau-tisnigrae* Arkell w osadach górnego oksfordu jury częstochow-skiej. Znamy liczne okazy wyżej wymienionego gatunku w osadach Jury Polskiej (W. Brochwicz-Lewiński, 1980). Na možliwość wyróżnienia tego poziomu w Polsce zwrócił już uwagę W.J. Arkell (1935–1948). Miąższość osadów dolnego poziomu oksfordu górnego, na podstawie otworów wiertniczych, waha się od 9 (np. w profilu Wiśniewa) do 43 m (Kcynia IG IV). Obserwuje się go w osadach mulowcowych rozprzestrzenionych przede wszystkim na północy kraju i w węglanowych w części południowej. Dolna granica tego poziomu wyznaczona została ścisłe jedynie w otworach wiertniczych, w miejscu pojawiennia się w profilach amoni-tów zaliczonych do rodziny Cardioceratidae (*Amoeboceras*) i Perisphinctidae (*Orthosphinctes*, *Dichotomoceras*), górna natomiast z chwilą pojawiennia się przedstawicieli rodzaju *Rasenia* (sensu lato). W odsłonięciach, wick ustalonono na podstawie obecności charakterystycznej fauny,nickiedy bez możliwości określenia spągu i stropu.

Generalnie można stwierdzić, że ilość okazów rodzaju *Amoeboceras* (Cardioceratidae) w osadach górnego oksfordu maleje ku południowi, natomiast zwiększa się udział okazów rodziny Perisphinctidae. W obu jednak typach osadów obserwuje się amonity tych obydwóch rodzin, jak-kolwiek w różnych proporcjach, co pozwala na przepro-wadzenie korelacji. Następstwo faunistyczne w obrębie omawianego poziomu zostało bardzo dobrze zaobserwo-

wane w otworach wiertniczych Polski północnej i centralnej (fig. 3, 4).

Podpoziomy: *Amoeboceras glosense* i *Amoeboceras ser-ratum*:

W obrębie poziomu *Perisphinctes cautisnigrae* stwier-dzono liczne gatunki z rodzaju *Amoeboceras*. Pozwoliły one na wyróżnienie dwóch podpoziomów: dolnego — *Amoeboceras glosense* i górnego — *Amoeboceras serratum* (tabela 1). Podpoziom pierwszy szczególnie dokładnie wy-znaczony został w otworach wiertniczych: Olsztyn IG 1, Gołdap IG 1, Bartoszyce IG 1, Pasłęk IG 1, Środa IG 2, Wągrowiec IG 1, Kcynia IG IV, Wiśniewa (fig. 2, 3). Drugi natomiast w profilach: Olsztyn IG 1, Gołdap IG 1, Środa IG 2, Wągrowiec IG 1, Bartoszyce IG 1, Kcynia IG IV, Wiśniewa, Pasłęk IG 1, Piekary IG 1, Prabuty IG 1, Nieczajna 50, Rynarzewo 1, Samsieczno, Gościejewo 1, Waliszewo 1 i Rokietnica 1. Warto tu zaznaczyć możliwość wyróżnienia horyzontu *Amoeboceras koldeweyense* w pro-filiu wiertniczym Bartoszyce IG 1 i Prabuty IG 1, gdzie oprócz typowego gatunku stwierdzono *Amoeboceras* sp. A (tabela 4). Horyzont ten w randze podpoziomu w podziale borealnym (R. M. Sykes, J. H. Callomon, 1979) został stwierdzony w typowym odsłonięciu Stafsin, w spągu poziomo-mu *Amoeboceras serratum* oraz w północno-wschodniej Grenlandii.

Poziom *Ringstaedia pseudocordata* został stwierdzony tak w osadach mulowcowych rozprzestrzenionych w pół-nocnej i północno-zachodniej Polsce, jak i w utworach węglanowych notowanych na pozostałym obszarze. Miąższość omawianego poziomu na podstawie danych z wiercen wynosi od 17 (np. w otworze Pasłęk IG 1) do 100 m (otwór Olsztyn IG 1). Dolna granica omawianego pozio-mu wyznaczona została ścisłe w otworach wiertniczych, w miejescu pojawiennia się przedstawicieli rodzaju *Rasenia* (sensu lato) — górną natomiast w miejscu określenia ty-powych dla dolnego kimerydu amonitów rodzaju *Ataxio-ceras* (L. Malinowska, 1988). Ścisłe następstwo faunistyczne w obrębie omawianego poziomu przedstawione jest na tabeli 1.

