I N S T Y T U T G E O L O G I C Z N Y
BIULETYN 291

Z BADAŃ STRATYGRAFICZNO-PALEONTOLOGICZNYCH W POLSCE

TOM VIII

(z 30 fig. i 3 tabl.)

СТРАТИГРАФО-ПАЛЕОНТОЛОГИЧЕСКИЕ ИССЛЕДОВАНИЯ В ПОЛЬШЕ

ТОМ VIII

(с 30 фиг. и 3 табл.)

STRATIGRAPHICAL-PALAEONTOLOGICAL INVESTIGATIONS IN POLAND

VOL. VIII

(with 30 Figs. and 3 Pls.)

W A R S Z A W A 1976
W Y D A W N I C T W A G E O L O G I C Z N E

Redaktor: mgr Ewa CHABELSKA

Na wniosek Przewodniczącego Komisji
Geologii Podstawowej i Badań Laboratoryjnych
doc. dr Aleksandra JELIŃSKIEGO
akceptował do druku dn. 21.3.1974 r.
dyrektor Instytutu Geologicznego
prof. Roman OSIKA

Redaktor techniczny: A. Bieńkowska

Korektor: M. Świetlik

WYDAWNICTWA GEOLOGICZNE — WARSZAWA 1976

Wydanie I. Nakład 500+80 egz. Format B5. Ark. wyd. 13,0. Ark. druk. 8,75. Papier druk. sat. kl. III B1/80 g. Oddano do składania 1.IX.1975 r. Podpisano do druku 7.IX.1976 r.
Druk ukończono we wrześniu 1976 r.

Lubelskie Zakłady Graficzne — Lublin, Unicka 4. Zam. 2120/75. J-94

SPIS TREŚCI

Lidia MALINOWSKA

Boreal Faunal Influences in the Lower and Middle Oxfordian of Poland 5

Бореальные фаунистические влияния в нижнем и среднем оксфорде Польши 41

Faunistyczne wpływy borealne w oksfordzie dolnym i środkowym Polski . 46

Aleksandra KRASSOWSKA

Kreda między Zamościem, Tomaszowem Lubelskim a Kryłowem . . 51

Мел в районе местностей Замосць, Томашув-Любельски и Крылув 93

The Cretaceous Between Zamość, Tomaszów Lubelski and Kryłów . 99

Emilia WITWICKA

Stratygrafia mikropaleontologiczna osadów kredy górnej w rejonie Zamościa 103

Микропалеонтологическая стратиграфия верхнего мела в районе Замосця 121

Micropalaeontological Stratigraphy of the Upper Cretaceous in the Vicinity of Zamość 124

INSTYTUT GEOLOGICZNY, BIULETYN 291, 1976 r.
Z badań stratygraficzno-paleontologicznych w Polsce. Tom. VIII

UKD 551.862.31.07:564.53+564.1(212.3)(438)

Lidia MALINOWSKA

BOREAL FAUNAL INFLUENCES IN THE LOWER AND MIDDLE OXFORDIAN OF POLAND

(with 3 Figs. and 3 Pls.)

Abstract

Penetrating from the east and north-west, boreal faunal influences determined biostratigraphical zones distinguished in Poland within the Lower and Middle Oxfordian beds. It may be assumed on the whole that the zones characterize the overlapping of two zoogeographical provinces, the subboreal and the sub-Mediterranean ones, during that period in the territory of Poland. Obviously, it is not easy to mark off precisely the boundary of this overlapping, but we may adopt the Cracow—Przemyśl line as a hypotetical line of division.

The boreal influences in the Lower and Middle Oxfordian of Poland have here been analyzed on the basis of the presence and quantity of ammonites of the genera: *Quenstedticeras, Cadoceras, Longaeviceras (?), Praecardioceras, Cardioceras, Goliathiceras, Pachycardioceras, Cawtoniceras, Maltoniceras, Amoeboceras, Amoebites* and *Kosmoceras,* as well as pelecypods of the genus *Aucella.* At the same time, studies have been conducted on the quantities of Mediterranean species, occurring in the Lower and Middle Oxfordian sediments, as compared with the number of these species in the area of the south-French and south-German Jurassic.

During that period, the northern and central parts of the Polish Basin were undoubtedly under the boreal faunal influence and, therefore, this area has been assigned to the subboreal province, with appropriate ammonite zones introduced to biostratigraphical sub-divisions. On the other hand, the southern part of this basin, corresponding to present-day area situated south of the Cracow—Przemyśl line, should be considered as a part of the sub-Mediterranean province.

Differences observed in the assemblage of fauna within the Polish Basin in the Lower and Middle Oxfordian are undoubtedly determined by palaeogeographical configurations and climatic factors.

INTRODUCTION

After the flood of the Callovian sea the Lower Oxfordian sea transgressed the territory of Poland. As follows from the analysis of the distribution of fauna, mostly ammonites, the Lower Oxfordian sea was connected with adjoining basins in the north, north-west and east. On the other hand, southwards, the connection with the Carpathian Basin in the lower part of the Lower Oxfordian was rather difficult. The Lower Oxfordian

sea drifted fauna of the boreal type, which was indicative of the direction of migration.

On a general assumption, in the lower part of the Lower Oxfordian, northern and western Poland (Fig. 1) was under a definitive boreal influence, of which we may become convinced after studying if only a few past years' rich stratigraphical and palaeontological literature (R. Dadlez, 1958; K. Dayczak-Calikowska, 1959; J. Znosko, 1959; S. Marek, 1961; J. Dembowska, 1962a, 1964; R. Dadlez, J. Dembowska, 1965; L. Malinowska, 1966). Assigning the area of northern Poland in the lower part of the Lower Oxfordian to the subboreal province should not, therefore, arouse any reservations.

On the other hand, the questions how far the boreal influences reached in the south of Poland during that period and what their intensity was are the subject of a further part of the present paper. However, we can already generalize the statement that the presence of boreal species and,

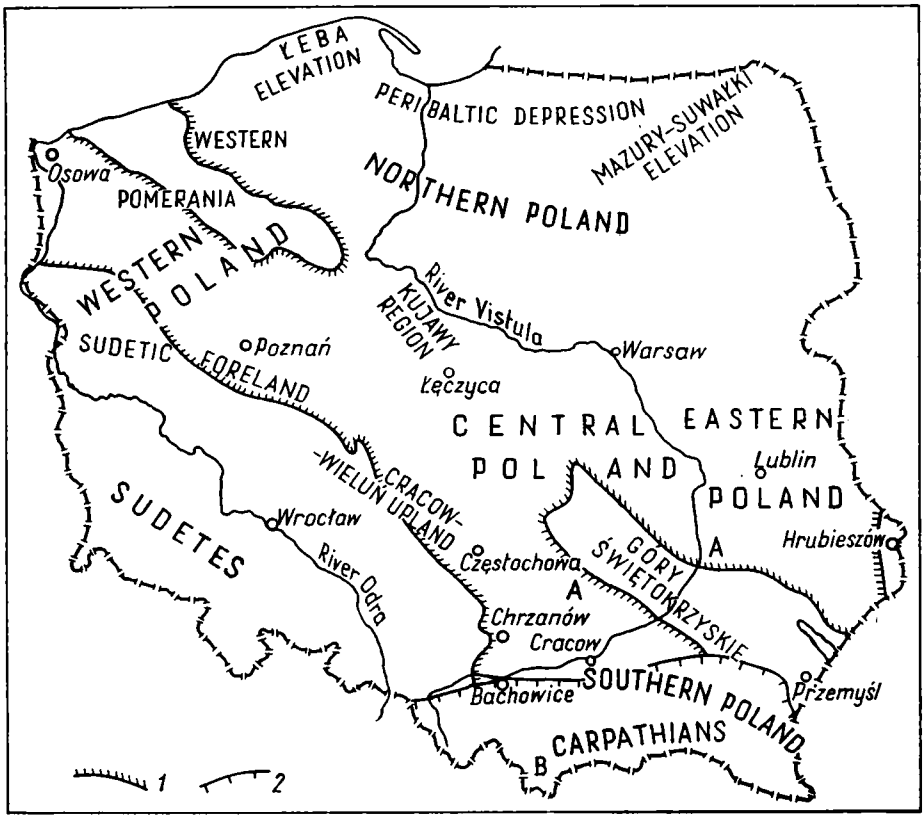


Fig. 1. Distribution of the Lower and Middle Oxfordian sediments in Poland
1 — boundary of the present-day range of sediments, *2* — line of the Carpathian overthrust; regions cited in text: *A* — margin of the Góry Świętokrzyskie, *B* — Pieniny Klippen Belt

Rozprzestrzenienie osadów oksfordu dolnego i środkowego w Polsce
1 — granica obecnego zasięgu osadów, *2* — linia nasunięcia karpackiego; regiony cytowane w tekście: *A* — obrzeżenie Gór Świętokrzyskich, *B* — pieniński pas skałkowy

in particular, their accumulation in the sediments of the lower part of the Lower Oxfordian of the Częstochowa Jurassic and the margin of the Góry Świętokrzyskie reach such a great degree that acknowledging this area as a southern zone of the subboreal province in the territory of Poland seems to be quite convincing.

The presence of boreal species in the sediments of the lower part of the Lower Oxfordian of the Cracow Jurassic enables separating ammonite zones, the same as those distinguished for this age in northern and central Poland. More to the south, in the Carpathian zone of the Polish area, species of the genus *Quenstedticeras* have never been found so far.

In the upper part of the Lower Oxfordian the boreal influences still persist but they are already accompanied by considerable effects of the Mediterranean fauna, particularly strongly marked in the Carpathian zone and less so in the Częstochowa Jurassic and on the margin of the Góry Świętokrzyskie.

The zoogeographical classification of the Middle Oxfordian of Poland should be discussed separately. In northern Poland this classification is determined by a considerable number of boreal species of the family Cardioceratidae, whereas the Częstochowa Jurassic, the margin of the Góry Świętokrzyskie and the area situated more to the south are now the object of studies intendend to elucidate this problem.

It follows from the review of literature published so far that the Middle Oxfordian sediments of the Cracow—Częstochowa Jurassic were traditionally assigned as a whole to the sub-Mediterranean zoogeographical province. Consequently, the ammonite zones were separated and given names by comparing them with previously described south-German zones, even in the case when no index ammonite species [1] were found in Polish sediments (L. Zejszner, 1869; F. Roemer, 1870; G. Bukowski, 1887; J. Siemiradzki, 1891, 1899, 1922; J. Premik, 1934; W. Brochwicz-Lewiński, 1970, 1972 and others).

We may suppose that the future, now already planned, faunal studies of Middle Oxfordian sediments in the area situated more to the south (the sub-Carpathian and Carpathian Jurassic) will undoubtedly confirm the assignment of this area to the sub-Mediterranean province. On the other hand, the Middle Oxfordian of the Częstochowa Jurassic and the margin of the Góry Świętokrzyskie would still remain in the zone of boreal influences, which is reflected in the quality and quantity of species.

The boreal influences in the Lower and Middle Oxfordian of Poland have been analyzed on the basis of the presence and quantity of ammonites assigned to the genera: *Quenstedticeras, Cadoceras, Longaeviceras* (?), *Praecardioceras, Cardioceras, Goliathiceras, Pachycardioceras, Cawtoniceras, Maltoniceras, Amoeboceras, Amoebites* and *Kosmoceras,* as well as pelecypods of the genus *Aucella.* At the same time, the number of sub-Mediterranean species, occurring in the Lower and Middle Oxfordian sediments, have been studied in comparison with their number in the area of the south-French and south-German Jurassic.

---

[1] The present writer believes that it is more correct to name zones after index species actually found in sediments than merely on the basis of comparisons. This enables more correct palaeogeographical and zoogeographical conclusions and preparing more reliable bases for conducting correlations.

THE OCCURRENCE AND FAUNAL CHARACTERISTICS OF THE LOWER AMD MIDDLE OXFORDIAN SEDIMENTS

THE LOWER OXFORDIAN

Beds with *Quenstedticeras*

Beds with *Quenstedticeras* are characteristic of the lower part of the Lower Oxfordian. They are widely distributed in Poland outside the Carpathians. They were recognized nearly in the entire territory of the country except for the Sudetic area, the Łeba Elevation and the region of Hrubieszów [2] (R. Dadlez, K. Dayczak-Calikowska, K. Dembowska, 1964). So far, no faunal data are available concerning the occurrence of these beds in the sub-Carpathian and Carpathian areas. The Cracow and Przemyśl Jurassic form the southernmost area in which the beds with *Quenstedticeras* have ever been recorded.

These beds are developed in two facies. The sediments of the marly--calcareous facies occur in the Cracow—Wieluń Jurassic, in the margin of the Góry Świętokrzyskie and in eastern and central Poland, whereas the sediments of the siltstone facies are known in northern and north--western Poland. The greatest thickness of the beds with *Quenstedticeras*, amounting to about 12.5 m., was found in the Osowa borehole (map sheet of Wolin), north-western Poland, where they occur in a siltstone facies.

The beds with *Quenstedticeras* may be observed in outcrops only within the Cracow—Wieluń Jurassic and on the margin of the Góry Świętokrzyskie.

On the margin of the Góry Świętokrzyskie the beds with *Quenstedticeras* have so far been found in the following outcrops:

Świnna near Opoczno (S. Z. Różycki, 1955), Podgrodzie near Ćmielów and Szwedy near Mnin (L. Malinowska, 1967b).

In the Cracow—Wieluń Jurassic they occur at:

Wieluń (J. Premik, 1924; Z. Mossoczy, 1960), Pierzchno, Jasna Góra, Przybynów, Ciągowice, Wysoka Pilecka, Łazy, Bzów, Ogrodzieniec II, Rodaki, Pustkowie—Kąty, Ryczówek, Klucze—Gliny, Klucze, Jaroszowiec, Grójec, Rzeczki, Parcze Dolne, Parcze Górne, Sikorka Dolna, Kozłowiec, Chrzanów, Bolęcin—Piła, Filipowice, Czerna (S. Z. Różycki, 1953), Kłobuck (S. Z. Różycki, 1953; L. Malinowska, 1963), Paczółtowice, Czatkowice, Racławice, Głuchówka, Podłęże, Radwanowice, Brodła (K. Wójcik, 1910), Nowa Krystyna (K. Dayczak-Calikowska, a manuscript of her degree thesis), Grójec near Alwernia (S. Zaręczny, 1894), Pomorzany, Włodowice (J. Siemiradzki, 1922; S. Z. Różycki, 1953).

In addition, data on the beds with *Quenstedticeras* were obtained from many boreholes such as:

Osowa in Western Pomerania (K. Dayczak-Calikowska, 1959), Kozielice, Sławno, Koplino, Kretlewo, Korytowo, Pobierowo, Mirosław 2, Słupy, Wiśniewa, Samsieczno, Sadłogoszcz 3 in western Poland (R. Dadlez, J. Dembowska, 1965; L. Malinowska,

[2] Some of the main localities, cited in the text, are shown in Fig. 1. In other cases, only larger geographical areas are marked in which the localities cited are situated.

1966), Kcynia IV in western Poland (J. Dembowska, 1964), Rokita, Międzychód, Chociwle 2, Dolice, Sierpc Geo 1, Oświno, Kobylniki, Wierzchowo 2, Gostynin IG 3 and 4, Wolin IG 1, Drawiny, Recław IG 1, Jamno IG 3, Korytowo, Mirosław 2 in western Poland (L. Malinowska, unpublished archival materials), Piekary in the Sudetic Foreland (L. Malinowska, 1966), Gołdap, Bartoszyce in the Peribaltic Depression (L. Malinowska, 1966), Parczew, Żyrzyn, Warsaw, Olszyny, Kętrzyn, Olsztyn, Kock, Cieszanów in eastern Poland (T. Niemczycka, 1964, 1965, 1970, 1973, 1976), Wierbka on the Pilica (S. Bukowy, A. Siewniak, 1963), Wodna, Trzebionka, Piaski, Luszowice, Brzezinki in the region of Chrzanów (L. Malinowska, 1958), Augustopol, Kocewia, Dąbrowice TK 4 in the Kujawy region (S. Marek, 1961), Sierpów IG 1, Dzieżbiętów, Łęczyca Tumska, Topola Duchowna, Sławoszew, Gąsiorów, Mazew in the region of Łęczyca (J. Znosko, 1957), Suwałki, Kruszyniany, Krasnopol 1 and 4, Sokółka 4, 7 and 8, Podborowisko 1, Grodziska IG 5 in north-eastern Poland (J. Znosko, unpublished archival materials).

The data obtained from the boreholes enabled a faunal correlation of the lower part of the Lower Oxfordian of the territory of Poland outside the Carpathians (Fig. 2).

Abundant specimens of fauna, mostly of the genera *Quenstedticeras*, *Praecardioceras*, and *Kosmoceras*, along with single *Cadoceras* and *Longaeviceras* (Table 1), were obtained from cores and outcrops of the non-Carpathian part of Poland. Particular sectors of cores were filled with *Quenstedticeras* as, for example, those in the Rokita borehole, Western Pomerania (Pl. I). In this group, of interest is the occurrence of *Quenstedticeras irinae* Sasonov (Pl. II), typical species of the Lower Oxfordian of the Russian Platform (N. T. Sasonov, 1957 — Pl. X, Figs. 1 — 3). In the fauna of the lower part of the Lower Oxfordian, widely distributed in northern Poland in siltstone facies, also interesting is the occurrence of such southern species as *Parapeltoceras caprinum fraasi* Prieser and *Peltoceratoides athletoides* (Lahusen) (L. Malinowska, 1966). Southern species are also known within the beds with *Quenstedticeras* of the non-Carpathian part of Poland, but in regard to the number of both species and specimens they are of minor importance. The following genera are represented: *Peltoceras* (*P. athleta*), *Peltoceratoides* (*P. athletulum*, *P. athletoides*), *Parapeltoceras* (*P. pseudocaprinum*, *P. caprinum fraasi*), *Collotites* (*Collotites sp.*), *Lunuloceras* (*L. pseudopunctatum*, *L. matheyi*), *Putealiceras* (*P. svevum*), *Rossiensiceras* (*R. rossiense*), and *Taramelliceras* (T. *incospicuum*).

The localities Podłęże, south-west of Cracow, and Kruhel Wielki near Przemyśl (K. Wójcik, 1910, 1913), are the southernmost places in which the traces of *Quenstedticeras* may be found.

An interesting lithological development of the lower part of the Lower Oxfordian was found in boreholes in the region of Chrzanów. In this area, the sediments are developed in the form of glauconitic marls, termed in literature as ornatum clays (W. Teisseyre, 1889; T. Wiśniowski, 1890; S. Zaręczny, 1894), directly overlaying the Callovian sediments. As shown by macroscopic observation, the Upper Callovian glauconitic marls are more clayey than the overlaying marls of the lower part of the Lower Oxfordian. The boundary between the Callovian and the Oxfordian was determined on the basis of the appearance of the first specimens of *Quenstedticeras* (L. Malinowska, 1958). It is worth emphasizing that only single specimens of southern fauna of the subfamily Hecticoceratinae were found in these sediments, with a simultaneous considerable accumulation of specimens of the genus *Quenstedticeras*.

Table 1

The occurrence of the species of the genera *Quenstedticeras, Praecardioceras, Kosmoceras, Cadoceras* and *Longaeviceras* (?) in the sediments of the lower part of the Lower Oxfordian of Poland

Występowanie gatunków rodzaju *Quenstedticeras, Praecardioceras, Kosmoceras, Cadoceras* i *Longaeviceras* (?) w osadach niższej części oksfordu dolnego Polski

Species	Poland		
	north.	cent.	south.
Quenstedticeras (*Lamberticeras*) *brasili* Douville	+	+	
Quenstedticeras (*Lamberticeras*) *flexicostatum* (Phillips)	+	+	+
Quenstedticeras (*Lamberticeras*) *henrici* Douville	+	+	
Quenstedticeras (*Lamberticeras*) cf. *henrici* Douville		+	
Quenstedticeras (*Lamberticeras*) *intermissum* Buckman	+		
Quenstedticeras (*Lamberticeras*) cf. *intermissum* Buckman	+	+	
Quenstedticeras sp. (ex gr. *intermissum* Buckman)			+
Quenstedticeras (*Lamberticeras*) *lamberti* (Sowerby)	+	+	+
Quenstedticeras (*Lamberticeras*) cf. *lamberti* (Sowerby)	+	+	
Quenstedticeras (*Lamberticeras*) *lamberti* Douville (non Sowerby)		+	
Quenstedticeras sp. (ex gr. *lamberti* Sowerby)	+		+
Quenstedticeras (*Lamberticeras*) *lamberti macer* (Quenstedt)	+		
Quenstedticeras (*Lamberticeras*) *lamberti gregariaeformis* Maire	+		
Quenstedticeras (*Lamberticeras*) *lamberti pseudomariae* Maire	+		
Quenstedticeras (*Lamberticeras*) *lorioli* Maire		+	
Quenstedticeras (*Lamberticeras*) *praelamberti* Douville		+	+
Quenstedticeras (*Lamberticeras*) *pseudobrasili* Maire	+		
Quenstedticeras (*Lamberticeras*) *pseudolamberti* Sinzow	+		
Quenstedticeras (*Quenstedticeras*) *leachi* (Sowerby)		+	+
Quenstedticeras (*Quenstedticeras*) cf. *leachi* (Sowerby)	+	+	
Quenstedticeras (*Quenstedticeras*) *mariae* (d'Orbigny)	+	+	+
Quenstedticeras (*Quenstedticeras*) cf. *mariae* (d'Orbigny)	+		
Quenstedticeras (*Quenstedticeras*) aff. *mariae* (d'Orbigny)		+	
Quenstedticeras sp. (ex gr. *mariae* d'Orbigny)	+		
Quenstedticeras (*Quenstedticeras*) *vertumnum* Bean-Leckeby (=*spoliatum* Buckman)		+	
Quenstedticeras (*Quenstedticeras*) cf. *vertumnum* Bean-Leckeby	+		
Quenstedticeras (*Eboraciceras*) cf. *jurense* Maire	+		
Quenstedticeras (*Eboraciceras*) *subordinarium* Buckman		+	
Quenstedticeras (*Eboraciceras*) *sutherlandiae* (Sowerby)		+	+
Quenstedticeras (*Eboraciceras*) aff. *sutherlandiae* (Sowerby)		+	
Quenstedticeras (*Eichwaldiceras*) *carinatum* (Eichwald)		+	
Quenstedticeras (?) *primigenium* Parona et Bonarelli	+		
Quenstedticeras (?) *nalivkini* Borissjak		+	
Quenstedticeras (?) *irinae* Sasonov	+		
Quenstedticeras (?) *ancestrale* Maire	+		
Quenstedticeras (?) sp. (Lahusen, tabl. IV, fig. 4)		+	
Quenstedticeras sp. sp.	+	+	
Praecardioceras praecordatum (Douville)	+	+	+
Praecardioceras cf. *praecordatum* (Douville)		+	
Praecardioceras sp. (cf. *praecordatum* Douville)	+		
Kosmoceras (*Spinikosmoceras*) *ornatum* (Schlotheim)	+		+
Kosmoceras (*Kosmoceras*) *gemmatum* (Phillips)		+	
Kosmoceras (*Kosmoceras*) *spoliatum* (Quenstedt)		+	
Kosmoceras sp. (cf. *spinosum* Sowerby)	+	+	
Cadoceras sp.	+		
Longaeviceras sp. (?)	+		

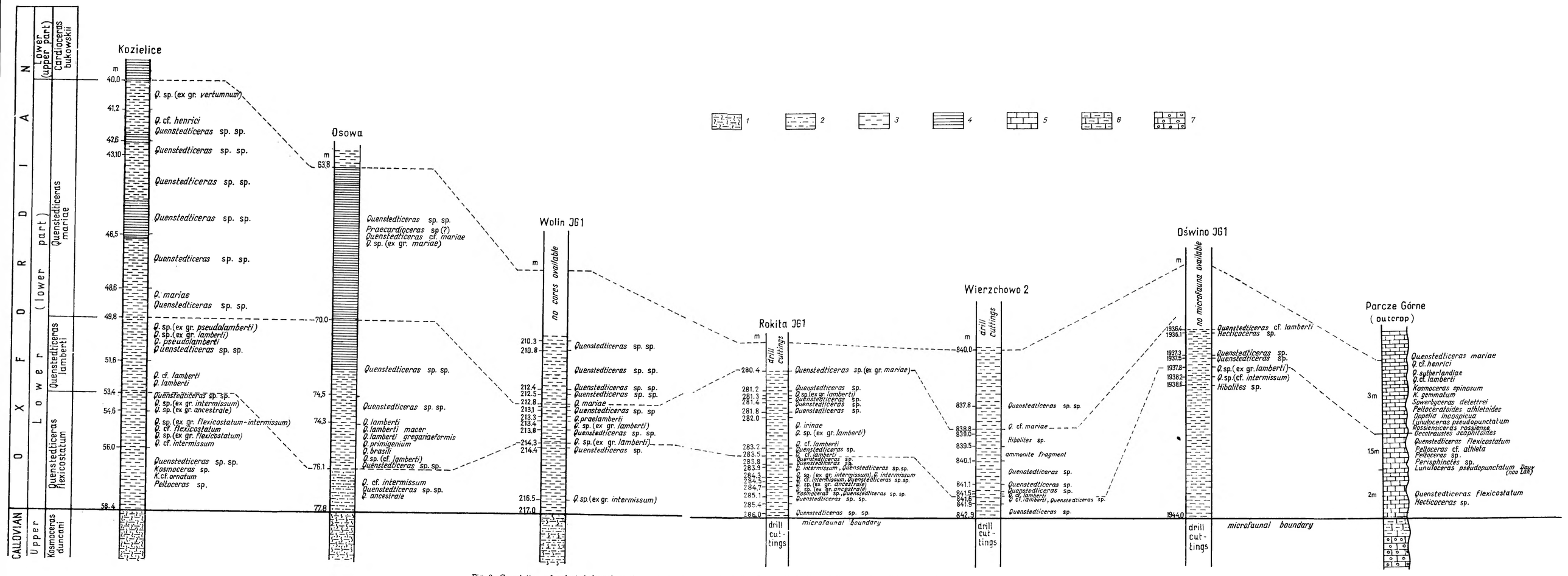


Fig. 2. Correlation of selected faunal sections of the lower part of the Lower Oxfordian of the non-Carpathian part of Poland (on the basis of the materials of K. Dayczak-Calikowska, J. Dembowska, S. Z. Różycki and the author herself)

1 — chlorite sandstones, *2* — sandy siltstones, *3* — siltstones, *4* — clayey and clayey-silty shales, *5* — limestones, *6* — marly limestones, *7* — oolitic limestones

Korelacja wybranych profilów faunistycznych niższej części oksfordu dolnego Polski pozakarpackiej (na podstawie materiałów K. Dayczak-Calikowskiej, J. Dembowskiej, S. Z. Różyckiego i własnych autorki)

1 — piaskowce chlorytowe, *2* — mułowce piaszczyste, *3* — mułowce, *4* — łupki ilaste i ilasto-mułowcowe, *5* — wapienie, *6* — wapienie margliste, *7* — wapienie oolitowe

Beds with *Cardioceras*

Beds with *Cardioceras* are characteristic of the upper part of the Lower Oxfordian. In Poland they are widely distributed, except for the Sudetic area where they do not occur. So far, no *Cardioceras* records are available concerning the sediments of this age in eastern Poland (the region of Lublin).

The beds with *Cardioceras* are developed on the whole in two facies, that is, the calcareous-marly one with a frequent dolomitization, spongy bioherms and crinoidal limestones, occurring in central, eastern and southern Poland and the sandy-siltstone one, which is predominant in north-western Poland. The thickness of the beds with *Cardioceras* fluctuates within limits of a few and 75 m.

The beds with *Cardioceras* may be observed in outcrops only on the margin of the Góry Świętokrzyskie, within the Cracow—Częstochowa Jurassic and in the Carpathian area.

On the margin of the Góry Świętokrzyskie these beds have so far been found in the following outcrops:

Przepaść (L. Malinowska, 1965), Siedlce (L. Malinowska, 1970), Wyszmontów, Drygulec (J. Samsonowicz, 1934), Mnin, Mięczyn, Lisów, Morawica 3, Michala Góra and Podgrodzie (L. Malinowska, 1967b; J. Lewiński, 1912).

In the Cracow—Częstochowa Jurassic and further to the south the beds with *Cardioceras* were found in the following outcrops:

Kłobuck, Wrzosowa, Błeszno, Jasna Góra, Zakrzew, Pierzchno, Lisieniec (S. Z. Różycki, 1953; L. Malinowska, 1963), Prędziszów (L. Malinowska, archival materials), Wieluń (J. Premik, 1924), Ostatni Grosz, Choroń, Przybynów, Wysoka Lelowska, Żarki, Góra Włodowska, Włodowice, Rudniki, Blanowice, Zuzanka, Łośnice, Wysoka Pilecka, Łazy, Rokitno Szlacheckie, Bzów, Ogrodzieniec, Niegowonice, Rodaki, Ryczówek, Klucze, Pomorzany, Parcze Górne (J. Siemiradzki, 1922; S. Z. Różycki, 1953), Trzebionka (K. Wójcik, 1910; S. Z. Różycki, 1953; L. Malinowska, 1958), Balin, Chrzanów, Czatkowice, Paczołtowice, Racławice, Rudno, Grójec, Nowa Krystyna, Kozłowiec, Zalas, Podłęże, Ratowa, Radwanowice, Dębnik (K. Wójcik, 1910; J. Siemiradzki, 1922; S. Z. Różycki, 1953), Bachowice (M. Książkiewicz, 1956), Kruhel Wielki near Przemyśl (K. Wójcik, 1913) and the Pieniny Klippen Belt (K. Birkenmajer, 1963).

The last three outcrops are the southernmost places in which these beds occur.

Data on the beds with *Cardioceras* were also obtained from numerous boreholes:

Prędziszów 1, Osona in the Częstochowa Jurassic (L. Malinowska, archival materials), Podgórzyce TW 6, Głogowiec, Augustopol, Dzierzbice, Kocewia in the Kujawy region (S. Marek, 1961), Piekary in the Sudetic Foreland (L. Malinowska, 1960), Józefów 1, Ciepielów, Kąty Denkowskie, Koszary in the margin of the Góry Świętokrzyskie (L. Malinowska, 1967b), Lulewiczki in Western Pomerania (R. Dadlez, 1958; L. Malinowska, archival materials), Osowa, Kozielice, Benice, Koplino, Kłodzino, Kretlewo, Pobierowo, Samsieczno, Sadłogoszcz 3, Kcynia IV, Barcin, Głęboczek, Mirosław 2 in north-western Poland (R. Dadlez, J. Dembowska, 1965; L. Malinowska, archival materials), Suwałki, Krasnopol 1 and 2, Sobótka 4 and 7 in north-western Poland (J. Znosko, archiwal materials), Dobre Miasto, Prabuty, Olszyny IG 1, Żuromin 2, Ustronie IG 1, Dobrzany Geo 1, Gostynin IG 3, Jastarnia, Grzybnica IG 1, Człuchów PN 1, Grudziądz IG 1, Racice, Koszalin IG 1, Dolice, Drawno Geo 3 in northern and western Poland (L. Malinowska, archival materials), Iwanowice in the Cracow Jurassic (S. Z. Różycki, 1953), Wodna, Piaski, Luszowice, Brzezinki in the Cracow Jurassic (L. Malinowska, 1958).

Table 2

The occurrence of the species of the family Cardioceratidae in the sediments of the upper part of the Lower Oxfordian of Poland

Występowanie gatunków rodziny Cardioceratidae w osadach wyższej części oksfordu dolnego Polski

Species	Poland		
	north.	cent.	south.
Cardioceras (*Scarburgiceras*) *bukowskii* Maire	+	+	
Cardioceras (*Scarburgiceras*) cf. *bukowskii* Maire		+	
Cardioceras (*Scarburgiceras*) *harmonicum* Maire		+	
Cardioceras sp. (cf. *harmonicum* Maire)	+		
Cardioceras (*Scarburgiceras*) *martini* Reeside		+	
Cardioceras (*Cardioceras*) *cordatum* (Sowerby)	+	+	+
Cardioceras (*Cardioceras*) cf. *cordatum* (Sowerby)	+	+	
Cardioceras (*Cardioceras*) aff. *cordatum* (Sowerby)	+		+
Cardioceras sp. (ex gr. *cordatum* Sowerby)	+	+	
Cardioceras (*Cardioceras*) *cordatum baltica* Kegel	+		
Cardioceras (*Cardioceras*) *cardia* Maire (non Buckman)		+	
Cardioceras (*Cardioceras*) *quadratoides* (Nikitin)		+	+
Cardioceras (*Cardioceras*) cf. *quadratoides* (Nikitin)	+		
Cardioceras (*Vertebriceras*) *altumeratum* Arkell		+	
Cardioceras (*Vertebriceras*) cf. *costulosum* Buckman		+	
Cardioceras (*Vertebriceras*) *quadratum* (Sowerby)		+	
Cardioceras (*Vertebriceras*) cf. *quadrarium* Buckman	+		
Cardioceras (*Vertebriceras*) *quadrarium biplicatum* Arkell		+	
Cardioceras (*Vertebriceras*) *quadrarium colloti* Maire	+	+	
Cardioceras (*Vertebriceras*) *rachis* Buckman	+	+	
Cardioceras (*Vertebriceras*) cf. *rachis* Buckman	+	+	
Cardioceras sp. (ex gr. *rachis* Buckman)	+		
Cardioceras (*Vertebriceras*) *vertebrale* (Sowerby)	+	+	+
Cardioceras (*Vertebriceras*) cf. *vertebrale* (Sowerby)	+		
Cardioceras (*Scoticardioceras*) *excavatum* (Sowerby)	+	+	+
Cardioceras (*Scoticardioceras*) cf. *excavatum* (Sowerby)		+	
Cardioceras (*Scoticardioceras*) *laevigatum* Boden		+	
Cardioceras (*Scoticardioceras*?) *rouilleri* (Nikitin)		+	+
Cardioceras (*Anacardioceras*) *douville* Maire		+	
Cardioceras (*Anacardioceras*) *subexcavatum* Maire		+	
Cardioceras (*Subvertebriceras*) cf. *costellatum* Buckman	+		
Cardioceras (*Subvertebriceras*) *zenaidae* Ilovayski		+	
Cardioceras (*Plasmatoceras*) *popilaniense* Boden		+	
Cardioceras (*Plasmatoceras*) *tenuicostatum* (Nikitin)	+	+	+
Cardioceras (*Plasmatoceras*) cf. *tenuicostatum* (Nikitin)		+	
Cardioceras sp. (ex gr. *tenuicostatum* Nikitin)	+		
Cardioceras (*Plasmatoceras*) *tenuistriaum* (Borissjak)	+	+	
Cardioceras (*Plasmatoceras*) cf. *tenuistriatum* (Borissjak)	+		
Cardioceras suessi Siemiradzki		+	
Cardioceras sp. *A, B, C, D, E, F, G*		+	
Cardioceras sp. sp.	+	+	
Pachycardioceras nikitinianum (Lahusen)		+	+
Pachycardioceras rotundatum (Nikitin)		+	+
Goliathiceras (*Goliathites*) *goliathum* (d'Orbigny)	+	+	+
Goliathiceras (*Goliathites*) *pseudogoliathum* (Maire)		+	
Goliathiceras (*Goliathites*) cf. *pseudogoliathum* (Maire)	+		
Goliathiceras (*Goliathites*) *juranum* (Maire)		+	
Goliathiceras sp. sp.	+		

Table 3

A quantitative comparison of ammonite and nautiloide species within the beds with *Cardioceras* (the upper part of the Lower Oxfordian) in Poland

Ilościowe zestawienie gatunków amonitów i łodzików w obrębie warstw z *Cardioceras* (wyższa część oksfordu dolnego) w Polsce

Fauna	Poland		
	north.	cent.	south.
Pseudaganides		1	
Paracenoceras		2	
Thysanolytoceras		1	2
Metalytoceras		1	1
Sowerbyceras	1	1	1
Holcophylloceras		1	1
Calliphylloceras			1
Popanites		2	3
Struebinia			1
Parapeltoceras		2	2
Peltoceratoides	5	8	5
Parawedekindia		2	2
Euaspidoceras	1	9	2
Glochiceras		1	1
Creniceras		2	2
Taramelliceras		7	10
Campylites	1	2	2
Trimarginites		3	1
Lissoceratoides		2	2
Perisphinctes	3	10	11
Pachyceras		2	
Scaphitodites		1	2
Cardioceras			
C. (Scarburgiceras)	2	3	
C. (Cardioceras)	6	5	3
C. (Vertebriceras)	8	8	1
C. (Scoticardioceras)	1	4	1
C. (Anacardioceras)		2	
C. (Subvertebriceras)	1	1	
C. (Plasmatoceras)	4	4	1
Cardioceras			
sp. *A, B, C, D, E, F, G*		6	
Pachycardioceras		2	2
Goliathiceras	3	3	1

The outrops and cores yielded abundant specimens of fauna assigned to the genera *Cardioceras*, *Goliathiceras* and *Pachycardioceras* (Table 2) related to the boreal zone, as well as specimens of the southern fauna (Table 3). The species of this fauna considerably decrease in number in sediments distributed more to the north of Poland, that is, in contrast with the boreal species. The genera *Struebinia* and *Calliphylloceras* are among the ammonites whose occurrence has hitherto been limited to southern Poland.