Podpoziomy: *Amoeboceras regulare* i *Amoeboceras li-neatum*:

W obrębie poziomu *Ringstaedia pseudocordata* (tab. 1) określono liczne gatunki rodzaju *Amoeboceras*, które poz-woliły na wyznaczenie dwóch podpoziomów: dolnego — *Amoeboceras regulare* i górnego — *Amoeboceras lineatum* (fig. 3, 4). Pierwszy podpoziom został dobrze wyróżniony w otworach wiertniczych: Bartoszyce IG 1, Gołdap IG 1, Środa IG 2, Wągrowiec IG 1, Olsztyn IG 1, Kcynia IG IV, Wiśniewa, Pasłęk IG 1, Piekary IG 1, Waliszewo 1, Rokietnica 1, Międzychód, Śmiłowo Kolonia 31/39, Miastko 2, Środa 1, Miroslaw 2, Lesiceniec 1, Kryniczka Morska IG 1, Czlichów IG 2, Dębowiec Warmiński 2. Drugi natomiast w profilach: Olsztyn IG 1, Gołdap IG 1, Środa IG 2, Wą-growiec IG 1, Bartoszyce IG 1, Kcynia IG IV, Pasłęk IG 1, Piekary IG 1, Waliszewo 1, Goliszew KT 5, Nidzica IG 1, Sickierki Wielkie 1, Bytyń 2 (tab. 1).

Korelacja biostratygraficzna z podziałami europejskimi

Osady górnego oksfordu Polski północnej i centralnej dzięki swej charakterystycznej faunie zostały zaliczone do prowincji subborealnej, do której należą także: południowa Anglia, Francja (Normandia, Boulonnais), północne Niemcy i europejska część Związku Radzieckiego. Trzeba tutaj podkreślić, że w północnej i północno-zachodniej Polsce brak jest przedstawicieli rodzajów typowych dla prowincji submedyterańskiej takich jak: *Idoceras*, *Larcheria*, *Passendorferia*; *Aniphilia*, *Subnebrotites*, *Epipteroeras*, a w Polsce centralnej brak jest przede wszystkim indeksowego gatunku *Epipteroeras bimammatum* (Quenstedt). Analiza zasięgu ważnych stratygraficznie gatunków amonitów, w otworach wiertniczych Polski północnej i centralnej, pozwala na ocenę dotychczas wyróżnianych poziomów w poszczególnych obszarach Polski i możliwość ich stosowania przy biostratygraficznej korelacji z krajami europejskimi (tabela 3).

Zwrócić należy uwagę na ważne opracowanie A. Gąsiewicza (1981), w którym autor omawia amonyty rodzaju *Amoeboeras ex gr. freboldi* z obszaru olkuskiego. Mogą one świadczyć o przynależności tego obszaru do prowincji subborealnej. Gatunek *Amoeboeras freboldi* Spath znany był dotychczas z osadów wschodniej Anglii, Szkocji, Grenlandii, północnej Syberii, Nowej Ziemi i arktycznej Kanady. Obecność tego gatunku w Polsce południowej jednoznacznie określa przynależność do prowincji subborealnej.

W profilach wiertniczych Polski północnej i centralnej, w obrębie poziomu *Ringsteadia pseudocordata* wyróżniono dwa podpoziomy: *Amoeboeras regulare* i *Amoeboeras lineatum*. Szczególnie ten ostatni odbiega od schematu podziału borealnego i można byloby go uznać za podpoziom charakterystyczny dla prowincji subborealnej. W podpoziomie tym oprócz gatunku typowego występują: *Amoeboeras sp. (ex gr. schulginae)*, *A. piecarum* Malinowska, *A. crenulatum* Buckmann, *Amoeboeras sp. (ex gr. crenulatum)*, *Amoeboeras sp. (ex gr. marstonense)*, *Amoeboeras sp. (ex gr. quadratolineatum)*, *Amoeboeras sp. G*, *Amoeboeras sp. J*. Gatunki te znane są z regionu Kostromy i Kaliningradu (L. Rotkylé, 1987), spotykane są również w jurze szwabskiej (B. Ziegler, 1977, H. Salfeld, 1915).

Ogólne uwagi o paleoekologii

Osady oksfordu górnego w Polsce mają szerokie rozprzestrzenienie (fig. 1). Basen górnooksfordzki miał swobodne połoczenie z sąsiadującymi zbiornikami. Na północy zaznaczył się ląd — wyniesienie Łeby, a na południowym wschodzie ląd lubelsko-wołyński. Aktualna granica zasięgu interesujących nas osadów jest wynikiem procesów denudacyjnych. Miąższość osadów górnego oksfordu w profiliach Polski północnej i centralnej wahają się od około 140 m, w profilu Olsztyn IG 1, do 37 m w profilu Pasłęk IG 1.

W obu poziomach górnego oksfordu Polski rozkład facji jest ogólnie podobny. Na północy i północnym zachodzie przeważają osady mulowcowe, ku południowi i południowemu wschodowi rozprzestrzeniają się osady wę-

gano. Osady górnego oksfordu Polski tworzą się w płytkim zbiorniku w środowisku sublitoralnym. Panujące w tym środowisku warunki uzależnione były od wielu czynników, między innymi od ukształtowania dna, konfiguracji brzegów, układu prądów, obecności lub braku pływów, temperatury itp. Miało to niewątpliwie wpływ na powstanie w odmiennych warunkach sedymentacyjnych różnych obocznie osadów i wykształcenie różnych ekosystemów. Na podstawie obserwacji fauny z wiercenia Polski północnej i centralnej, a także odsłonięć Polski południowej, nasuwa się wniosek, że warunki termiczne środowiska mogły odegrać dużą rolę przy wytwarzaniu zjawiska faunistycznej strefowości obserwowanej w osadach górnego oksfordu. Obszar Polski, jak na to wskazują fakty, jest obszarem bardzo ciekawym i ważnym z uwagi na mieszanie się wpływów południowych i północnych, zarejestrowanych w obrazie faunistycznym.

Wśród określonych gatunków rodzaju *Amoeboeras* uderza znaczna różnorodność form, wśród których z jednej strony mamy do czynienia z typowymi gatunkami dla strefy borealnej, z drugiej natomiast dla centralnych stref europejskich. To ciekawe i ważne z punktu widzenia paleozoogeografii wymieszanie gatunków pozwala uznać polski zbiornik górnooksfordzki za niezwykle ważny przy wszelkiej rodzinie faunistycznych korelacjiach. Amoeboerasy stanowią dla Polski północnej i centralnej ważny element biostratygraficzny, a ich obfite niekiedy nagromadzenie, jak np. w otworze wiertniczym Pasłęk IG 1, Bartoszyce IG 1, Gołdap IG 1 i Kcynia IG IV świadczy, że optymalnym środowiskiem sedymentacyjnym dla ich rozwoju było środowisko, w którym tworzyły się mułowce margliste.

Część systematyczna

Gromada CEPHALOPODA Cuvier, 1797

Rząd AMMONITIDA Zittel, 1884

Rodzina Cardioceratidae Siemiradzki, 1891

Rodzaj *Amoeboeras* Hyatt, 1900

Amoeboeras wrighti sp. nov.

Tabl. I, fig. 13

Holotypus: tabl. I, fig. 13.

Stratum typicum: poziom *P. cautisnigrae*, podpoziom *A. glosense*.

Locus typicus: otwór wiertniczy Gołdap IG 1 (Polska północna), głęb. 563,90 m.

Derivatio nominis: od nazwiska J. K. Wrighta, znawcy jury górnej, Yorkshire (Anglia).

1972 *Amoeboeras sp.*; J. K. Wright, tabl. 14, fig. 2

Kolekcja: MUZ PiG, coll. L. Malinowska

Opis: Muszla około 35 mm średnicy, ewolutna. Żeberka główne w liczbie 8 na 1 cm są wygięte na brzegu pępkowym ku tylowi, następnie w nieznacznym skierowaniu ku przodowi dochodzą do 2/3 wysokości boku. W tym miejscu dzielą się na dwa żeberka II rzędu. Widoczne pojedyncze żeberko.

Występowanie: Polska północna (Gołdap IG 1), podpoziom *A. glosense*; Newbridge Quarry Yorkshire, poziom *P. cautisnigrae*.