Giving a maximum thickness of the sediments of the upper part of the Lower Oxfordian as 75 m., the present writer has in mind the thickness of the sediments of this age, proven faunally in the Lulewiczki columnar section near Białogard, western Poland. The following species which are indicative of the upper part of the Lower Oxfordian were

determined by this writer from an interval of 118.6 to 193.2 m. in chlorite sandstones: *Cardioceras* (*Vertebriceras*) *rachis* Buckman, *C.* (*V*) cf. *rachis* Buckman, *C.* (*Cardioceras*) cf. *cordatum* (Sowerby), *C.* (*Anacardioceras*) cf. *costellatum* Buckman, *Goliathiceras* sp. and *Campylites delmontanus* (Oppel). According to R. Dadlez (1958), this atypical development and an exceptionally large thickness of the sediments are connected with an adjoining land.

Spongy bioherms (S. Z. Różycki, 1948, 1953; L. Malinowska, 1965) make up a characteristic feature of the upper part of the Lower Oxfordian in the Częstochowa Jurassic and the margin of the Góry Świętokrzyskie. In the latter area, they are embedded among reef limestones. Of particular interest is a spongy bioherm in the environs of Ćmielów where it occurs among crinoidal and dolomitic limestones. The age of bioherms is proven by ammonites, among which fairly frequent are the boreal genera *Cardioceras* and *Goliathiceras*.

The sediments of the upper part of the Lower Oxfordian, which occur at Prędziszów, a quarry situated on a hill (altitude point 298), south-east of Częstochowa, should be discussed separately. In literature the view is generally expressed that they represent the Middle and Upper Oxfordian. Field studies conducted in 1954—1956 and the Prędziszów 1 columnar section show, however, that there are also the sediments of the upper part of the Lower Oxfordian recorded faunally. As shown by the section of one of the walls of the quarry, under about 15 m.-thick, compact platy limestone, ringing when struck and containing numerous Middle Oxfordian *Perisphinctes* sp. sp. there are limestones and spongy marls 3 m. in thickness and containing the species *Perisphinctes* (*Properisphinctes*) *bernensis* Loriol, *Campylites delmontanus* (Oppel), *Cardioceras* (*Anacardioceras*) *subexcavatum* Maire, *C.* (*A.*) *douvillei* Maire, *C.* (*Cardioceras*) *cordatum* (Sowerby), *C.* (*Vertebriceras*) *rachis* Buckman, *C.* (*Plasmatoceras*) *tenuistriatum* (Borissjak), *Goliathiceras juranum* (Maire), and *Lissoceratoides erato* (d'Orbigny).

The presence of the sediments of this age was confirmed by Prędziszów 1 borehole (L. Malinowska, archival materials) where spongy limestones with the fauna of *Cardioceras* (*Plasmotoceras*) *tenuicostatum* (Nikitin), *Campylites delmontanus* (Oppel) and *Glochiceras* sp. sp. were found under Middle Oxfordian grey-creamy limestones.

The species *Cardioceras* (*Plasmatoceras*) *tenuicostatum* (Nikitin), *Cardioceras* sp. sp., *Goliathiceras* (*Goliathites*) *goliathum* (d'Orbigny), *Peltoceratoides eugenii* (Raspail), *Lissoceratoides* sp. and *Perisphinctes* sp. sp., which are indicative of the upper part of the Lower Oxfordian, were also found in the Osona borehole (the Częstochowa Jurassic) at depths ranging between 76.20 and 90.00 m.

Most typical species determining precisely the age of the upper part of the Lower Oxfordian in the southern part of Poland were supplied by an outcrop at Kruhel Wielki near Przemyśl (K. Wójcik, 1913). On the basis of K. Wojcik's identifications, it has been found that the assemblage of ammonites includes six species of the genus *Cardioceras* (*C. cordatum, C. quadratoides, C. vertebrale, C. rouillieri, C. excavatum*, and *C. tenuicostatum*), one of the genus *Pachycardioceras* (*P. nikitianum*), three of the genus *Popanites* and one from each of the genera *Scaphitodites*, *Lissoceratoides* and *Campylites*.

The analysis of the ranges of the particular species, in particular

that of the genus *Cardioceras*, enables the hypothesis that two zones of the upper part of the Lower Oxfordian are represented in the outcrop at Kruhel Wielki near Przemyśl.

It is more difficult, however, to evaluate faunally the sediments of this age, occurring at Bachowice (M. Książkiewicz, 1956). Most ammonites mentioned from the Oxfordian sediments are marked by an extensive stratigraphical range. This concerns particularly the species assigned to the family Phylloceratidae. On the other hand, it is a fact that a small fragmentary whorl, identified as *Cardioceras* (*Cardioceras*) aff. *cordatum* (Sowerby), may be an evidence that the upper part of the Lower Oxfordian is represented at Bachowice.

Of interest is the question if the sediments of the upper part of the Lower Oxfordian occur in the Pieniny Klippen Belt. A positive answer may here be given only by the species *Struebinia simplex simplex* Zeiss, found by M. Neumayr (1871) at Stankowa Skałka and correctly identified by A. Zeiss (1962). It is accepted on the whole that the stratigraphical position of this species is the Lower Oxfordian although, according to A. Zeiss (1962, p. 18), it was also found in the Gregoryceras transversarium Zone, but this finding is not quite certain.

THE MIDDLE OXFORDIAN

The Middle Oxfordian sediments are very widely distributed in Poland. They are known in both the non-Carpathian part of Poland and the Carpathian area. It is only in the Sudetic area that they do not occur at all.

The sediments of the siltstone-marly facies predominate in northern and western Poland, while those of the siltstone-sandy facies prevail near the peripheries of the basin. The carbonate facies with various biofacies varieties is developed in the remaining territory of Poland. The overlapping of these two broadly understood facies occurs in the western part of central Poland (J. Dembowska, 1962b). The greatest thickness of the Middle Oxfordian sediments, amounting to 120 m., was found in central Poland.

The Middle Oxfordian sediments occurring in eastern Poland (T. Niemczycka, 1976), so far not recorded macrofaunally, are distinguished only on the basis of microfauna and the lithological variability. Hence, they have not been taken into account in the present paper.

Natural outcrops of the Middle Oxfordian sediments are observed in the Cracow—Częstochowa Jurassic where they form a picturesque Jurassic range, as well as on the margin of the Góry Świętokrzyskie and in the Carpathian area. On the margin of the Góry Świętokrzyskie the Middle Oxfordian sediments have so far been faunally recorded in the following outcrops:

Szwedy near Mnin, Józefina, Wielebnów, Gnieździska, Młynki, Polichno, Tokarnia, Podzamcze, Morawica, Siedlce, Wola Morawicka, Zaborze, Dębska Wola, Stoki Stare, Bałtów, Eugeniów, Boria, Maleszowa, Brody (J. Lewiński, 1902, 1908, 1912; J. Siemiradzki, 1922; H. Świdziński, 1931; L. Malinowska, 1967, 1968, 1970).

In the Częstochowa Jurassic these sediments were recorded in the following outcrops:

Góra Opatowska, Wilkowiecko, Kurzelów, Mokra, Brody Malina, Zagórze, Łobodno, Smugi (L. Zejszner, 1884; L. Malinowska, 1972a), Jasna Góra (G. Bukowski, 1887; S. Z. Różycki, 1953), Błeszno, Kamyk (S. Z. Różycki, 1953; L. Malinowska, 1963), Gruszewnia, Biała Dolna, Biała Górna, Pierzchno, Olsztyn, Prędziszów, Osona (L. Malinowska, 1963, 1972a and archival materials), Zawodzie (S. Z. Różycki, 1948, 1953; L. Malinowska, 1963, 1972b; W. Brochwicz-Lewiński, 1970, 1972, 1973), Przybynów, Żarki, Blanowice, Rokitno Szlacheckie, Bzów, Jaroszowice, Parcze Dolne, Parcze Górne, Olkusz, Nowa Krystyna (J. Siemiradzki, 1922; S. Z. Różycki, 1953), Niegowonice (S. Z. Różycki, 1953; J. Znosko, 1953), Trzebionka, Brzezie, Luszowice near Chrzanów (S. Z. Różycki, 1953; L. Malinowska, 1958).

In southern Poland the Middle Oxfordian sediments occur in the following outcrops:

Bachowice (M. Książkiewicz, 1956), Kruhel Wielki near Przemyśl (K. Wójcik, 1913), Stankowa Skała, the environs of Jaworki, and Czorsztyn in the Pieniny Klippen Belt (K. Birkenmajer, 1963).

Much information on the Middle Oxfordian sediments is supplied by boreholes scattered all over Poland. Their location is as follows:

Osona in the Częstochowa Jurassic, Kąty Denkowskie, Koszary, Ciepielów, Józefów 1, Wąglany on the margin of the Góry Świętokrzyskie (L. Malinowska, 1967b, 1970), Środa and Piekary in the Sudetic Foreland (J. Znosko, 1959; L. Malinowska 1960), Gołdap, Bartoszyce, Pasłęk in the Peribaltic Depression (J. Dembowska, 1962a; L. Malinowska, 1966), Rzadka Wola, Kąkowa Wola in the Kujawy region (S. Marek, 1961; L. Malinowska, archival materials), and in western and northern Poland — Wągrowiec, Mirosław 2, Kcynia IV, Słupy, Wiśniewa, Samsieczno, Głęboczek 3, Rynarzewo 1, Barcin 1, Koplino, Lulewiczki, Stójkowo 2, Bukowiec 1, Kościerzyna, Radęcin, Wierzchowica, Brda 7, Jastarnia, Władysławowo, Ustronie, Choszczno IG 1, Drawno Geo 1, Międzychód, Grudziądz IG 1, all of them described by L. Malinowska, archival materials; Szamotuły 7 and 20 (L. Malinowska, 1966).

A certain zonation is outlined in the faunal picture of the Middle Oxfordian sediments of Poland. In northern Poland an exceptionally extensive development is reached by the genera and species assigned to the family Cardioceratidae, with a subordinate occurrence of those of the family Perisphinctidae.

In central Poland, on the other hand, the main faunal background is formed by the genera and species of the families Perisphinctidae and Oppeliidae and the subfamily Haploceratinae, along with a still considerable occurrence of the species of the family Cardioceratidae.

In southern Poland, the predominance is recorded of the species of the families Perisphinctidae, Oppeliidae and the subfamily Haploceratinae, with already a fairly frequent occurrence, both specific and quantitative, of the representatives of the families Phylloceratidae, Lytoceratidae and Aspidoceratidae. The family Cardioceratidae is represented by single species only.

What is known as a *Cardioceras* gap (L. Malinowska, 1966, 1968) (Table 4), found in a dozen or so boreholes, is a characteristic feature of the Middle Oxfordian sediments of northern Poland. It was also observed in other regions and places distant from each other, that is, in western Poland (the Pomerania Paranticlinorium), in north-eastern Poland (the Peribaltic Depression) and in the Sudetic Foreland (the Piekary and Środa boreholes). It is worth mentioning that this gap was found in both carbonate and siltstone sediments. It occurs between the last identified specimen of the species *Cawtoniceras tenuiserratum* (Oppel) or specimens of *Cawtoniceras* sp. (ex gr. *tenuiserratum* Oppel),

Table 4

The biostratigraphy of the Middle Oxfordian of northern and central Poland
Biostratygrafia oksfordu środkowego północnej i centralnej Polski

Subdivision after S. Z. Różycki (1948, 1953) and L. Malinowska (1963, 1966, 1968)	Carbonate Facies		Siltstone-Marly Facies	
	Characteristic fauna	Perisphinctidae and others	Cardioceratidae	Characteristic fauna
Amoeboceras alternans and Perisphinctes wartae Zone	*Amoeboceras alternans* *A. ovale* *A.* ex gr. *alternans*	*Perisphinctes* cf. *paturattensis, P. pumilus, P.* cf. *helenae, P. buckmani, P. cowleyensis, P. andelotensis, P. cuneicostatus, P. alatus, P. alatiformis, P. wartae, P. wartaeformis, P. wartae bedoensis, P. enayi, P. martelli, P. parandieri, P. globicostatus, P. trifidus, P. plicatilis, P. maximus, P. swidzinskii, P. dybowskii, P. multicostatus, P. elisabethae, P. elisabethaeformis, Lithacoceras choffati, L. berlieri, L. aeneas plana, Subdiscosphinctes boreale, S. kreutzi, S. mindowe, S. lucingensis, Sowerbyceras tortisulcatum, Taramelliceras externnodosum, T. różyckii, T. szajnochai, T. sarasini, T. nimbatum, T. lorioli, T. calliceratum, Glochiceras cornutum, G. subclausum, Epipeltoceras* cf. *uhligi, Euaspidoceras oegir, Aucella bronni, A. bronni lata*	*Amoeboceras alternans, A. ovale, Amoeboceras* sp. *A, Amoeboceras* sp. *B, Amoeboceras* sp. sp., *Amoebites subcordatum, A. reichenbachense, A. tuberculato-alternans*	*Perisphinctes virgulatus, P. wartae, Perisphinctes* sp. sp., *Subdiscosphinctes lucingensis, Ochetoceras* sp., *Glochiceras subclausum*
	Cardioceras gap		*Cardioceras* gap	
	Lamellibranchiata *Serpula* sp. sp.		Lamellibranchiata *Serpula* sp. sp. Flora	
Perisphinctes „chloroolithicus" and Cawtoniceras tenuiserratum Zone	*Cawtoniceras tenuiserratum*	*Perisphinctes „chloroolithicus", P. promiscuus, P. antecedens, P.* cf. *marcoui, P. andelotensis, P.* cf. *cotovui, P. cyrylli, P. methodii, P. maximus, P. pumilus, P. buckmani, P.* cf. *helenae, Ochetoceras canaliculatum, O. hispidum, Glochiceras subclausum, Proscaphites anar*	*Cawtoniceras tenuiserratum, C. tenuiserratum trinodosa, C. schellwieni, C. zieteni, Cawtoniceras* sp. sp., *Maltoniceras* cf. *kokeni, Goliathiceras chamoussetiforme*	*Ochetoceras canaliculatum, O. hispidum, Glochiceras subclausum, Trimarginites* sp., *Perisphinctes* sp. sp.

and specimens of the species *Amoeboceras alternans* (Buch) and *A.* ex gr. *alternans* appearing in this place. The size of the *Cardioceras* gap varies between two and fifty metres. Stratigraphically, this gap appears at the boundary between the lower and upper zone of the Middle Oxfordian. With the lack of species of the family Cardioceratidae it displays an overlapping of ranges of such species important stratigraphically as *Perisphinctes* (*Dichotomosphinctes*) *wartae* Bukowski, *Ochetoceras canaliculatum* (Buch) and *O. hispidum* (Oppel), which unequivocally determine the stratigraphical position of the *Cardioceras* gap (L. Malinowska, 1966, 1968).

Perceptible lithological and faunal changes fall during the period of the *Cardioceras* gap. In that gap, more frequent is the deposition of marly sediments. Ammonites of the genus *Perisphinctes* display a poor state of preservation and many, but destroyed, remains of pelecypod valves are met with, along with numerous *Serpula* sp. and fairly frequent carbonated plant remains.

These changes observed not only in lithology but also due to the "susceptibility" of forms of the family Cardioceratidae are undoubtedly connected with certain dynamic processes of the sea bottom.

In natural outcrops it is difficult to observe accurately the *Cardioceras* gap on the one hand due to the fragmentary character of outcrops and, on the other, as a result of difficulties in dividing high walls of quarries into particular layers. However, we may expect that further field studies will enable finding this gap also in outcrops.