EXPLANATIONS OF PLATES

PLATE I
***Periphinctes cauismigrae* Zone**
***Amoeboceras glosense* Subzone**

- Fig. 1. *Amoeboceras* sp. H, x 1, borehole Pasłek IG 1 (Peribaltic Syneclide), deepness 796.60, MUZ IG 506. II. 237.
- Fig. 2. *Amoeboceras* sp. (ex gr. *glosense*), x 1, borehole Olsztyn IG 1, deepness 1022.80.
- Figs. 3, 5. *Amoeboceras damoni* Spath, x 1, borehole Olsztyn IG 1, 3 – deepness 1022.50; 5 – deepness 1023.30.
- Fig. 4. *Amoeboceras glosense* (Bigot et Brasil), x 1, borehole Olsztyn IG 1, deepness 1023.20.
- Figs. 6, 7. *Amoeboceras schlosseri* (Wegele), x 1.5; 6 – borehole Bartoszyce IG 1, deepness 623.20; 7 – borehole Wągrowiec IG 1, deepness 1031.80.
- Fig. 8. *Amoeboceras* sp., x 1, borehole Olsztyn IG 1, deepness 1022.80.
- Figs. 9, 18. *Amoeboceras* sp. (ex gr. *glosense*) x 1, borehole Olsztyn IG 1; 9 – deepness 1023.40; 18 – deepness 1023.10.
- Fig. 10. *Amoeboceras* sp., x 1, borehole Kcynia IG IV, deepness 459.90.
- Fig. 11. *Amoeboceras* sp., x 1, borehole Olsztyn IG 1, deepness 1022.60.
- Fig. 12. *Amoeboceras* sp. (ex gr. *damoni*), x 1, borehole Olsztyn IG 1, deepness 1022.80.
- Fig. 13. *Amoeboceras wrighti* sp. nov., x 1.5, borehole Gołdap IG 1, deepness 563.90.
- Fig. 14. *Amoeboceras* sp. B, x 1, borehole Kcynia IG IV, deepness 461.90.
- Figs. 15–17. *Amoeboceras* sp. sp., x 1; 15 – borehole Wągrowiec IG 1, deepness 1036.40; 16 – borehole Gołdap IG 1, deepness 563.90; 17 – borehole Olsztyn IG 1, deepness 1022.80.
- Fig. 19. *Amoeboceras* sp. E, x 1, borehole Kcynia IG IV, deepness 459.90; MUZ IG 141, II. 748 A. *glosense/A.serratum* Sub-zone.
- Fig. 20. *Taramelliceras* cf. *tricristatum* (Oppel), x 1, borehole Wągrowiec IG 1, deepness 1040.50.
- Figs. 21–23. *Dichotomoceras bifurcatum* (Quenstedt), 21 – x 1.5, borehole Gołdap IG 1, deepness 563.20; 22 – x 1, borehole Środa IG 2, deepness 562.10; 23 – x 1 borehole Środa IG 2, deepness 563.40.
- Fig. 24. *Dichotomoceras bifurcatoides* (Quenstedt), x 1, borehole Bartoszyce IG 1, deepness 631.50.
- Fig. 25. *Orthosphinctes* sp. (ex gr. *polygyratus*), x 1, borehole Wiśniewa 1, deepness 243.80; MUZ IG 568.II.67.
- Figs. 26ab. a – *Orthosphinctes* sp. (ex gr. *polygyratus*); b – *Microbiplices* sp., x 1, borehole Wiśniewa 1, deepness 243.80; MUZ IG 568.II.67.

PLATE II
***Periphinctes cauismigrae* Zone**
***Amoeboceras serratum* Subzone**

- Figs. 1 – 3. *Amoeboceras* cf. *koldeweyense* Sykes et Callomon; 1 – x 1.5, borehole Prabuty IG 1, deepness 1138.50; 2, 3 – x 2, borehole Bartoszyce IG 1, deepness 622.30 – *Amoeboceras koldeweyense* Horizon.
- Fig. 4. *Amoeboceras* cf. *pseudocaelatum* Spath, x 2, borehole Gołdap IG 1, deepness 546.10.
- Figs. 5, 6. *Amoeboceras* sp. A, x 1, borehole Bartoszyce IG 1, deepness 620.30. *Amoeboceras koldeweyense* Horizon.
- Figs. 7, 8. *Amoeboceras lorioli* (Oppenheimer), x 1; 7 – borehole Olsztyn IG 1, deepness 1018.80; 8 – borehole Kcynia IG IV, deepness 456.90.
- Figs. 9, 10. *Amoeboceras lorioli* (Oppenheimer) var., x 1; 7 – borehole Olsztyn IG 1; 9 – deepness 1019.20; 10 – deepness 1018.70.
- Figs. 11, 12. *Amoeboceras* sp. F, x 1, 11 – borehole Gołdap IG 1, deepness 545.80; 12 – borehole Rynarzewo 1, deepness 130.50 – MUZ IG 571.II.51.
- Figs. 13–16. *Amoeboceras* sp. (ex gr. *schulginae*), x 2, borehole Gołdap IG 1; 13, 15 – deepness 543.90; 14 – deepness 545.90; 16 – deepness 546.10.
- Fig. 17. *Amoeboceras* sp. D, x 2, borehole Gołdap IG 1, deepness 546.90.
- Figs. 18a–d. a – *Amoeboceras* sp. (ex gr. *schulginae*); b – *Amoeboceras mansoni* Pringle; c, d – *Amoeboceras* sp. sp.; x 1, borehole Olsztyn IG 1, deepness 1021.30.
- Figs. 19ab. a – *Amoeboceras* cf. *mansi* Pringle, b – *Amoeboceras* sp.; x 1, borehole Bartoszyce IG 1, deepness 617.80.
- Fig. 20. *Amoeboceras* sp. C, x 2, borehole Bartoszyce IG 1, deepness 617.20.
- Figs. 21–25. *Amoeboceras* sp. (ex gr. *ovale*), x 1; 21, 22 – borehole Nieczajna 50, deepness 308.40, MUZ IG 1023.II.18; 23 – borehole Olsztyn IG 1, deepness 1019.60; 24, 25 – borehole Wiśniewa 1, deepness 240.30, MUZ IG 568.II.52.
- Figs. 26ab. a – *Amoeboceras* sp. (ex gr. *ovale*), b – *Amoeboceras* sp.; x 1, borehole Wiśniewa 1, deepness 240.30.

PLATE III
***Periphinctes cauismigrae* Zone**
***Amoeboceras serratum* Subzone**

- Figs. 1–4. *Amoeboceras reclinatoalternans* (Nikitin), x 2; 1 – borehole Gołdap IG 1, deepness 542.40; 2 – borehole Bartoszyce IG 1, deepness 619.80; 3, 4 – borehole Gołdap IG 1, deepness 543.20.
- Figs. 5, 6. *Amoeboceras* sp. (ex gr. *serratum*), x 1, borehole Bartoszyce IG 1, deepness 618.20.

Figs. 7–11. *Amoeboceras* sp. sp.; 7 – x 1, borehole Gołdap IG 1, deepness 546.90; 8 – x 1, borehole Olsztyn IG 1, deepness 1018.40; 9, 10 – x 1, borehole Olsztyn IG 1, deepness 1020.20; 11 – x 2, borehole Gołdap IG 1, deepness 545.20.

Figs. 12–14. *Amoeboceras* cf. *praebauhini* (Salfeld), x 2; 12 – borehole Gołdap IG 1, deepness 543.90; 13 – borehole Wągrowiec IG 1, deepness 1025.20; 14 – borehole Gołdap IG 1, deepness 540.20.

Figs. 15a–d. a – *Amoeboceras reclinatoalternans* (Nikitin); b, d – *Amoeboceras* sp.; c – *Amoeboceras* sp. (ex gr. *ovale*), x 1, borehole Środa IG 1, deepness 240.30, MUZ IG 568.II.48.

Figs. 16–17. *Amoeboceras reclinatoalternans* (Nikitin), x 1; 16 – borehole Nieczajna 50, deepness 308.40, MUZ IG 1023.II.18; 17 – borehole Międzychód 1, deepness 665.30, MUZ IG 781.II.41.

Figs. 18a–d. a – *Amoeboceras reclinatoalternans* (Nikitin); b – *Amoeboceras* sp. (ex gr. *serratum*); c, d – *Amoeboceras* sp. sp., x 1, borehole Bartoszyce IG 1, deepness 618.60.

Fig. 19. *Amoeboceras* sp. (ex gr. *serratum*), x 1, borehole Bartoszyce IG 1, deepness 618.60.

Figs. 20a–d. a, b – *Amoeboceras reclinatoalternans* (Nikitin); c – *Amoeboceras* sp.; d – *Amoeboceras* sp. (ex gr. *ovale*); x 1, borehole Wiśniewa IG 1, deepness 241.40, MUZ IG 568.II.52.

Figs. 21a–d. a, b – *Amoeboceras reclinatoalternans* (Nikitin); c – *Amoeboceras* sp.; d – *Amoeboceras* sp. (ex gr. *ovale*); x 1, borehole Wiśniewa IG 1, deepness 240.30.

PLATE IV *Perispinctes cautisnigrae* Zone *Amoeboceras serratum* Subzone

Figs. 1–4. *Amoeboceras* sp. sp., x 2; 1 – borehole Gołdap IG 1, deepness 545.60; 2 – borehole Gołdap IG 1, deepness 543.90; 3 – borehole Bartoszyce IG 1, deepness 618.60; 4 – borehole Gołdap IG 1, deepness 747.70.

Fig. 5. *Amoeboceras* sp. (ex gr. *serratum*), x 1, borehole Olsztyn IG 1, deepness 1022.40.

Fig. 6. *Amoeboceras* sp. (ex gr. *reichenbachense*), x 1, borehole Gołdap IG 1, deepness 546.20.

Figs. 7a–c. a – *Amoeboceras reichenbachense* (Salfeld), b, c – *Amoeboceras* cf. *leucum* Spath; x 1, borehole Bartoszyce IG 1, deepness 618.60.

Figs. 8a–c. a – *Amoeboceras reichenbachense* (Salfeld), b, c – *Amoeboceras* cf. *reclinatoalternans* (Nikitin); x 1, borehole Bartoszyce IG 1, deepness 618.60.

Figs. 9–22. *Amoeboceras reichenbachense* (Salfeld), x 1; 9, 17 – borehole Kcynia IV, deepness 458.90; 10 – borehole Bartoszyce IG 1, deepness 619.80; 11 – borehole Gołdap IG 1, deepness 549.50; 12, 14–16, 19 – borehole Bartoszyce IG 1, deepness 618.60; 13 – borehole Olsztyn IG 1, deepness 1020.40; 20 – borehole Wągrowiec IG 1, deepness 1024.50; 18, 21, 22 – borehole Kcynia IV, deepness 448.00.