Further to the south, in the zone of central Poland, which includes the Częstochowa Jurassic and the margin of the Góry Świętokrzyskie, species and genera of the families Perisphinctidae, Oppeliidae and the subfamily Haploceratinae predominate in the Middle Oxfordian sediments. The family Cardioceratidae is represented by the genera *Cawtoniceras* and *Amoeboceras*. Of importance is the occurrence of two species, *Amoeboceras ovale* (Quenstedt) and *A. alternans* (Buch), in carbonate sediments (Table 5) of the Częstochowa Jurassic where they are accompanied by species of ammonites characteristic of the Middle Oxfordian. The locality Osona, five kilometres south-east of Częstochowa, is an important outcrop in which the species *Amoeboceras ovale* (Quenstedt) occurs in abundance. This outcrop, as well as ten boreholes yielded numerous fauna which included such species as: *Amoeboceras ovale* (Quenstedt), *A. alternans* (Buch), *Amoeboceras* sp. sp., *Perisphinctes* (*Otosphinctes*) *paturattensis* Loriol, *P.* cf. *obliqueradiatus* Yüssen, *Lithacoceras aeneas plana* (Siemiradzki) (Pl. III, Fig. 2), *L.* (*Discosphinctes*) *idelettae* (Riaz) (Pl. III, Fig. 1), *Epipeltoceras* cf. *uhligi* (Oppenheimer), *Euaspidoceras nikitini* (Borissjak) and *Perisphinctes* (*Microbiplices*) *microbiplex* (Quenstedt).

The occurrence of the species *Amoeboceras alternans* (Buch) is mentioned by J. Siemiradzki (1922) as he describes the outcrops at Wieluń and Trzebinia in the Cracow—Wieluń Jurassic, containing such index species of the Middle Oxfordian as: *Perisphinctes* (*Arisphinctes*) *plicatilis* (Sowerby) and *P.* (*Perisphinctes*) *martelli* (Oppel). Describing a railway cutting at Chęciny, J. Lewiński (1912) mentions *Amoeboceras alternans* (Buch), together with other species characteristic of the Middle Oxfordian.

The species *Cawtoniceras tenuiserratum* (Oppel) marking the lower zone of the Middle Oxfordian, and related species of this same genus

Table 5

A quantitative comparison of specimens of the particular species of the family Cardioceratidae in the Middle Oxfordian sediments of Poland

Ilościowe zestawienie okazów poszczególnych gatunków rodziny Cardioceratidae w osadach oksfordu środkowego Polski

Species	Poland		
	north.	cent.	south.
Goliathiceras chamoussetiforme	1		
Cawtoniceras tenuiserratum	28	4	1
C. cf. *tenuiserratum*	8	1	
C. sp. (ex gr. *tenuiserratum*)	11		
C. tenuiserratum trinodosa	3		
C. tenuiserratum neumayri			1
Cawtoniceras schellwieni	2		
C. cf. *schellwieni*	5		
Cawtoniceras zieteni	1		
C. cf. *zieteni*	1		
Cawtoniceras sp. *A*	1		
Cawtoniceras sp. *B*	1		
Cawtoniceras sp. sp.	24	1	
Amoeboceras alternans	19	7	1 (?)
A. cf. *alternans*	8	1	
A. sp. (ex gr. *alternans*)	7	1	
Amoeboceras ovale	25	40	
A. cf. *ovale*	2		
Amoeboceras sp. *A*	2		
Amoeboceras sp. *B*	1		
Amoeboceras sp. sp.	38	1	
Amoebites subcordatum	2		
A. cf. *subcordatum*	4		
Amoebites tuberculato-alternans	2		
Amoebites reichenbachense	2		
A. cf. *reichenbachense*	1		
Maltoniceras cf. *kokeni*	2		

are primarily known as occurring abundantly in the sediments of this age in northern Poland. Further to the south, the frequency of the occurrence of specimens of this species decreases, although it may well be that the small number of the specimens found may result from a smaller extent of field studies, during which the faunal material is collected.

The species *Cawtoniceras tenuiserratum* (Oppel), occurring in the area of the Częstochowa Jurassic, was found by S. Z. Różycki (1953) on Mt. Jasna Góra in platy limestones, together with such species as *Perisphinctes (Perisphinctes) "chloroolithicus"* Gümbel, *P. (Kranaosphinctes) promiscuus* Bukowski and *Ochetoceras canaliculatum* (Buch).

In the north-eastern part of the margin of the Góry Świętokrzyskie the species *Proscaphites anar* (Oppel) and *Perisphinctes* cf. *berlieri* (Loriol) were found together with *Cawtoniceras tenuiserratum* (Oppel).

In the Cracow Jurassic, this species was found by J. Siemiradzki (1922) in the Kozłowiec outcrop, along with *Proscaphites anar* (Oppel).

An elucidation of the problem of the frequency of the occurrence of species which are typical of the southern zone is necessary to obtain complete faunal characteristics of the Middle Oxfordian sediments of central Poland. This primarily concerns the genus *Gregoryceras*. In the

course of his long-time geological studies, S. Z. Różycki (1953) found, in platy limestones of Mt. Jasna Góra, together with *Perisphinctes (Dichotomosphinctes) wartae* Bukowski, a single specimen which he determined as *"Peltoceras" transversarium* (Oppel). In 1922 the occurrence of the species *"Peltoceras" transversarium* (Oppel) in limestiones of Zawodzie was mentioned by J. Siemiradzki.

As follows from hitherto conducted observations, species of the genus *Gregoryceras* are very rarely met with in the Middle Oxfordian sediments of central Poland, not to mention the fact that no specimen has hitherto been found in the sediments of this age of northern Poland. It seems that a more frequent occurrence of specimens of this and other species of the genus *Gregoryceras* will be found in the Cracow Jurassic. The occurrence of *"Peltoceras" transversarium* (Oppel) in the sediments of Zalas near Cracow was mentioned by J. Siemiradzki (1922). In addition, a specimen from the vicinity of Nawojowa Góra in the environs of Chrzanów, determined by the present writer as *Gregoryceras toucasi* (d'Orbigny) (Pl. III, Fig. 3a, b), has been preserved in Professor S. Doktorowicz-Hrebnicki's collections.

In the Middle Oxfordian sediments of southern Poland we may find the assemblage of fauna, which includes the following genera: *Holcophylloceras*, *Calliphylloceras*, *Sowerbyceras*, *Phylloceras*, *Thysanolytoceras*, *Taramelliceras*, *Trimarginites*, *Pseudogregoryceras*, *Euaspidoceras*, *Proscaphites*, *Lithacoceras*, *Simoceras* and *Perisphinctes* with its subgenera *Arisphinctes* and *Perisphinctes* (*sensu stricto*).

Cawtoniceras tenuiserratum neumayri Maire (Stankowa Skałka, K. Birkenmajer, 1963), *Cawtoniceras tenuiserratum* (Oppel) (Bachowice, M. Książkiewicz, 1956) and probably *Amoeboceras alternans* (Buch), cited by K. Wójcik (1908) from marly limestones of Kruhel Wielki, represent the boreal fauna. To be sure, the last named species was not mentioned in K. Wójcik's paper of 1913, although he continuously emphasized the presence of the Middle Oxfordian sediments.

BIOSTRATIGRAPHICAL ZONES OF THE LOWER AND MIDDLE OXFORDIAN OF POLAND

The biostratigraphical division of the Lower and Middle Oxfordian of Poland, given in the present paper, has been based on a detailed analysis of fauna sampled from several scores of outcrops and boreholes. Most detailed stratigrapical-palaeontological and strictly palaeontological studies of the Lower and Middle Oxfordian fauna from particular outcrops and boreholes of the territory of Poland have already been published and, therefore, it is possible to prepare on their basis an up-to-date and reliable biostratigraphical subdivision of the Lower and Middle Oxfordian of Poland.

Generaly speaking, particular zones have been distinquished on the basis of a real material, that is, of species of fauna which actually occur in sediments and in a close correlation with a corresponding zoogeographical province.

The standpoint of some authors (J. Kutek, B. Matyja, A. Wierzbowski, 1973 and others), who determine particular zones of the Lower and Mid-

Table 6

A correlation of the Lower and Middle Oxfordian biostratigraphical zones of Poland with those of France, England and USSR
Korelacja poziomów biostratygraficznych oksfordu dolnego i środkowego Polski z poziomami Francji, Anglii i ZSRR

Mediterranean and Sub-Mediterranean Province				Subboreal Province											
France southern and eastern part of the Paris Basin (E. Cariou *et al*, 1971)				Poland						England (W. J. Arkell, 1956; J. H. Callomon, 1964)				USSR central and western part (J. G. Sasonova, N. T. Sasonov, 1967; G. J. Krymholz, 1972)		
						southern		northern and central								
Oxfordian	Middle	transversarium	schilli	Oxfordian	Middle	transversarium		wartae and alternans		Oxfordian	Middle	plicatilis	parandieri	Oxfordian	Upper (pars)	alternans
			parandieri													martelli and zenaidae
		plicatilis	antecedens			plicatilis		chloroolithicus and tenuiserratum					antecedens			
			tenuicostatum or vertebrale										vertebrale			
	Lower	cordatum	cordatum		Lower	excavatum			Beds with *Cardioceras*		Lower	cordatum	cordatum		Lower	cordatum
			costicardia										costicardia			
			bukowskii			bukowskii							bukowskii			
		mariae	praecordatum			No species of the genus Quenstedticeras in the Carpathian area		mariae	Beds with *Quenstedticeras*			mariae	praecordatum			praecordatum and mariae
			scarburgense										scarburgense			
Callovian	Upper	lamberti						lamberti		Callovian	Upper	lamberti	lamberti	Callovian	Upper	lamberti
													henrici			
		athleta	collotiformis					flexicostatum				athleta				athleta
			trezeense													

dle Oxfordian of Poland mostly on the basis of their correlation with those separated in other areas of Europe, seems to be a considerable misapprehension. For, we cannot consider it to be correct when someone deals with a general conception of distinguishing biostratigraphical zones, skipping a detailed analysis of abundant faunal materials, which have already been made available in the form of publications and when collections of such materials may be seen at the Geological Institute's Museum in Warsaw. As a result of such an erroneous attitude, on the one hand, zones are described which are not confirmed by actual conditions of this country and, on the other, there occurs an obliteration of the faunal specificity typical of the Polish Jurassic Basin. It is only the presentation of documentary evidence for actual faunal zones within the Lower and Middle Oxfordian of particular regions of Poland with consideration of differences resulting from a variable facies development of sediments that may provide a basis for conducting a proper correlation with other areas. Works on the Lower and Middle Oxfordian fauna of Poland have already been published in a sufficient number so as they could be at least tentatively used as a basis for a correct separation of biostratigraphical zones (Table 6).

Penetrating from the east and north-west the boreal faunal influences left their mark on the character of zones distinguished in Poland within the Lower and Middle Oxfordian beds. On the whole, we may assume that the zones characterize the overlapping, in the area of Poland during that period, of two zoogeographical provinces, the subboreal and sub-Mediterranean ones. Obviously, it is difficult to trace precisely the boundary of the overlapping of the two provinces, but we can assume the Cracow—Przemyśl line as a hypothetical boundary.

THE CALLOVIAN—OXFORDIAN BOUNDARY

An accurate tracing of the boundary between the Callovian and the Oxfordian in the area of Poland, based on faunal premises, is possible only in the epicontinental Jurassic. On the other hand, in the Polish Carpathian area a very small number of fauna and observations made so far, concerning this period, does not allow a detailed subdivision of sediments into particular beds and, all the more, the establishing of a boundary between the Callovian and the Oxfordian. Assuming such boundary as running between the Quenstedticeras lamberti and Quenstedticeras mariae Zones in the Polish Carpathian area is based on the adaptation of W. J. Arkell's (1956) or F. Trauth's (1948) subdivisions. In the light of recently obtained data this does not seem to be correct if only because species of the genus *Quenstedticeras*, accurately defining biostratigraphical zones, have never been found so far in the Polish Carpathian area and because of the lack of age equivalents in the form of species important stratigraphically.

The boundary between the Callovian and the Oxfordian, that is, between the Kosmoceras duncani Zone of the uppermost Callovian and the Quenstedticeras flexicostatum Zone of the lowermost Oxfordian, was accurately determined faunally in the epicontinental area of Poland. The adoption of only such a boundary seems correct since this allows maintaining a continuity of the evolutionary series of ammonites of the

genera *Quenstedticeras* and *Cardioceras*, uninterrupted artificially by a boundary between biostratigraphical members of a higher order (R. Dadlez, J. Kopik, 1973). The concurrence of the representatives of the genera mentioned above is observed, although only sporadically, within the Nodular Bed (K. Dayczak-Calikowska, 1967).

THE LOWER OXFORDIAN

Lower part

A considerable number of species of the genus *Quenstedticeras* allows us to maintain, for the lower part of the Lower Oxfordian of northern and central Poland and for the Cracow Jurassic, a tripartite subdivision based on species of the genus *Quenstedticeras* (S. Z. Różycki, 1953; L. Malinowska, 1967b). The following zones have been distinguished:

upper zone — Quenstedticeras mariae (L. Malinowska, 1967),
middle zone — Quenstedticeras lamberti (S. Z. Różycki, 1953),
lower zone — Quenstedticeras flexicostatum (S. Z. Różycki, 1953).

Lower zone — Quenstedticeras flexicostatum

In addition to fine-ribbed species of the genus *Quenstedticeras (Q. ancestrale, Q. intermissum, Q. flexicostatum)*, specimens representing the genus *Kosmoceras* are met with in this zone. An interesting assemblage of fauna was determined from the lower zone sediments of the Jamno IG 3 borehole. In addition to many *Quenstedticeras* sp. sp., a specimen of *Cadoceras* sp. (Pl. II, Fig. 2) was found there. The assemblage also includes *Longaeviceras* sp., although its state of preservation arouses certain doubts concerning the accuracy of generic identification. Southern species, *Peltoceras athleta* (Phillips), *Parapeltoceras pseudocarprinum* Prieser, *Parapeltoceras* sp. and *Collotites* sp. are also known from this zone. The most abundant development of species of the genus *Kosmoceras* falls in the Callovian, while the sediments of the lower part of the Lower Oxfordian contain single, rather poorly preserved, specimens of *Kosmoceras (Kosmoceras) spoliatum* (Quenstedt), *K. (K.) gemmatum* (Phillips), *K. (Spinikosmoceras) ornatum* (Schlotheim) and *K. (S.) cf spinosum* (Sowerby).

No serious problems are posed by the correlation of the Quenstedticeras lamberti and Quenstedticeras mariae Zones with the zones distinguished in the Jurassic of Western and Eastern Europe (Table 6); the correlation of the Quenstedticeras flexicostatum Zone with the Peltoceras athleta Zone requires a separate discussion.

In Poland we cannot distinguish a separate Peltoceras athleta Zone. The index species *Peltoceras athleta* (Phillips) occurs in Poland's sediments both in the Kosmoceras duncani (the uppermost zone of the Upper Callovian *sensu polonico)* and the Quenstedticeras flexicostatum Zones, sometimes reaching as far as the bottom of the Quenstedticeras lamberti

Zone. Knowing a wider stratigraphical range of the index species it is difficult to determine on its basis a separate zone, as it has already been mentioned by K. Wójcik (1910).

On the other hand, it is a well-known fact that this species occurs in the classical area of the Polish Jurassic [3] mostly with species of the genus *Quenstedticeras* characteristic of the Quenstedticeras flexicostatum Zone (S. Z. Różycki, 1953), in which its main development takes place. This fact is, on the other hand, of considerable importance to a tentative correlation.

Species, mostly of the genus *Quenstedticeras,* forming a main background of the Quenstedticeras flexicostatum Zone are indicative of indubitable boreal influences. However, this is also indicated by *Cadoceras* sp., also found there and which seems to belong to the *stenolobum* group, known from the region of Pechora and Novaya Zemlya where it occurs in the same stratigraphical position. *Longaeviceras* sp. was identified with a certain degree of probability among the fauna of the lower zone. Species of this genus have hitherto been known in the north-eastern part of the Russian Platform (I. G. Sasonova, N. T. Sasonav, 1967).

It seems that the Quenstedticeras flexicostatum Zone *(sensu polonico)* may in part be correlated with the Longaeviceras kayserlingi Zone of the Pechora Jurassic (M. S. Mesezhnikov, 1969; G. J. Krymholz, 1972), although the range of the latter is wider and also includes the Quenstedticeras lamberti Zone.

The southern influences, marked in the Quenstedticeras flexicostatum Zone, are considerably limited as a result of palaeogeographical configurations, which then occurred within the area of the Polish Basin. Only single specimens of the genera *Parapeltoceras, Peltoceras* and *Collotites,* which got outside the Polish Basin through the Przemyśl Gate, allow a tentative correlation of this zone with the Peltoceras athleta Zone of Western and Eastern Europe.

Among southern fauna, not numerous specifically, of particular interest is the genus *Collotites* characteristic of the Peltoceras athleta Zone (Collotites collotiformis Subzone) of southern France (E. Cariou, *et al.,* 1971). In the sediments falling to the Quenstedticeras flexicostatum Zone in the north-eastern margin of the Góry Świętokrzyskie, only a fragment of a specimen of this genus was found and subsequently identified as *Collotites* sp. (L. Malinowska, 1967b).

Middle zone — Quenstedticeras lamberti

In this zone, the assemblage of fauna includes mostly species of the genus *Quenstedticeras (Q. lamberti, Q. lamberti macer, Q. lamberti pseudomariae, Q. brasili, Q. primigenium* and *Q. irinae).* Among these species of interest is the occurrence of *Quenstedticeras irinae Sasonov,* which is known in the western part of the Russian Platform (N. T. Sasonov, 1957). In addition to these species, also known are *Parapeltoceras caprinum fraasi* Prieser, *Parapeltoceras* sp., *Hecticoceras* sp., *Kosmoceras* sp. and *Perisphinctes* sp.

---

[3] The term Polish Jurassic was suggested by S. Z. Różycki 1960 to denote a zone of the Jurassic Range between Cracow and Wieluń.

The assemblage of fauna allows a correlation of this zone with an identically named zone distinguished in England (H. Callomon, 1964) where also predominate species of the genus *Quenstedticeras*. This matter is somewhat different in France (Poitou) (E. Cariou, 1962) where predominant species and genera belong to the superfamily Hecticoceratinae and, to a lesser extent, Pseudoperisphictinae. Species of the families Aspidoceratidae and Cardioceratidae occur less frequently.

The Quenstedticeras lamberti Zone, distinguished in the Russian Platform, is marked by a considerable number of species of the genus *Quenstedticeras*.