Figs. 23a–d. a – *Amoeboceras reichenbachense* (Salfeld); b, d – *Amoeboceras* sp. sp., c – *Amoeboceras* sp. (ex gr. *serratum*); x 1, borehole Bartoszyce IG 1, deepness 618.60.

Plate V *Perispinctes cautisnigrae* Zone *Amoeboceras serratum* Subzone

Figs. 1–15. *Amoeboceras* sp. sp.; 1, 2 – x 2, borehole Gołdap IG 1, deepness 547.50; 3 – x 2, borehole Bartoszyce IG 1, deepness 617.80; 4, 6 – x 2, borehole Gołdap IG 1, deepness 543.90; 5, 7 – x 1, borehole Bartoszyce IG 1, deepness 618.60; 8 – x 1, borehole Rynarzewo 1, deepness 122.00; 9, 15 – x 2, borehole Bartoszyce IG 1, deepness 619.40; 10 – x 1, borehole Olsztyn IG 1, deepness 1018.60; 11 – x 1, borehole Gołdap IG 1, deepness 544.50; 12 – x 1, borehole Olsztyn IG 1, deepness

987.30; 13 – x 4, borehole Gołdap IG 1, deepness 539.20; 14 – x 2, borehole Gołdap IG 1, deepness 545.30.

Figs. 16–18. *Amoeboceras* sp. (ex gr. *serratum*); 16 – x 1.5, borehole Bartoszyce IG 1, deepness 621.20; 17 – x 1, borehole Wiśniewa 1, deepness 240.30, MUZ IG 568.II.47; 18 – x 1, borehole Gołdap IG 1, deepness 548.40.

Figs. 19–28. *Amoeboceras serratum* (Sowerby); 19 – x 1, Olsztyn IG 1, deepness 1022.40; 20, 23 – x 1, borehole Bartoszyce IG 1, deepness 619.60; 21, 27 – x 1, borehole Gościewo 1, deepness 1474.00; 22 – x 1, borehole Rynarzewo 1, deepness 126.15, MUZ IG 571.II.53; 25 – x 1, borehole Olsztyn IG 1, deepness 1018.70; 26–28 – x 1, borehole Środa IG 2, deepness 561.70.

Plate VI

Perispinctes cautisnigrae Zone *Amoeboceras serratum* Subzone

Figs. 1, 17. *Amoeboceras* sp. (ex gr. *serratum*); 1 – x 2, borehole Bartoszyce IG 1, deepness 619.40; 17 – x 2.5, borehole Gołdap IG 1, deepness 545.80; 18 – x 2, borehole Gołdap IG 1, deepness 547.50.

Fig. 2, 6–13. *Amoeboceras* sp. sp.; 2 – x 2, borehole Bartoszyce IG 1, deepness 618.60; 6 – x 2, borehole Bartoszyce IG 1, deepness 622.30; 7 – x 2, borehole Bartoszyce IG 1, deepness 617.80; 8 – x 2, borehole Gołdap IG 1, deepness 545.50; 9 – x 1.5, borehole Prabuty IG 1, deepness 1138.50; 10 – x 2, borehole Gołdap IG 1, deepness 543.90; 12 – x 1, borehole Wiśniewa, deepness 241.00, MUZ IG 568.II.52; 13 – x 2, borehole Gołdap IG 1, deepness 545.60.

Figs. 3, 4. *Amoeboceras* sp. (ex gr. *mansi*), x 2, borehole Bartoszyce IG 1; 3 – deepness 617.80; 4 – deepness 619.80.

Fig. 5. *Amoeboceras* sp. (ex gr. *ovale*), x 2, borehole Gołdap IG 1, deepness 546.20.

Figs. 14, 15. *Amoeboceras* sp. (ex gr. *schulginae*); 14 – x 2.5, borehole Gołdap IG 1, deepness 545.00; 15 – x 2, borehole Gołdap IG 1, deepness 542.40.

Fig. 16. *Amoeboceras* sp. (ex gr. *reichenbachense*), x 2, borehole Olsztyn IG 1, deepness 1018.50. .

Plate VII

Perispinctes cautisnigrae Zone *Amoeboceras serratum* Subzone

Fig. 1. *Ochetoceras* sp., x 1, borehole Gołdap IG 1, deepness 547.70.

Figs. 2, 3. *Taramelliceras rigidum* (Wegele), x 1, borehole Rokietnica 1, deepness 773.60.

Fig. 4. *Lingulatriceras* sp., x 1, borehole Rokietnica, deepness 774.90.

Figs. 5, 6. *Ringstedia salfeldi* Dorn, x 1, borehole Bartoszyce IG 1, deepness 620.10.

Fig. 7. *Orthospinctes virgulatus* (Quenstedt), x 1, borehole Gołdap IG 1, deepness 547.70.

Fig. 8. *Epipeltoceras* sp., x 1, borehole Wągrowiec IG 1, deepness 1021.20.

Fig. 9. *Taramelliceras costatum* (Quenstedt), x 1, borehole Kcynia IG IV, deepness 420.50.

Figs. 10–12. *Amoeboceras* sp. (ex gr. *leucum*); 10 – x 1, borehole Olsztyn IG 1, deepness 1018.30; 11 – x 2, borehole Rynarzewo 1, deepness 122.70, MUZ IG 571.II.20; 12 – x 2, borehole Gołdap IG 1, deepness 543.90.

Figs. 13–15. *Amoeboceras leucum* Spath; 13 – x 2, borehole Bartoszyce IG 1, deepness 618.80; 14 – x 2, borehole Gołdap IG 1, deepness 543.90; 15 – x 1, borehole Bartoszyce IG 1, deepness 618.60.

Figs. 16a,b. a – *Amoeboceras leucum* Spath, b – *Amoeboceras* cf. *serratum* (Sowerby); x 1, borehole Olsztyn IG 1, deepness 1021.30.

- Figs. 17–18. *Microbiplices* sp. sp., x 1, borehole Krynia IG IV; 17 – deepness 430.20; 18 – deepness 457.90.
- Fig. 19. *Dichotomoceras bifurcatoides* Enay, x 1, borehole Bartoszyce IG 1, deepness 617.80.

Plate VIII
Ringsteadia pseudocordata Zone
Amoeboceras regulare Subzone

- Figs. 1–3. *Amoeboceras ravnii* Spath; 1, 2 – x 2, borehole Krynia Morska IG 1, deepness 567.40; 3 – x 1, borehole Lesieniec 1, deepness 513.20.
- Figs. 4–6. *Amoeboceras pectinatum* Mesezhnikov; 4 – x 1, borehole Krynia IG IV, deepness 388.70; 5 – x 1, borehole Piekary IG 1, deepness 261.80, MUZ IG 1311.II.48; 6 – x 1, borehole Piekary IG 1, deepness 264.60, MUZ IG 1311.II.51.
- Fig. 7. *Amoeboceras cf. regulare* Spath, x 1, borehole Śmiłowo Kolonia 31/93, deepness 184.00.
- Fig. 8. *Amoeboceras regulare* Spath, x 1, borehole Dębowiec Wartniński 2, deepness 700.00.
- Fig. 9. *Amoeboceras freboldii* Spath, x 1, borehole Dębowiec Wartniński 2, deepness 700.00.
- Fig. 10. *Amoeboceras* sp. (ex gr. *schulginae*), x 1, borehole Olsztyn IG 1, deepness 924.80.
- Fig. 11. *Amoeboceras* sp., x 2, borehole Gołdap IG 1, deepness 533.10.
- Fig. 12. *Amoeboceras* sp. F, x 1, borehole Olsztyn IG 1, deepness 932.80.
- Figs. 13, 14. *Ringsteadia salfeldii* Dorn, x 1.5, borehole Krynia Morska IG 1; 13 – deepness 566.20; 14 – deepness 567.10.
- Fig. 15. *Ringsteadia weinlandi* (Fischer), x 1, borehole Olsztyn IG 1, deepness 935.60.

Plate IX
Ringsteadia pseudocordata Zone
Amoeboceras regulare Subzone

- Fig. 1. *Eurasenia primera* (Oppel), x 1.5, borehole Bartoszyce IG 1, deepness 599.70.
- Fig. 2. *Ringsteadia* sp., x 1.5, borehole Krynia Morska IG 1, deepness 567.10.
- Fig. 3. *Linguliceras sculptatum* Ziegler, x 1.5, borehole Olsztyn IG 1, deepness 925.70.
- Fig. 4. *Prorasenia* sp. x 2, borehole Bartoszyce IG 1, deepness 598.20.
- Fig. 5. *Raseniodes transitorius* (Schindewolf), x 1, borehole Bartoszyce IG 1, deepness 584.00.
- Fig. 6. *Coryceras modestiforme* (Oppel), x 1, borehole Rokietnica 1, deepness 774.20.
- Fig. 7, 16. *Prorasenia crenata* (Quenstedt), x 1; 7 – borehole Śmiłowo Kolonia 31/93, deepness 179.80; 16 – borehole Gołdap IG 1, deepness 532.70.
- Fig. 8. *Taramelliceras costatum* (Quenstedt), x 1, borehole Gołdap IG 1, deepness 533.30.
- Fig. 9. *Prorasenia* cf. *quenstedti* (Schindewolf), x 1, borehole Krynia Morska IG 1, deepness 567.60.
- Fig. 10. *Prorasenia* cf. *bathyschista* Koerner, x 1, borehole Gołdap IG 1, deepness 532.70.
- Fig. 11. *Coryceras modestiforme* (Oppel), x 1, borehole Środa IG 2, deepness 518.60.
- Fig. 12. *Taramelliceras ausfeldi* (Wueremb.), x 1, borehole Środa IG 2, deepness 521.10.
- Fig. 13. *Ringsteadia* sp., x 1, borehole Krynia Morska IG 1, deepness 566.00.