Upper zone — Quenstedticeras mariae

The zone contains abundantly occurring *Praecardioceras praecordatum* (Douville) and many species of the genus *Quenstedticeras (Q. mariae, Q.* ex gr. *mariae, Q. jurense)*. In addition, *Peltoceratoides athletulum* (Mayer) and *P. athletoides* (Lahusen) were identified in sediments. The species *Parapeltoceras caprinum fraasi* Prieser is known in both the upper and middle zone.

In the beds with *Quenstedticeras* of the non-Carpathian part of Poland, southern species of the subfamily Hecticoceratinae are met with represented by single specimens of *Lunuloceras (Lunuloceras) pseudopunctatum* (Lahusen), *L. (L.) matheyi* Loriol, *Putealiceras (Putealiceras) svevum* Bonarelli, *Rossiensiceras (Rossiensiceras) rossiense* (Teisseyre) and a single specimen of *Taramelliceras incospicuum* (Loriol).

The correlation of the Quenstedticeras mariae Zone distinguished in Poland with that of Western Europe does not pose many problems. The presence of the species *Praecardioceras praecordatum* (Douville) and *Quenstedticeras (Quenstedticeras) mariae* (d'Orbigny) in Lower Oxfordian sequences enables comparisons. Certain differences are found of course but they primarily concern the number of particular species of the genus *Quenstedticeras* and the frequency of their occurrence on the one hand and the frequency of the occurrence of southern species of the subfamily Hecticoceratinae and the family Aspidoceratidae, on the other.

For the purposes of correlation, the Quenstedticeras mariae Zone was distinguished in the subdivision applied to the Russian Platform (I. G. Sasonova, N. T. Sasonov, 1967; G. J. Krymholz, 1972). According to G. J. Krymholz's (1972) data, the index species was found in the environs of Saratov. In other areas only equivalents of this zone may be found including the characteristic species *Praecardioceras praecordatum* (Douville).

Upper part

It is caused by the quantitative predominance of specimens and specific variability of the genus *Cardioceras* (Table 3) in sediments that a bipartite subdivision is applied to the higher part of the Lower Oxfordian in northern, central and southern Poland. It is worth mentioning that more detailed faunal data are available for northern and central Poland. Due to incomplete faunal records, all comparisons with the Polish Carpathian area are general in character. Fauna collected from sediments at Bachowice (M. Książkiewicz, 1956) and in the Pieniny Klippen Belt (K.

Birkenmajer, 1963) contains species which are known to characterize the upper part of the Lower Oxfordian. However, they do not allow a more detailed biostratigraphical subdivision which, on the other hand, can be done on the basis of specimens obtained at Kruhel Wielki near Przemyśl (K. Wójcik, 1913).

At present, a subdivision into zones with *Cardioceras* is applied to the sediments of the upper part of the Lower Oxfordian. The following zones have been distinguished:

upper zone — Cardioceras excavatum (L. Malinowska, 1963),
lower zone — Cardioceras bukowskii (L. Malinowska, 1963).

Lower zone — Cardioceras bukowskii

The index species *Cardioceras (Scarburgiceras) bukowskii* Maire is abundantly represented in the lower zone. It was first described by G. Bukowski (1887) from the area of the Częstochowa Jurassic under the name of *Cardioceras (Scoticardioceras) excavatum* (Sowerby). The palaeontological records of the lower zone was prepared on the basis of a very abundant faunal material of the genera: *Perisphinctes, Taramelliceras, Metalytoceras, Trimarginites, Lissoceratoides, Campylites, Peltoceratoides, Parawedekindia, Euaspidoceras* and *Holcophylloceras.*

Ammonites of the family Cardioceratidae, of which *Cardioceras (Plasmatoceras) tenuicostatum* (Nikitin), *C. (Scarburgiceras) harmonicum* Maire, *C. (Scoticardioceras) laevigatum* Boden and the index species *Cardioceras (Scarburgiceras) bukowskii* Maire occur only in the lower zone, are among the most numerous, both in regard to the numbers of particular specimens and particular species. It is also in this zone that the representatives of the genera *Goliathiceras* and *Pachycardioceras* (Table 3) are recorded.

Kłobuck I, Kłobuck II and Wrzosowa in the area of the Częstochowa Jurassic are typical sections of the sediments of the upper part of the Lower Oxfordian, enabling a datailed study of the ranges of particular species in the continuous succession of beds. These sections display a considerable similarity to those of Michala Góra (L. Malinowska, 1967b) and Siedlce (L. Malinowska, 1970) in the south-western part of the Góry Świętokrzyskie, as well as to those in northern and north-western Poland (L. Malinowska, 1966).

Determining the Cardioceras bukowskii Zone or Subzone is not a rare occurrence described in literature. In his stratigraphical elaborations concerning the Lower Oxfordian of the environs of Blumberg A. Zeiss (1955, 1956, 1957) distinguishes the Cardioceras bukowskii Zone as an equivalent of the upper part of the Lower Oxfordian. In the English subdivision W. J. Arkell (1941, 1956) also separates, within the Cardioceras cordatum Zone, the Cardioceras bukowskii Subzone, from which he mentions several species of the genus *Goliathiceras* and the subgenus *Scarburgiceras.* The existence of this subzone is confirmed by J. H. Callomon (1964) who, moreover, emphasizes that the Cardioceras bukowskii Subzone may be easily observed also in the Jurassic of Scotland (at Staffin, Skye). The Cardioceras bukowskii Subzone is also distinguished within

the Cardioceras cordatum Zone in southern France (E. Cariou, *et al.*, 1971), with *Protocardioceras* and, less frequently, *Vertebriceras* and *Cardioceras (sensu stricto)* mentioned by these authors as genera characteristic of this subzone.

The Cardioceras bukowskii Zone, distinguished in the area of northern and central Poland, may generally correspond to Cardioceras bukowskii and Cardioceras costicardia Subzones separated in England and France and may be a part of the assemblage Cardioceras cordatum Zone of the Russian Platform (I. G. Sasonova, N. T. Sasonov, 1967; G. J. Krymholz, 1972).

Upper zone — Cardioceras excavatum

In this zone we may observe the development of the genus *Cardioceras* of the subgenera *Subvertebriceras, Plasmatoceras, Cardioceras (sensu stricto)* and *Scoticardioceras. Cardioceras (Scoticardioceras) excavatum* (Sowerby), *C. (Plasmatoceras) popilaniense* Boden, *C. (P.) tenuistriatum* (Borissjak), *C. Subvertebriceras) zenaidae* Ilovayski are typical species of this zone.

Particularly noteworthy is the fact that the remaining specimens of the genus *Cardioceras*, that is, Cardioceras sp. *A*, *B*, *C*, *D* and *E* (L. Malinowska, 1959), occurring in the upper zone, are mostly easily distinguishable from specimens occurring in the lower zone. They seem to be transitional forms whose keel is very similar to that of younger forms. Despite their abundant occurrence they cannot be accurately determined specifically because of their small dimensions (13 to 18 mm in diameter).

The occurrence of the species *Popanites paturattensis* (Greppin) and *P. paturattensis wrzosoviensis* Malinowska is limited to the upper zone.

The assemblage of particular species of the subgenera *Plasmatoceras*, *Subvertebriceras* and *Scoticardioceras* in the Cardioceras excavatum Zone separated in the Polish Jurassic allows a correlation with the Cardioceras cordatum and, partly, Cardioceras vertebrale Subzones, distinguished in the English Jurassic (J. H. Callomon, 1964). The Cardioceras tenuicostatum Subzone distinguished as an equivalent of the Cardioceras vertebrale Zone of the French Jurassic (E. Cariou, *et al.*, 1971) should be separately discussed. Apart from the name itself of this subzone, called after *Cardioceras tenuicostatum*, a species whose occurrence in Polish sediments in limited to the lower part of the Cardioceras bukowskii Zone, the presence of the representatives of the genus *Cawtoniceras* suggests the correlation line within the Cardioceras vertebrale Subzone. It is noteworthy that the species of the genus *Cawtoniceras* in the Polish Jurassic are known from the Middle Oxfordian sediments.

In his work of 1955, A. Zeiss distinguishes, above the Cardioceras cordatum Zone, a bed known as "Mumienschichtle". The fauna, mentioned by this author, in particular specimens of the groups *Cardioceras excavatum* (Sowerby) and *C. maltonense* (Young-Bird), indicates that this one-metre thick bed might in part correspond to the Cardioceras excavatum Zone, distinguished within the Lower Oxfordian of northern and central Poland and at Kruhel Wielki near Przemyśl.

The fact that specimens of the subgenera *Vertebriceras* and *Cardioceras (sensu stricto)* occur over the entire time interval of the two zones is a characteristic feature of the sediments of the upper part of the Lower Oxfordian of Poland. These species are: *Cardioceras (Vertebriceras) quadrarium biplicatum* Arkell, *C. (V.) quadrarium colloti* Maire, *C. (V.) altumeratum* Arkell, *C. (V.) rachis* Buckman, *C. (V.) quadratum* (Sowerby), *C. (Cardioceras) cordatum* (Sowerby), *C. (C.) cardia* Maire (non Buckman).

THE MIDDLE OXFORDIAN

The analysis of fauna contained in the Middle Oxfordian sediments, in particular the index ammonites allowed the present writer an accurate biostratigraphical zonation. It should be emphasized, however, that, due to a not yet sufficient faunal material from the Middle Oxfordian sediments of southern Poland, zones of this area may be only suggested by a detailed correlation with those accurately established in northern and central Poland.

Thus, the following subdivision into two zones has been prepared for the Middle Oxfordian of northern and central Poland:

upper zone — Prisphinctes wartae and Amoeboceras alternans
(S. Z. Różycki, 1953; L. Malinowska, 1966, 1968),
lower zone — Perisphinctes "chloroolithicus" and Cawtoniceras tenuiserratum
(S. Z. Różycki, 1953; L. Malinowska, 1966, 1968).

The bipartite names of zones in the Middle Oxfordian of northern and central Poland indicate a considerable part of boreal species on the one hand and an occurrence of southern species on the other. Fauna occurring in both siltstone-marly and carbonate sediments of the area under study enabled determining a uniform faunal profile, with the main role played by the concurrence of the representatives of the families Cardioceratidae and Perisphinctidae in the sediments of the two facies, although in different proportions (L. Malinowska, 1968) (Table 4).

Lower zone — Perisphinctes "chloroolithicus" and Cawtoniceras tenuiserratum

Numerous species of ammonites of the genus *Perisphinctes* with the subgenera *Arisphinctes, Kranaosphinctes*, and *Dichotomosphinctes* (W. Brochwicz-Lewiński, 1970, 1972; L. Malinowska, 1972a, b) are known in this zone. In addition, many specimens of the family Cardioceratidae, belonging to the species *Cawtoniceras tenuiserratum* (Oppel), *C. tenuiserratum trinodosa* Maire, *C. schellwieni* (Boden), *C. zieteni* (Ilovayski), *Cawtoniceras* sp. *A*, *B*, *Maltoniceras* cf. *kokeni* (Boden) and *Goliathiceras* cf. *chamoussetiforme* Arkell, occur below the *Cardioceras* gap.

Ochetoceras canaliculatum (Buch), *O. hispidum* (Oppell), *Euaspidoceras pauciluberculatum* Arkell, *Campylites lautlingensis* (Rollier), *Proscaphites anar* (Oppel) and *Sowerbyceras tortisculcatum* (d'Orbigny), the last-named only sporadically occurring in central Poland and passing

to the upper zone, are among interesting species recorded in the lower zone of the Middle Oxfordian.

Due to the assemblage of fauna, represented by the genera *Cawtoniceras, Maltoniceras, Perisphinctes* and *Ochetoceras,* the lower zone may be correlated in part with the Cardioceras vertebrale and Perisphinctes parandieri Subzones, as well as with the Perisphinctes antecedens Subzone of the French Jurassic (E. Cariou, *et al.*, 1971). Undoubtedly, we should also mention here the Cardioceras tenuiserratum Horizon distinguished by E. Cariou (1966b) in the Jurassic of Poitou within the Perisphinctes antecedens Subzone. To evaluate fauna it is necessary to pay attention to the occurrence, within the Perisphinctes antecedens Subzone of the French Jurassic, of species of the genera *Pachyceras* and *Protophites* so far never met with in this stratigraphical position in the Jurassic of Poland.

Due to a small number of species in the Perisphinctes parandieri Zone (J. H. Callomon, 1960, 1964), the correlation with the particular zones of the Jurassic of England is rather difficult.

The assemblage of fauna corresponding to this space of time in the Russian Platform (I. G. Sasonova, N. T. Sasonov, 1967) enables a general correlation with the Perisphinctes martelli and Cardioceras zenaidae Zones and with a part of the Amoeboceras alternans Zone of the Upper Oxfordian *sensu russico.*

Upper zone — Perisphinctes wartae and Amoeboceras alternans

Species of both the families Perisphinctidae and Cardioceratidae occur in the upper zone. Particularly abundantly represented is the genus *Perisphinctes* with its subgenera *Perisphinctes* (*sensu stricto*), *Dichotomosphinctes, Arisphinctes, Liosphinctes,* as well as the genus *Lithacoceras* with its subgenera *Progeronia, Discosphinctes, Larcheria* and the genus *Subdiscosphinctes.*

In the upper parts of Upper Oxfordian sequences there occur boreal species of the family Cardioceratidae, assigned to the genera *Amoeboceras* and *Amoebites,* that is, *Amoeboceras alternans* (Buch), *Amoeboceras* sp. (ex gr. *alternans* Buch), *A. ovale* (Quenstedt), *Amoeboceras* sp. *A* and *B, Amoeboceras* sp. sp., *Amoebites reichenbachense* (Salfeld), *A. tuberculato-alternans* (Nikitin), *A. subcordatum* (*sensu* Salfeld, non d'Orbigny).

Species of the genus *Amoeboceras* are represented by many specimens (Table 5). This mostly concerns this age's sediments of northern and, in part, also central (Częstochowa Jurassic) Poland. The presence of species of the genus *Amoeboceras,* occurring together with species which are typical of the Middle Oxfordian precisely defines their stratigraphical position, which is also confirmed by literature. Thus, the species *Amoeboceras alternans* Loriol (non Buch) and *A. alternans* (Buch) are mentioned by E. Cariou (1966a, b) from the Larcheria schilli Horizon of the Middle Oxfordian in the sequences from Pamproux and Poitou. The presence of the representatives of the genus *Amoeboceras* in the Perisphinctes parandieri Subzone has also been confirmed by E. Cariou, *et al.*, (1971), as well as by R. Enay (1966) who mentions from this same sub-

zone the species *Amoeboceras alternans* (Buch) and *A.* cf. *truculentum* Buckman.

In the light of the facts cited above, the standpoint presented in their papers by W. Brochwicz-Lewiński (1970), as well as J. Kutek, B. Matyja, A. Wierzbowski (1973), who would like to include the upper part of the Perisphinctes wartae and Amoeboceras alternans Zones if only partly in the Upper Oxfordian (*sensu polonico*) seems to be rather strange. Such suggestions are not confirmed by facts. The species *Perisphinctes (Microbiplices) microbiplex* (Quenstedt) and *Epipeltoceras* cf. *uhligi* (Oppenheimer), mentioned by the present writer in her work of 1963 from the Upper Oxfordian limestones of Osona (Częstochowa Jurassic) would be, according to W. Brochwicz-Lewiński (1970), indicative of Upper Oxfordian age. In the outcrop, mentioned above, the two species are accompanied by *Lithacoceras* (*Discosphinctes*) *idelettae* (Riaz), *L. aeneas plana* (Siemiradzki) and *Perisphinctes* (*Otosphinctes*) cf. *paturattensis* Loriol, which give a firm evidence of Middle Oxfordian age of the sediments. In regard to the stratigraphical position of the species *Perisphinctes* (*Microbiplices*) *microbiplex* (Quenstedt) the opinions are divergent. This species occurs mostly in the Upper Oxfordian, although single specimens may be also found in the Middle Oxfordian (P. Dorn, 1930). On the other hand, *Epipeltoceras* cf. *uhligi* (Oppenheimer), mentioned by the present writer, is very poorly preserved but its generic assignment is quite certain.

In addition, few southern species of the genera *Taramelliceras, Campylites, Glochiceras* and *Euaspidoceras* are known from the upper zone of the Middle Oxfordian of northern and central Poland, being more numerous in the sediments of central Poland.

No species of the genus *Neomorphoceras* have so far been found in this age's sediments of the non-Carpathian part of Poland, and single specimens of the genus *Gregoryceras* are known only from literature (J. Siemiradzki, 1922; S. Z. Różycki, 1953) concerning the area of the Częstochowa Jurassic. Not a single specimen has hitherto been found in this age's sediments of northern Poland.

A subdivision typical of the sub-Mediterranean area has been applied to the Middle Oxfordian of southern Poland. In fact, no stratigraphical-palaeontological elaboration has hitherto been available, which might unequivocally elucidate this problem. Such a subdivision might be adopted as a result of taking into account an analysis of fauna, in particular ammonites and nautiloides, and a comparison with the south-French and south-German subdivisions. All this taken into account, the writer suggests the following subdivision of the Middle Oxfordian sediments in the southern area of Poland:

upper zone — Gregoryceras transversarium,
lower zone — Perisphinctes plicatilis.

Although faunal elaborations of this part of Poland are rare, they may be a basis for the statement that a general assemblage of the genera represented is similar to those in the countries mentioned above, even if not all of the genera known from the south-French or south-German Jurassic have so far been recorded in this country. In this region of Poland the following genera are known mostly: *Lytoceras, Holcophylloceras, Sowerbyceras, Calliphylloceras, Trimarginities, Taramelliceras, Cre-*

niceras, *Gregoryceras*, *Pseudogregoryceras*, *Proscaphites*, *Euaspidoceras* and *Perisphinctes* with its subgenus *Discophinctes* and others.

As follows from the papers published till now, they do not entitle one to a quite certain distinction of accurately outlined zones within the Middle Oxfordian of southern Poland. The occurrence of single specimens of the boreal species *Cawtoniceras tenuiserratum* (Oppel) and *Cawtoniceras tenuiserratum neumayri* Maire at Bachowice and at Stankowa Skałka in the Pieniny Klippen Belt should here be mentioned to show a complete faunal picture of this age's sediments.

PALAEOZOOGEOGRAPHY

The analysis of ammonite species occurring within the Lower and Middle Oxfordian of Poland enables a certain generalization concerning the direction of the migration of organisms, their geographical distribution and their connection with a corresponding zoogeographical province.

The problem of the southward migration of boreal elements was many times mentioned in literature, in which it is known under the names of "boreal spread" (W. J. Arkell, 1956) or "boreal transgression" (E. Cariou, 1973). Demarcating an accurate boundary between the two faunal provinces, that is, the boreal and the Mediterranean, is impossible because of the existence of zones in which these faunal elements are mixed. The evaluation of this phenomenon in a given area should be preceded first of all by a quantitative analysis of faunal elements characteristic of the sediments discussed.

At present, it is already possible to determine approximately the range of mixed, that is, subboreal and sub-Mediterranean zones which, after certain modifications, may correspond in general outline to those drawn by A. Zeiss (1968).

Let us consider the question how this situation developed in the Polish Basin of the Lower and Middle Oxfordian? The extensively stretched Polish Basin, remained during that period in its northern and central parts under the boreal influence, which is indicated by quantitative data concerning the species of the genera *Quenstedticeras*, *Cadoceras*, *Longaeviceras*, *Praecardioceras*, *Cardioceras*, *Goliathiceras*, *Pachycardioceras*, *Cawtoniceras*, *Maltoniceras*, *Amoeboceras*, *Amoebites*, and *Kosmoceras*, as well as pelecypods of the genus *Aucella*. On the basis of this fact this area has been assigned in the present paper to the subboreal province (Table 6), with appropriate ammonite zones distinguished in biostratigraphical subdivision. On the other hand, the southern part of the basin, corresponding to present-day area south of the Cracow—Przemyśl line, should be assigned, due to the assemblage of fauna known so far, to the sub-Mediterranean province.

Observations of the faunal material, collected from the sediments of the lower part of the Lower Oxfordian of Poland, confirm the standpoint of N. T. Sasonov's (I. G. Sasonova, N. T. Sasonov, 1967) statement that the connection of that period's Polish Basin with the western and central parts of the Russian Platform ran along the Prypet Depression called in the present paper the Prypet Gate. Due to the distribution of continental zones, species of the genera *Quenstedticeras* and *Kosmoceras* al-

ready reached then the area of the Lithuanian Jurassic, which was not directly connected with the basin of the Russian Platform (I. G. Sasonova, N. T. Sasonov, 1967, p. 143), getting there from the Polish Basin (Fig. 3). Single species, *Quenstedticeras* (*Lamberticeras*) *lamberti* (Sowerby), *Q.* (*Eichwaldiceras*) *carinatum* (Eichwald), *Q.* (*Quenstedticeras*) *mariae* (d'Orbigny) (A. A. Grigelis, 1961; L. M. Rotkýte, 1970), are known from this age's sediments of Lithuania.

A particular attention should be paid to the Lower Oxfordian species of the genus *Quenstedticeras* from the peri-Caspian area (the localities: Mangyshlak, Tuarkyr and Gissar; K. Amanniazov, 1960, 1962), which include species exactly like those met with in the Częstochowa Jurassic (the writer's own observations of Professor G. J. Krymholz's collections at the Academy of Sciences' Museum in Leningrad).

The connection with the north-German Basin in that time is indicated by the species *Quenstedticeras* (*Lamberticeras*) *lamberti* (Sowerby), whose occurrence is mentioned by J. Wormbs (1965) as he describes the Karstädt Ost II/3 borehole in the German Democratic Republic, as well as by *Quenstedticeras praelamberti* Sinzov, *Q.* (*Lamberticeras*) *lamberti* (Sowerby) and *Q.* (*Quenstedticeras*) *mariae* (d'Orbigny), identified by W. Haller (oral information) from the Seehausen borehole and which are housed at the Geological Institute's Museum in Berlin, G.D.R.

In the lower part of the Lower Oxfordian the connection of the epicontinental Polish Basin with the Carpathian Basin was undoubtedly more difficult. This conclusion results from the fact that no species of the genus *Quenstedticeras* have so far been found in this age's sediments of the Carpathian area. Their occurrence is not mentioned by M. Książkiewicz (1956) from the Jurassic of Bachowice and by J. Neumann (1907) from the Jurassic of Četechovice. It was only in Kruhel Wielki that *Cardioceras* (*Quenstedticeras*) sp. indet. was found by K. Wójcik (1913). A new species, *Quenstedticeras* (*Vertumniceras*) *banaticum* Răileanu, now housed at the Department of Geology in Bucharest, was mentioned by A. Bărbulescu (information imparted by letter).

These traces of fauna in the form of the representatives of the genus *Quenstedticeras* might be an evidence for a way leading through the Przemyśl Gate, which connected the north with the south during the period corresponding to the lower part of the Lower Oxfordian. The existence of a connection with the southern sea is indicated by specimens of the fauna of southern genera: *Peltoceras*, *Peltoceratoides*, *Hecticoceras*, *Taramelliceras* and *Collotites*, in fact not very abundant but more numerous in the sediments of the lower part of the Lower Oxfordian of central than of northern Poland.

The separation of the Cracow Jurassic from the Bachowice Trough by a barrier is discussed by M. Książkiewicz (1956), who admits the possibility that such a separation might have lasted throughout the Oxfordian. As shown by recent studies, however, this hypothesis should be limited to the lower part of the Lower Oxfordian only.

In the upper part of the Lower Oxfordian, the contact with the basin of the Russian Platform is continued through the Prypet Gate (Fig. 3). Many specimens of the genus *Cardioceras*, which had exceptionally convenient development conditions in the Polish Basin, are found in the area of central Poland, as well as in the Dnieper-Donets and Moscow Basins. On the other hand, according to N. T. Sasonov's (1967) supposit-

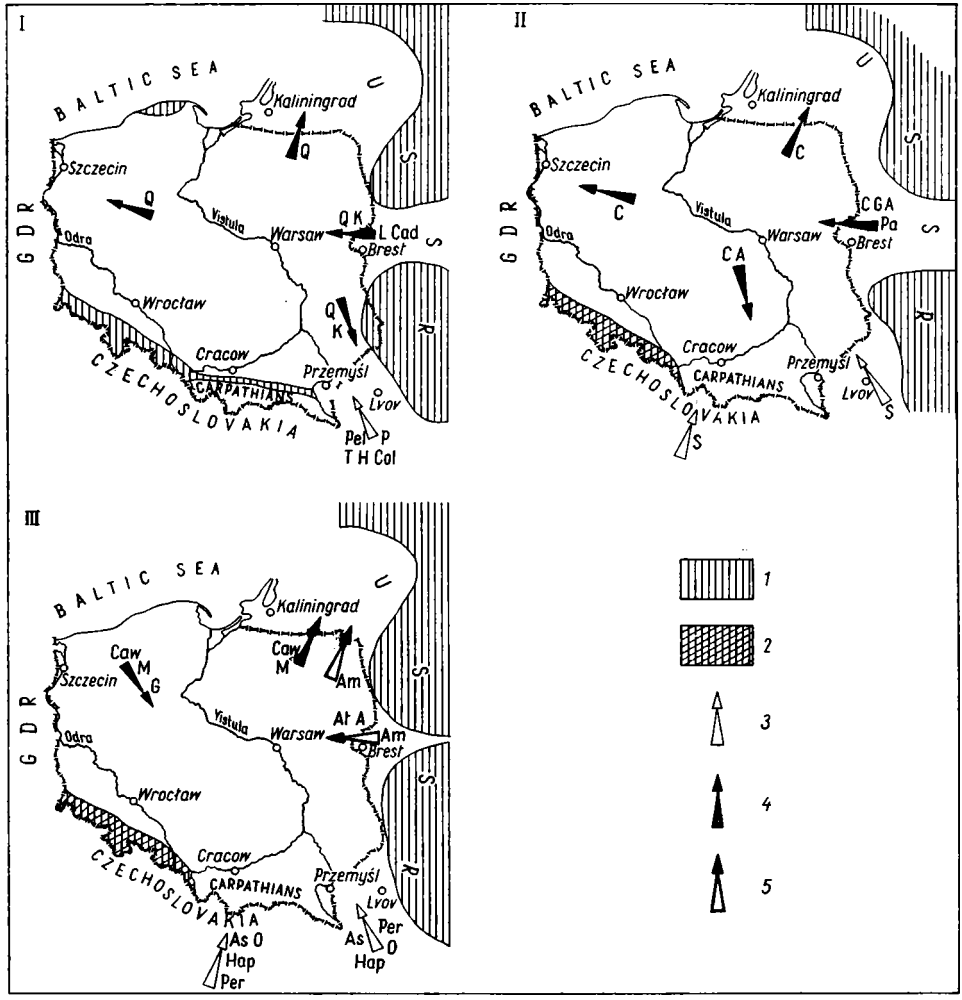


Fig. 3. Direction of the migration of boreal and southern fauna up the Polish Basin in the lower (I) and upper (II) part of the Lower Oxfordian and in the Middle Oxfordian (III)

1 — continental areas (western part of the Russian Basin after N. T. Sasonov in I. G. Sasonova, N. T. Sasonov, 1967), *2* — presumably continental areas, *3* — directions of the migration of southern fauna; directions of the migration of boreal fauna: *4* — in the Lower Oxfordian and in the lower part of the Middle Oxfordian, *5* — in the upper part of the Middle Oxfordian; *S* — southern fauna species shown in Table 3

Q — Quenstedticeras, Cad — Cadoceras, L — Longaeviceras, K — Kosmoceras, Pel — Peltoceratoides, P — Peltoceras, T — Taramelliceras, Col — Collotites, C — Cardioceras, G — Goliathiceras, Pa — Pachycardioceras, A — Aucella, Caw — Cawtoniceras, M — Maltoniceras, Am — Amoeboceras, At — Amoebites, As — Aspidoceratidae, *O* — Oppellidae, *Hap* — Haploceratidae, *Per* — Perisphinctidae, *H* — Hecticoceratinae

Kierunki migracji fauny borealnej i południowej w obręb zbiornika polskiego w części niższej (I) i wyższej (II) oksfordu dolnego i w oksfordzie środkowym (III)

1 — obszary lądowe (zachodnia część basenu rosyjskiego według N. T. Sazonowa *in* I. G. Sazonowa, N. T. Sazonow, 1967), *2* — przypuszczalne obszary lądowe, *3* — kierunki migracji fauny południowej; kierunki migracji fauny borealnej; *4* — w oksfordzie dolnym i w niższej części oksfordu środkowego, *5* — w wyższej części oksfordu środkowego; *S* — rodzaje fauny południowej według tabeli 3

3 — Z badań strat.

ion, *Parawedekindia arduennensis* (d'Orbigny), *Taramelliceras polonicum* Malinowska, *Campylites* aff. *delmontanus* (Oppel), *Creniceras crenatum* (Brugnier), *C. renggeri* (Oppel) and *Taramelliceras* sp. (ex gr. *richei* Loriol), that is species occurring in the sediments of the Częstochowa Jurassic, migrated through the Prypet Gate from the Polish Basin to the Dnieper-Donets Basin. In the Russian Platform some of these species are known only in the Prypet Depression.

Specimens of the species *Aucella impressa* (Quenstedt) (K. Wójcik, 1910), immigrants from boreal seas in which their most abundant occurrence is recorded, may be met with among numerous ammonites in the Radwanowice outcrop (Cracow Jurassic).

As follows from palaeogeographical data, species of the genus *Cardioceras* migrated to a basin in the area of present-day Lithuania from the Polish Basin, much the same as in the lower part of the Lower Oxfordian (K. Boden, 1911; Cz. Pachucki, 1932).

The connection with the north-German Basin in that time is indicated by the following species of the genus *Cardioceras*, found and identified by W. Haller (oral communication) from the Trieplatz and Seehausen boreholes: *Cardioceras* (*Scarburgiceras*) *bukowskii* Maire, *C.* (*Plasmatoceras*) *tenuicostatum* (Nikitin), *C.* (*P.*) *tenuistriatum* Borissjak, *C.* (*Cardioceras*) *cordatum* (Sowerby), *C.* (*Scoticardioceras*) *excavatum* (Sowerby), *C.* (*S.*) *laevigatum* Boden.

It is difficult to determine precisely how far to the south reached the migration of boreal forms of the genus *Cardioceras*. It is known, however, that they are absent from this age's sediments of Bulgaria, Rumunia and Yugoslavia. Single specimens of the species *Cardioceras* (*Cardioceras*) *cordatum* (Sowerby) were found in the eastern part of the Crimea (I. G. Sasonova, N. T. Sasonov, 1967) and at Bachowice (M. Książkiewicz, 1956). More numerous sites of this group were recorded at Četechovice, Moravia (J. Neumann, 1907) and at Kruhel Wielki near Przemyśl (K. Wójcik, 1913). It seems that future faunal finds should confirm the supposition that the contact with the Mediterranean Basin was direct. It is indicated by southern species particularly abundant in central Poland (Table 3). Most of these genera are not represented in northern Poland. Single representatives of the genera *Campylites*, *Euaspidoceras*, *Peltoceratoides* and *Perisphinctes* (Table 3) have thus far been found in the sediments of the upper part of the Lower Oxfordian of northern Poland.

In the lower part of the Middle Oxfordian, falling during the period when the genera *Cawtoniceras* and *Maltoniceras* occurred, the connection with the Russian Platform through the Prypet Gate seems to be limited. Of known species only *Cawtoniceras zieteni* (Ilovayski) was found in the south-eastern part of the Ukrainian Syneclise (W. P. Makridin, J. J. Migaczeva, B. P. Sterlin, 1972b) in a stratigraphical position, which may be correlated in the area of Poland.

Observing the quantitative occurrence of species of the genera *Cawtoniceras* and *Maltoniceras* we reach the conclusion that most of them are recorded in northern Poland, their numbers considerably decreasing southwards. It is difficult to find if their occurrence increased or decreased eastwards, since no ammonites have hitherto been recorded in the Middle Oxfordian of eastern Poland. The data given above may serve for drawing the conclusion that species of these genera reached the Polish Basin of the Middle Oxfordian from the north-western direction. Ample

evidence for this fact is supplied by many species of the genera *Cawtoniceras* and *Maltoniceras* occurring in the English Jurassic, where they developed abundantly, as well as in the north-French Jurassic, north-west German Jurassic, Greenland, western Canada and the western part of the U.S.A (J. B. Reeside, 1919; A. P. Dutertre, 1925; L. F. Spath, 1935; W. J. Arkell, 1935 — 1946, 1956; P. Siegfried, 1953).

This migration direction may also be confirmed by the species *Goliathiceras chamoussetiforme* Arkell, recently found in the Grudziądz IG 1 borehole and which is also known from the Cardioceras vertebrale Zone of the English Jurassic (J. K. Wright, 1972).

The difficulties in that period's connection with the Russian Platform are also indicated by the lack of pelecypods of the genus *Aucella* in Polish sediments on the one hand and by the lack of differentiated species of the genus *Perisphinctes*, otherwise so abundant in the sediments of the Polish Jurassic, in the central parts of the Russian Platform, on the other.

It is worth emphasizing that subgenera occurring, within the genus *Perisphinctes*, in this age's sediments in the area of Poland are, generally speaking, similar to English and north-German ammonites. This is particularly true of the subgenus *Arisphinctes*.

Of interest is the question how far species of the genera *Cawtoniceras* and *Maltoniceras* reached southwards. So far, single specimens of the genus *Cawtoniceras* have been found at Bachowice in the Carpathian area of Poland (M. Książkiewicz, 1956) and in the Pieniny Klippen Belt (K. Birkenmajer, 1963).

In the lower part of the Middle Oxfordian the epicontinental basin of Poland was undoubtedly connected directly with the southern basin, of which ample evidence is supplied by many species of the genera *Perisphinctes* and *Ochetoceras*. On the other hand, the sediments of the boreal zone do not contain representatives of the genera *Cawtoniceras* and *Maltoniceras*, which may only be ascribed to their susceptibility to changes in temperature.

During the period corresponding to the upper zone of the Middle Oxfordian the connection with the Russian Platform through the Prypet Gate seems to be more direct. The faunal data from the territory of Poland confirm N. T. Sasonov's suggestion (I. G. Sasonova, N. T. Sasonov, 1967) that the Dnieper-Donets Basin might be connected through the Prypet Gate with the Polish Basin. Species of the genera *Amoeboceras* and *Amoebites* occurring in the sediments of the Dnieper-Donets, Voronezh and Ulyanovsk areas, in the southern part of the Moscow Syneclise and in the Prypet Depression on the one hand, and in the area of the Polish Jurassic on the other indicate that there was a possibility of a connection between the two basins. Further evidence may be supplied by the abundant occurrence of specimens of the genus *Amoeboceras* within the upper part of the Middle Oxfordian in the Częstochowa Jurassic (L. Malinowska, 1963).

The presence of pelecypods of the genus *Aucella* (*A. bronni* Rouiller, *A. bronni lata* Trautschold) in the Middle Oxfordian sediments of the Cracow—Częstochowa Jurassic (J. Znosko, 1952; L. Malinowska, 1963) may be also indicative of the connection between the two basins. The species *Aucella bronni* Rouiller is considerably widely distributed in the boreal zone. It is known from the Franz Josef Land, the western part of

Siberia, and the Ussuri and Kolyma areas. It is abeent, on the other hand, from the Crimea, Caucasus and Central Asia (N. I. Schulgina, 1972).

Specimens of *Amoeboceras* sp. (ex gr. *alternans* Buch) (W. P. Makridin, J. J. Migaczeva, B. P. Sterlin, 1972b), found in the region of Kaliningrad, may indicate a connection, during that period, between the Polish and Lithuanian Jurassic.