- Figs. 14, 15. *Taramelliceras wenzeli* (Oppel), x 1, borehole Środa IG 2, deepness 514.20.
- Fig. 17. *Taramelliceras* cf. *externodosum* Dorn, x 1, borehole Miroslaw 2, deepness 129.00, MUZ IG 778.II.2.

Plate X
Ringsteadia pseudocordata Zone
Amoeboceras lineatum Subzone

- Figs. 1–3, 14. *Amoeboceras lineatum* (Quenstedt); 1–3 – x 2, borehole Gołdap IG 1, deepness 522.20; 14 – x 1, borehole Olsztyn IG 1, deepness 885.00.
- Figs. 4–8. *Amoeboceras* sp. (ex gr. *quadratolineatum*); 4 – x 2.5, borehole Gołdap IG 1, deepness 518.50; 5 – x 2, borehole Gołdap IG 1, deepness 505.20; 6 – x 2, borehole Bartoszyce IG 1, deepness 570.00; 7 – x 2, borehole Bartoszyce IG 1, deepness 575.00; 8 – x 2, borehole Bartoszyce IG 1, deepness 574.60.
- Fig. 9. *Amoeboceras* sp. G, x 1, borehole Pasłek IG 1, deepness 763.50.
- Figs. 10–12. *Amoeboceras* sp. (ex gr. *crenatum*), x 2; 10 – borehole Bartoszyce IG 1, deepness 574.60; 11 – borehole Bartoszyce IG 1, deepness 575.70; 12 – borehole Gołdap IG 1, deepness 510.90.
- Fig. 13. *Amoeboceras crenatum* (Buckmann), x 1, borehole Bartoszyce IG 1, deepness 580.20.
- Figs. 15–20. *Amoeboceras* sp. I, x 2, borehole Bartoszyce IG 1, 15–17, 19, 20 – deepness 575.20; 18 – deepness 574.90.

Plate XI
Ringsteadia pseudocordata Zone
Amoeboceras lineatum Subzone

- Figs. 1ab. a – *Amoeboceras* sp. (ex gr. *marstonense*); b – *Amoeboceras crenatum* (Buckmann); x 1, borehole Pasłek IG 1, deepness 763.00.
- Figs. 2–5. *Amoeboceras* sp. (ex gr. *marstonense*), x 1, borehole Pasłek IG 1, deepness 763.00.
- Fig. 6. *Taramelliceras* sp. (ex gr. *wenzeli*), x 1, borehole Bytyń 2, deepness 616.00.
- Figs. 7–12. *Amoeboceras piccarum* Malinowska, x 1; 7 – borehole Bartoszyce IG 1, deepness 574.60; 8, 11 – borehole Piekary IG 1, deepness 228.20, MUZ IG 1311.II.101.102; 9 – borehole Piekary IG 1, deepness 234.60, MUZ IG 1311.II.84; 10 – borehole Piekary IG 1, deepness 232.10, MUZ IG 1311.II.92; 12 – borehole Piekary IG 1, deepness 231.60, MUZ IG 1311.II.84.
- Figs. 13, 18. *Prorasenia* cf. *crenata* (Quenstedt), x 1, borehole Gołdap IG 1, deepness 505.20.
- Fig. 14. *Taramelliceras pseudowenzeli* (Wegele), x 1, borehole Olsztyn IG 1, deepness 923.10.
- Fig. 15. *Taramelliceras wenzeli* (Oppel), x 1, borehole Olsztyn IG 1, deepness 909.70.
- Fig. 16. *Taramelliceras* sp. (ex gr. *litocerum*), x 1, borehole Bartoszyce IG 1, deepness 577.80.
- Fig. 17. *Taramelliceras litocerum* (Oppel), x 1, borehole Bartoszyce IG 1, deepness 578.80.
- Fig. 19. *Prorasenia* cf. *quenstedti* Schindewolf, x 1, borehole Bartoszyce IG 1, deepness 570.00.
- Figs. 20, 21. *Ringsteadia* sp. sp., x 1; 20 – borehole Goliszew KT 5, deepness 20.20, MUZ IG 827.II.9; 21 – borehole Nidzica IG 1, deepness 1260.00, MUZ IG 767.II.222.
- Fig. 22. *Taramelliceras* cf. *tenuinodosum* (Wegele), x 1, borehole Siekierki Wielkie 1, deepness 744.60, MUZ IG 1376.II.3.