Palaeozoological Laboratory, Department of Stratigraphy
Geological Institute, Warszawa, Rakowiecka 4
August, 1974

Translated by J. Dłutek

REFERENCES

[AMANNIAZOV, K.] АМАННИЯЗОВ, К., 1960 — Кардиоцерасы из нижнего оксфорда Туаркыра. *Изв. АН ТССР, сер. физ.-техн.-хим. и геол. наук*, № 2. Ашхабад.

[AMANNIAZOV, K.] АМАННИЯЗОВ, К., 1962 — Стратиграфия и аммониты верхнеюрских отложений Туаркыра. Изд. Акад. Наук Туркменской ССР. Ашхабад.

ARKELL, W. J., 1935—1948 — The Ammonites of the English Corallian Beds. *Paleont. Soc.* part 1—14. London.

ARKELL, W. J., 1941 — The Upper Oxfordian Clay at Purton, Wilts, and the Zones of the Lower Oxfordian. *Geol. Mag.* v. 78, nr 3. Londres.

ARKELL, W. J., 1956 — Jurassic Geology of the World. London.

BIRKENMAJER, K., 1963 — Stratygrafia i paleogeografia serii czorsztyńskiej pienińskiego pasa skałkowego Polski. [Eng. Sum.] Stratigraphy and Palaeogeography of the Czorsztyn Series (Pieniny Klippen Belt, Carpathians) in Poland. *Studia geol. pol.* v. 9. Warszawa.

BODEN, K., 1911 — Die Fauna des unteren Oxford von Popilany in Litauen. *Geol. Palaeont.* Abh. Bd 10, H. 2. Jena.

BROCHWICZ-LEWIŃSKI, W., 1970 — Biostratigraphy of Oxfordian Limestones from the Zawodzie Quarries in Częstochowa Polish Jura Chain. *Bull. Acad. Pol. Sc. Sér. Sc. géol. géogr.* v. 18, nr 4. Varsovie.

BROCHWICZ-LEWIŃSKI, W., 1972 — Middle Oxfordian Representatives of the Genera Lithacoceras Hyatt, 1900, and Liosphinctes Buckman, 1925, from the Polish Jura Chain. *Acta geol. pol.* v. 22, nr 3. Warszawa.

BROCHWICZ-LEWIŃSKI, W., 1973 — Some Remarks on the Origin of the Subfamily Idoceratinae Spath, 1924 (Perisphinctidae, Ammonoidea). *Acta paleont. pol.* v. 18, nr 3. Warszawa.

BUKOWSKI, G., 1887 — Über die Jurabildungen von Czenstochau in Polen. *Beitr. Paläont. Öster.-Ung.* Bd V. Wien.

BUKOWY, S., SIEWNIAK, A., 1963 — Profil jury i kredy w Wierbce koło Pilicy. [Eng. Sum.] Jurassic and Cretaceous Profile at Wierbka, Near the Pilica River. *Kwart. geol.* T. 7, nr 4. Warszawa.

CALLOMON, J. H., 1960 — New Section in the Corallian Beds around Oxford, and the Subzones of the Plicatilis Zone. *Rep. Proc. Geol. Assoc.* v. 71, part 2. Colchester.

CALLOMON, J. H., 1964 — Notes on the Callovian and Oxfordian Stages. Coll. du Jurassique. Luxemburg.

CARIOU, E., 1966a — L'Oxfordian supérieur du synclinal de Lezay-Avon (Deux-Sèvres). *C. r. Acad. Sc.* T. 262. Paris.

CARIOU, E., 1966b — Les faunes d'Ammonites et la sédimentation rythmique dans l'Oxfordian supérieur du seuil Poitou. *Trav. Inst. Geol. et Anthrop. Preh. de la Fac. des Sc. de Poitiers*, T. VIII. Poitou.

CARIOU, E., 1968 — Caractères de la faune et subdivisions du Callovien supérieur en Poitou (France). Colloque du Jurassique méditerranéen. *Ann. Inst. Geol. Publ. Hungarici*, T. LIV. Budapest.

CARIOU, E., 1973 — Ammonites of the Callovian and Oxfordian. *In:* A. Hallam (Ed.): Atlas of Palaeobiogeography. Amsterdam — London — New York.

CARIOU, E., ELMI, S., MANGOLD, Ch., THIERRY, J., TINTANT, H., 1971 — Zones de l'étage Callovien en France (province subméditerranéenne). *Bull. Soc. géol. de France* (7), T. XIII. Paris.

DADLEZ, R., 1958 — Badania geologiczne na antyklinorium pomorskim w roku 1957. [Eng. Sum.] Notes on Geological Investigations in Pomorze Antyclinorium in 1957. *Kwart. geol.* T. 2, nr 4. Warszawa.

DADLEZ, R., DAYCZAK-CALIKOWSKA, K., DEMBOWSKA, J., 1964 — Atlas Geologiczny Polski. Zagadnienia stratygraficzno-facjalne, z. 9 — Jura. Geological Atlas of Poland. Stratigraphic and Facies Problems. Fasc. 9 — Jurassic. Inst. Geol. Warszawa.

DADLEZ, R., DEMBOWSKA, J., 1965 — Budowa geologiczna parantyklinorium pomorskiego. [Eng. Sum.] Geological Structure of the Pomeranian Parantyclinorium *Pr. Inst. Geol.* T. 40. Warszawa.

DADLEZ, R., KOPIK, J., 1973 — Stratygrafia i paleogeografia jury. *Biul. Inst. Geol.* 252. Warszawa.

DAYCZAK-CALIKOWSKA, K., 1959 — Dotychczasowe wyniki badań stratygraficznych doggeru w obszarze Kamienia Pomorskiego (na podstawie makrofauny). [Eng. Sum.] Hitherto Obtained Results of Stratigraphical Investigations of the Dogger in the Region of Kamień Pomorski (Pomerania) on the Basis of Its Macrofauna. *Kwart. geol.* T. 3, nr 2. Warszawa.

DAYCZAK-CALIKOWSKA, K., 1967 — Problems of Middle Jurassic Stratigraphy in Poland. The I-st Jurassic Colloquium in Poland. *Biul. Inst. Geol.* 203. Warszawa.

DEMBOWSKA, J. 1962a — Rozwój malmu w południowej części syneklizy perybałtyckiej w świetle nowych wierceń. [Eng. Sum.] The Malm Development in the Southern Part of the Peribaltic Syneclise in the Light of New Drillings. *Prz. geol.* nr 4—5. Warszawa.

DEMBOWSKA, J., 1962b — Terrygeniczna facja argowu i rauraku w niektórych obszarach Polski północnej i zachodniej. [French Sum.] Les facies terrigenes de l'Argovien et du Rauracien dans la Pologne du Nord. Księga Pamiątkowa ku czci profesora Jana Samsonowicza. Wyd. Geol. Warszawa.

DEMBOWSKA, J., 1964 — Opracowania stratygraficzne utworów z czterech wierceń w okolicy Kcyni. [Eng. Sum.] The Stratigraphy of 4 Bore-Holes from the Vicinity of Kcynia (Northern Poland). *Biul. Inst. Geol.* 1975. Warszawa.

DORN, P., 1930 — Die Ammonitenfauna des untersten Malm der Frankenalb. *Palaeontographica*, Bd. 73. Stuttgart.

DUTERTRE, A. P., 1925 — Observations sur les terrains jurassiques supérieurs dans la Vallée de la Liane (Bas-Boulonnais). *Ann. Soc. Geol. Nord.* 49.

ENAY, R., 1966 — L'Oxfordien dans la moitie sud du Jura Français. *Nouv. Arch. Mus. Hist. nat. Lyon.* Fasc. VIII, T. I. Lyon.

[GRIGELIS, A. A.] ГРИГЯЛИС, А. А., 1961 — Схема стратиграфии юрских отложений Южной Прибалтики. Труды всесоюзного совещания по уточнению унифицированной схемы стратиграфии мезозойских отложений Русской платформы. *Трудьı*, вып. 39, Т. 2. Ленинград.

[KRYMHOLZ, G. J.] КРЫМГОЛЬЦ, Г. Я., 1972 — Основное деление юрской системы в СССР. Стратиграфия СССР. Юрская Система. Москва.

KSIĄŻKIEWICZ, M., 1956 — Jura i kreda Bachowic. [Eng. Sum.] The Jurassic and Cretaceous of Bachowice (Western Carpathians). *Rocz. Pol. Tow. Geol.* T. 24, z. 2—3. Kraków.

KUTEK, J., MATYJA, B., WIERZBOWSKI, A., 1973 — Problematyka stratygraficzna górnej jury z kilku wierceń w synklinorium warszawskim. [Eng. Sum.] Stratigraphical Problems of the Upper Jurassic Deposits in the Warsaw Synclinorium. *Acta geol. pol.* v. 23, nr 3. Warszawa.

LEWIŃSKI, J., 1902 — Przyczynek do znajomości utworów jurajskich na wschodnim zboczu Gór Świętokrzyskich. *Pam. fizjogr.* T. 17. Warszawa.

LEWIŃSKI, J., 1908 — Les dépôts jurassiques près la station Chęciny et leur faune. *Spraw. Pol. Akad. Umiej.* nr 4. Kraków.

LEWIŃSKI J., 1912 — Utwory jurajskie na zachodnim zboczu Gór Świętokrzyskich. *Spraw. Tow. Nauk. Warsz.* 5. Warszawa.

[MAKRIDIN, W. P., MIGACZEVA, J. J., STĚRLIN, B. P.] МАКРИДИН, В. П., МИГАЧЕВА, Е. Е., СТЕРЛИН, Б. П., 1972a — Украинская синеклиза и северо-западная окраина Донецкого складчатого сооружения. Стратиграфия СССР. Юрская Система. Москва.

[MAKRIDIN, W. P., MIGACZEVA, J. J., STĚRLIN, B. P.] МАКРИДИН, В. П., МИГАЧЕВА, Е. Е., СТЕРЛИН, Б. П., 1972b — Польско-Литевская си-

неклиза и Предкарпатский прогиб. Стратиграфия СССР. Юрская Система. Москва.

MALINOWSKA, L., 1958 — Stratygrafia dolnego malmu okolic Wodnej koło Chrzanowa na podstawie makrofauny. [Eng. Sum.] Stratigraphy of the Lower Malm in the Vicinity of Wodna Near Chrzanów (Cracow Region) on the Basis of its Macrofauna. *Kwart. geol.* T. 2, nr 4, Warszawa.

MALINOWSKA, L., 1959 — Uwagi o newizie Jury Częstochowskiej. [Eng. Sum.] Notes on the Nevisian of the Częstochowa Jura Chain. *Kwart. geol.* T. 3, nr 2. Warszawa.

MALINOWSKA, L., 1960 — Fauna malmu w otworze wiertniczym Piekary (koło Poznania). [Eng. Sum.] The Malm Fauna in Bore—Hole Piekary Near Poznań. *Kwart. geol.* T. 4, nr 2. Warszawa.

MALINOWSKA, L., 1963 — Stratygrafia oksfordu jury częstochowskiej na podstawie amonitów. [Eng. Sum.] Stratigraphy of the Oxfordian of the Częstochowa Jurassic on the Basis of Ammonites. *Pr. Inst. Geol.* T. 36. Warszawa.

MALINOWSKA, L., 1965 — Bioherma gąbkowa newizu w rejonie Ćmielowa (północno-wschodnie obrzeżenie Gór Świętokrzyskich). [Eng. Sum.] Spongy Bioherm of the Neuvizyan in the Vicinity of Ćmielów. (North-Eastern Surrounding Formations of the Święty Krzyż Mts.) *Biul. Inst. Geol.* 192. Warszawa.

MALINOWSKA, L., 1966 — Podstawy stratygrafii dolnego i środkowego oksfordu północnej i północno-zachodniej Polski. [Eng. Sum.] Stratigraphical Basis of the Lower and Middle Oxfordian in the North and North-West Poland. *Kwart. geol.* T. 10, nr 3. Warszawa.

MALINOWSKA, L., 1967a — Remarks on the Stratigraphy of the Extra-Carpathian Upper Jurassic in Poland. The I-st Jurassic Colloquium in Poland. *Biul. Inst. Geol.* 203. Warszawa.

MALINOWSKA, L., 1967b — Biostratygrafia osadów dolnego i środkowego oksfordu w obrzeżeniu Gór Świętokrzyskich. [Eng. Sum.] Biostratigraphy of Lower and Middle Oxfordian Deposits in the Margin of the Świętokrzyskie Mountains. *Biul. Inst. Geol.* 209. Warszawa.

MALINOWSKA, L., 1968 — Stratygrafia osadów środkowego oksfordu w Polsce (bez Karpat). [Eng. Sum.] Stratigraphy of the Middle Oxfordian Deposits in Poland — Except for the Carpathian Area. *Kwart. geol.* T. 12, nr 1. Warszawa.

MALINOWSKA, L., 1970 — Jura górna. [Eng. Sum.] Upper Jurassis. *In:* Stratygrafia mezozoiku obrzeżenia Gór Świętokrzyskich. The Stratigraphy of the Mesozoic in the Margin of the Góry Świętokrzyskie. *Pr. Inst. Geol.* T. 66. Warszawa.

MALINOWSKA, L., 1971 — Ammonites and Nautiloids of the Epicontinental Oxfordian in Poland. *In:* Colloque du Jurassique méditerranéen. *Ann. Inst. Geol. Publ. Hungarici,* T. 54, fasc. 2. Budapest.

MALINOWSKA, L., 1972a — Środkowy i górny oksford w północno-zachodniej części jury częstochowskiej. [Eng. Sum.] Middle and Upper Oxfordian in the North-West Part of the Częstochowa Jurassic. *Biul. Inst. Geol.* 233. Warszawa.

MALINOWSKA, L., 1972b — The Middle Oxfordian Perisphinctidae of Zawodzie Near Częstochowa (Poland). *Acta palaeont. pol.* v. 17, nr 2. Warszawa.

MALINOWSKA L., DEMBOWSKA, J., 1973 — Jura górna. *In:* Budowa geologiczna Polski (Geology of Poland). T. 1, cz. 2. Inst. Geol. Warszawa.

MAREK, S., 1961 — Budowa geologiczna antykliny Wojszyc. [Eng. Sum.] Geological Structure of Wojszyce Anticline. *Kwart. geol.* T. 5, nr 4. Warszawa.

[MESEZHNIKOV, M. S.] МЕСЕЖНИКОВ, М. С., 1969 — Зональная стратиграфия и зоогеографическое районирование морских бассейнов. Издат. Наука, Сибирское отложение. Ленинград.

MOSSOCZY, Z., 1960 — Jura i pokrywające ją utwory na północ od Częstochowy. Przewodnik XXXIII Zjazdu Pol. Tow. Geol. Warszawa.

NEUMANN, J., 1907 — Die Oxfordfauna von Četechovitz. *Beitr. Paläont. Öster.-Ung.* Bd 20. Wien.

NEUMAYER, M., 1871 — Die Vertretung der Oxfordgruppe im östlichen Theile der mediterranen Provinz I. Jurastudien. *Jahrb. Kais.-Königl. Geol. Reichenanstalt.* Bd. 21, H. 4. Wien.

NIEMCZYCKA, T., 1964 — Osady malmu nad górnym Bugiem. [Eng. Sum.] The Malm Formations in the Upper River Area. *Kwart. geol.* T. 8, nr 2. Warszawa.

NIEMCZYCKA, T., 1965 — Granica jury środkowej i górnej na obszarze północnej Lubelszczyzny i Podlasia. *Kwart. geol.* T. 9, nr 3. Warszawa.
NIEMCZYCKA, T., 1970 — Stratygrafia oksfordu centralnej Lubelszczyzny w powiązaniu z profilowaniem geofizycznym otworów wiertniczych. [Eng. Sum.] Oxfordian Stratigraphy of the Central Lublin Region in the Light of Geophysical Logging in Bore Hole. *Kwart. geol.*. T. 14, nr 2. Warszawa.
NIEMCZYCKA, T., 1973 — Jura górna wschodniej Polski. *In:* Budowa geologiczna Polski (Geology of Poland). T. 1, cz. 2. Inst. Geol. Warszawa.
NIEMCZYCKA, T., 1976 — Jura górna na obszarze wschodniej Polski (między Wisłą i Bugiem). [Eng. Sum.] Upper Jurassic Rocks of the Eastern Poland Area (Between the Vistula and the Bug Rivers). *Pr. Inst. Geol.* 77. Warszawa.
[PACHUCKI, Cz.] PAKUCKAS, Č., 1932 — Papilės oksfordo ir kelovejo amonitų fauna (Die Ammoniten-Fauna des Oxford und Kelloway von Papile). *Mém. Fac. Sc. de l'Univ. de Vytautas le Grand.* T. VI Kaunas.
PREMIK, J., 1924 — Sprawozdanie z badań geologicznych w okolicach Olewina, Kraszkowic, Burzenina, Widawy i Szczercowa. *Posiedz. nauk. Państw. Inst. Geol.* 8. Warszawa.
PREMIK, J., 1934 — Budowa i dzieje geologiczne okolic Częstochowy. *In:* Ziemia Częstochowska 1. Warszawa.
REESIDE, J. B., 1919 — Some American Jurassic Ammonites of the Genera Quenstedticeras, Cardioceras, and Amoeboceras, Fam. Cardioceratidae. *U. S. Geol. Survey Prof. Papers,* 118. Washington.
ROEMER, F., 1870 — Geologie von Oberschlesien. Wrocław.
[ROTKÝTE, L. M.] РОТКИТЕ, Л. М., 1970 — Космоцерасы келловейских отложений Литвы и Латвии. Палеонтология и Стратиграфи Прибалтики и Белоруссии. Сб. II. Вильнюс.
RÓŻYCKI, S. Z., 1948 — Uwagi o Rhynchonellidach jury górnej pasma Krakowsko-Częstochowskiego. [Eng. Sum.] Remarks about Upper Jurassic Rhynchonellidae of the Cracow — Częstochowa Chain. *Biul. Inst. Geol.* 42. Warszawa.
RÓŻYCKI, S. Z., 1953 — Górny dogger i dolny malm jury krakowsko-częstochowskiej. [Eng. Sum.] Upper Dogger and Lower Malm of the Cracow — Częstochowa Jurassic Chain. *Pr. Inst. Geol.* T. 17. Warszawa.
RÓŻYCKI, S. Z., 1955 — Parkinsonie, garantiany i strenocerasy z doggeru obrzeżenia Gór Świętokrzyskich i ich znaczenie stratygraficzne. *Acta geol. pol.* v. 5, nr 3. Warszawa.
RÓŻYCKI, S. Z., 1960 — O nazwę Jura Polska zamiast Wyżyna Krakowsko-Częstochowska. *Prz. geol.* nr 8. Warszawa.
SAMSONOWICZ, J., 1934 — Explication de la feuille Opatów 1:100 000. Państw. Inst. Geol. Warszawa.
[SASONOVA, I. G., SASONOV, N. T.] САЗОНОВА, И. Г., САЗОНОВ, Н. Т., 1967 — Палеогеография Русской Платформы в юрское и раннемеловое время. Недра, Ленинградское отделение. *Труды,* вып. 62. Ленинград.
[SASONOV, N. T.] САЗОНОВ, Н. Т., 1957 — Юрские отложения Центральных областей Русской платформы. ВНИГНИ. Ленинград.
[SCHULGINA, N. I.] ШУЛЬГИНА, Н. И., 1972 — Фауна, флора и биогеографическое районирование. Ауцеллы. Стратиграфия СССР. Юрская Система. Москва.
SIEGFRIED, P., 1953 — Die Heersumer Schichten in Hildesheimer Jura-Zug. *Geol. Jahrb.* Bd 67. Hannover.
SIEMIRADZKI, J., 1891 — Fauna kopalna warstw oksfordzkich i kimerydzkich w okręgu krakowskim i przyległych częściach Królestwa Polskiego. *Pam. Wydz. Matem.-Przyr. Akad. Umiej.* T. 18. Kraków.
SIEMIRADZKI, J., 1899 — Monographie der Gattung Perisphinctes. *Palaeontographica.* Bd. 45. Stuttgart.
SIEMIRADZKI, J., 1922 — Geologia ziem polskich. T. 2. Muzeum im. Dzieduszyckich. Lwów.
SPATH, L. F., 1935 — The Upper Jurassic Invertebrate Faunas of Cape Leslie, Milne Land. I. Oxfordian and Lower Kimmeridgian. *Medd. Gronland,* Bd 99, nr. 2. København.
ŚWIDZIŃSKI, H., 1931 — Utwory jurajskie między Małogoszczą a Czarną Nidą. [French Sum.] Dépôts jurassiques entre Małogoszcz et la Czarna Nida — Massif de Sainte Croix. *Spraw. Państw. Inst. Geol.* T. 6, z. 4. Warszawa.

TEISSEYRE, W., 1899 — Über die systematische Bedeutung der sogennanten Parabeln bei Perisphincten. *Neues Jb. Miner. Beil.-Bd* 6. Stuttgart.
TRAUTH, F., 1948 — Die Fazielle Ausbildung und Gliederung des Oberjura in den nördlichen Ostalpen. *Verh. Geol. Bund.* H. 10—12. Wien.
WIŚNIOWSKI, T., 1890 — Mikrofauna iłów ornatowych okolic Krakowa. *Pam. fizjogr.* T. 17. Kraków.
WORMBS, J., 1965 — Makrofaunenführung und Fazies des Oberen Bath und Callov in einigen Bohrungen der Prignitz. *Mitteilungen G.I.* H. 1. Berlin.
WRIGHT J. K., 1972 — The Stratigraphy of the Yorkshire Corallian. *Proc. of the Yorkshire Geol. Soc.* v. 39, part 2. London.
WÓJCIK, K., 1908 — Exotica fliszowe Kruhela Wielkiego koło Przemyśla. *Spraw. Komis. Fizjogr. Pol. Akad. Umiej.* 42. Lwów.
WÓJCIK, K., 1910 — Bat, kelowej i oksford okręgu krakowskiego (stratygrafia). Bathonien, Callovien und Oxfordien des Krakauer Gebietes. Stratigraphie. *Spraw. Pol. Akad. Umiej.* nr 8. Kraków.
WÓJCIK, K., 1913 — Jura Kruhela Wielkiego pod Przemyślem. Cz. 1. *Rozpr. Pol. Akad. Umiej.* B 53. Kraków.
ZARĘCZNY, S., 1894 — Atlas geologiczny Galicji. Tekst do zeszytu III. Komis. Fizjogr. Kraków.
ZEISS, A., 1955 — Zur Stratigraphie des Callovien und Unter-Oxfordien bei Blumberg (Südbaden). *Jh. geol. Landsamt,* Bd 1. Baden — Württemberg.
ZEISS, A., 1956 — Hecticoceras und Reineckeia Mittel und Ober Callovien von Blumberg (Südbaden). *Bayer. Akad. Wissensch. Abh. N. F.* H. 80 München.
ZEISS, A., 1957 — Die ersten Cardioceraten-Faunen aus dem oberen Unter-Oxfordien Süddeutschlands und einige Bemerkungen zur Dogger-Malm Grenze. *Geol. Jahrb.* Bd 73. Hannover.
ZEISS, A., 1962 — Die Ammonitengattung Paraspidoceras L. F. Spath. *Erlanger. Geol. Abh.* H. 41. Erlanger.
ZEISS, A., 1968 — Untersuchungen zur Paläontologie der Cephalopoden des Unter-Tithon der Südlichen Frankenalb. *Bayer. Akad. Wissensch. Abh. N. F.* H. 132. München.
ZEJSZNER, L., 1869 — Die Gruppen und Abtheilungen des polnischen Juras, nach neueren Beobachtungen zusammengestelt. *Z. Dtsch. Geol. Ges.* Bd 22. Berlin.
ZEJSZNER, L., 1884 — Poszukiwania geologiczne dokonane w południowo-zachodnich okolicach Królestwa Polskiego, a przeważnie w górnej dolinie rzeki Warty. *Pam. fizjogr.* T. 4. Warszawa.
ZNOSKO, J., 1952 — Uwagi o niektórych przedstawicielach fauny borealnej w jurze krakowsko-częstochowskiej. [French Sum.] Remarques sur certain representants de la faune boreale dans le Jurassique de Cracovie — Częstochowa. *Rocz. Pol. Tow. Geol.* T. 21, z. 3. Kraków.
ZNOSKO, J., 1953 — Budowa geologiczna okolic Błędowa i Niegowonic koło Olkusza. [Eng. Sum.] Geological Structure of the Błędów and Niegowonice, Region near Olkusz. *Biul. Inst. Geol.* 74. Warszawa.
ZNOSKO, J., 1957 — Zarys stratygrafii łęczyckiego doggeru. [Eng. Sum.] Outline of Stratigraphy of the Dogger in the Łęczyca Area. *Biul. Inst. Geol.* 125. Warszawa.
ZNOSKO, J., 1959 — Wstępny zarys stratygrafii utworów jurajskich w południowo-zachodniej części Niżu Polskiego. [Eng. Sum.] Preliminary Description of Stratigraphy of Jurassic Sediments in Southwestern Part of Polish Lowland. *Kwart. geol.* T. 3, nr 3. Warszawa.

Лидия МАЛИНОВСКА

БОРЕАЛЬНЫЕ ФАУНИСТИЧЕСКИЕ ВЛИЯНИЯ В НИЖНЕМ И СРЕДНЕМ ОКСФОРДЕ ПОЛЬШИ

(с 3 фиг. и 3 табл.)

РЕЗЮМЕ

Содержание. В настоящей статье проведено сопоставление районов распространения нижнего и среднего оксфорда на территории Польши и описаны аммонитовые сообщества, характеризующие отдельные районы. Представлена актуальная схема биостратиграфического расчленения и корреляция выделенных горизонтов с эквивалентными горизонтами южной и восточной частей Парижского бассейна, с юрой Англии, а также западной и центральной областей Советского Союза. Северные и центральные районы Польши, в которых решительно преобладает бореальная фауна, отнесены к суббореальной провинции. Детально проанализированы направления миграции организмов и их географическое распространение.

Бореальные фаунистические влияния, проникшие с востока и северо-запада, решительным образом отразились в составе фаунистических горизонтов нижнего и среднего оксфорда на территории Польши. Можно в общих чертах указать, что фаунистические горизонты указанных подъярусов отражают перемежающиеся признаки двух зоогеографических провинций — суббореальной и субсредиземноморской.

Бореальные влияния в нижнем и среднем оксфорде Польши анализировались на основании наличия и количества следующих родов: *Quenstedticeras, Cadoceras, Longaeviceras* (?), *Praecardioceras, Cardioceras, Goliathiceras, Pachycardioceras, Cawtoniceras, Maltoniceras, Amoeboceras, Amoebites* и *Kosmoceras,* а также пелеципод рода *Aucella.* Одновременно определялось количество средиземноморских видов, представленных в нижнем и среднем оксфорде, в сопоставлении с их количеством в юре южной Франции и Швабской и Франконской Юры.

В нижнем интервале нижнего оксфорда выделены слои с *Quenstedticeras,* которые получили широкое распространение в пределах внекарпатской части Польши. Они наблюдались почти на всей территории страны, за исключением Судет, поднятия Лебы и района г. Хрубешув, в котором отсутствуют отложения этого возраста (фиг. 1). Пока нет фаунистических доказательств о распространении этих слоев в Предкарпатском и Карпатском районах. Крайним южным

районом известного распространения слоев с *Quenstedticeras* является Краковская юра (Подленже к юго-западу от Кракова) и юра района г. Пшемысля (Кругель-Вельки близ г. Пшемысль — К. Вуйцик, 1910, 1913). Эти слои представлены двумя фациями. Отложения мергелисто-известняковой фации представлены в пределах Краковско-Велюньской юры, в обрамлении Свентокшиских гор и в восточной и центральной частях Польши. Отложения алевролитовой фации занимают северную и северо-западную части страны.

Самая большая мощность слоев с *Quenstedticeras*, составляющая около 12,5 м, наблюдалась по разрезу скважины Осова в северо-западной окраине Польши. В обнажениях эти слои можно наблюдать единственно в Краковско-Вельюньской юре и в обрамлении Свентокшиских гор. Богатый материал по этим слоям получен благодаря многочисленным скважинам. На этом основании удалось провести фаунистическую корреляцию нижнего интервала нижнего оксфорда для всей внекарпатской территории страны (фиг. 2). В керне буровых скважин и в обнажениях были найдены многочисленные экземпляры бореальной фауны, принадлежащие, главным образом, родам *Quenstedticeras, Praecardioceras, Kosmoceras* и спорадически к родам *Cadoceras* и *Longaeviceras* (?) (табл. 1). В некоторых интервалах керна наблюдались богатые скопления экземпляров рода *Quenstedticeras*. В качестве примера можно указать разрез буровой скважины Рокита (Западное Поморье) (табл. 1).

Верхний интервал нижнего оксфорда представлен слоями с *Cardioceras*. На территории Польши они характеризуются широким распространением и отсутствуют лишь в Судетском районе. До сих пор нет еще кардиоцерасовой характеристики отложений этого возраста в восточной части Польши (Люблинский регион). В общих чертах, слои с *Cardioceras* представлены отложениями двух фаций: известняково-мергелистой, с частыми проявлениями доломитизации, с губковыми биогермами и криноидными известняками, которая распространена в центральной, восточной и южной частях страны, и песчано-алевролитовой, преобладающей в северо-западной части Польши. Мощность слоев с *Cardioceras* составляет от нескольких метров до 75 м (Люлевички близ г. Бялогард, западная Польша).

Слои с *Cardioceras* обнажаются в обрамлении Свентокшиских гор, в Краковско-Ченстоховской юре и в Карпатском районе. Кроме того, данные по залеганию этих слоев были получены с помощью многочисленных скважин. В керне скважин и в обнажениях добыты экземпляры аммонитов, относящихся к родам *Cardioceras, Goliathiceras, Pachycardioceras* (табл. 2), связанным с бореальной зоной, а также типичные экземпляры южной зоны (табл. 3). Количество видов южной зоны сильно сокращается в отложениях, распространенных в северных районах Польши.

Отложения среднего оксфорда тоже отличаются широким распространением. Они известны как в пределах внекарпатской части страны, так и в Карпатском районе. Отсутствуют единственно в Судетах. В северной и западной Польше преобладают отложения алевролито-мергелистой фации, а ближе к периферии бассейна — отложения алевролито-песчанистой фации. На остальной площади страны развита карбонатная фация с многочисленными биофациальными разновидностями. Перемежание этих фаций наблюдается по западной окраине центральной Польши (Я. Дембовска, 1962b). Максимальная мощность среднего оксфорда, составляющая 120 м, наблюдалась в центральной Польше. Естественные обнажения пород этого возраста встречаются в пределах Краковско-Ченстоховской юры, где они слагают живописную гряду, в обрамлении Свентокшиских гор и в Карпатах. Много данных по этим отложениям дали буровые скважины, пройденные в разных местах всей территории страны.

Характерной чертой в залегании среднего оксфорда в северной Польше является кардиоцерасовый перерыв (табл. 4), наблюдавшийся в разрезах нескольких скважин. Стратиграфически он приходится на границу между нижним и верхним горизонтами среднего оксфорда.

В составе фауны среднего оксфорда проявляется некоторая зональность. В отложениях северной Польши обильное развитие получили роды и виды семейства Cardioceratidae. Подчиненную роль играют роды и виды семейства Perisphinctidae. В центральной же Польше основную фаунистическую массу составляют роды и виды семейств Perisphinctidae, Oppeliidae и Haploceratidae, с все еще многочисленными видами семейства Cardioceratidae. В южной Польше сохраняется преобладание видов семейств Perisphinctidae, Oppeliidae, Haploceratidae, однако часто уже встречаются представители семейств Phylloceratinae, Lytoceratidae и Aspidoceratidae. Семейство Cardioceratidae представлено спорадическими видами.

Описанное в работе биостратиграфическое расчленение нижнего и среднего оксфорда Польши основывается на детальных анализах фауны, которая была добыта в десятках буровых скважин и естественных обнажений. В настоящее время уже опубликованы детальные стратиграфические и палеонтологические описания фауны нижнего и среднего оксфорда по отдельным обнажениям и скважинам и поэтому имеется возможность составления детальной и актуальной схемы расчленения этого яруса.

Анализ аммонитовых видов, представленных в нижнем и среднем оксфорде Польши дал основу для сообщения взглядов на направления миграции, географическое распространение и связь с определенной зоогеографической провинцией этих организмов. Северная и центральная части польского бассейна во время рассматриваемого периода находились несомненно под фаунистическим влиянием бореальной провинции, что следует из количественных распределений видов. В связи с этим, исследованная площадь относится автором к суббореальной провинции (табл. 6) с выделением в биостратиграфическом расчленении соответствующих аммонитовых горизонтов. Южная часть бассейна, охватывавшая площадь южнее линии Краков—Пшемысль, относится к субсредиземноморской провинции. Выделенные фаунистические горизонты нижнего и среднего оксфорда Польши коррелируются с горизонтами южной и восточной частей Парижского бассейна, Англии и центральной и западной частей Советского Союза.

Изучение фаунистического материала, содержащегося в нижнем интервале нижнего оксфорда Польши, подтверждает взгляды Н. Т. Сазонова (И. Г. Сазонова, Н. Т. Сазонов, 1967), согласно которым связь бассейнов на территории Польши и России происходила посредством Припятского прогиба. Учитывая распределение материков, следует предполагать, что виды родов *Quenstedticeras* и *Kosmoceras* в литовскую юру попали из польского бассейна (фиг. 3). Связь с бассейном Северной Германии доказывается наличием видов рода *Quenstedticeras*. Эпиконтинентальный бассейн Польши в начале раннего оксфорда был слабо связан с карпатским бассейном, судя по отсутствию находок видов рода *Quenstedticeras* в отложениях этого возраста в пределах Карпатского района.

В течение раннего оксфорда соединение с русским бассейном происходило по прежнему посредством Припятского прогиба. Многочисленные экземпляры кардиоцерасов, обитавших в польском бассейне в исключительно благоприятных условиях, встречаются как на территории центральной Польши, так и в Днепровско-Донецком и Московском бассейнах. Палеогеографические предпосылки заставляют предполагать, что виды рода *Cardioceras* мигрировали в бассейн, расположенный на территории современной Литвы, из польского бассейна, так

же, как это происходило в начальной стадии раннего оксфорда. О связи с северогерманским бассейном свидетельствуют виды рода *Cardioceras*, найденные и определенные Халлером (частное сообщение) по разрезам скважин Триплятц и Зеегаузен. Трудно определить южную границу миграции бореальных форм рода *Cardioceras*. Известно лишь, что в эквивалентных отложениях Болгарии, Румынии и Югославии они совершенно отсутствуют. Отдельные экземпляры вида *Cardioceras/Cardioceras cordatum* (Sowerby) наблюдались в восточной части Крымского полуострова (И. Г. Сазонова, Н. Т. Сазонов, 1967) и в местности Баховице (М. Ксёнжкевич, 1956). Более многочисленные местонахождения этой группы известны в районе местности Цетеховице в Моравии (И. Нейманн, 1907) и в местности Кругель-Вельки близ г. Пшемысль (К. Вуйцик, 1913). Следует надеяться, что дальнейшие находки фауны подтвердят предположения о непосредственной связи с южным бассейном.

В среднем оксфорде, в его ранней стадии, ознаменованной обитанием видов родов Cawtoniceras и Maltoniceras, связь с русским бассейном через Припятский прогиб была очевидно ограничена. Количественное распределение видов родов *Cawtoniceras* и *Maltoniceras* характеризуется тем, что максимальное их скопление наблюдается в северной Польше, а к югу их количество сокращается. Нет данных относительно распространения этих видов в восточной Польше, так как в отложениях среднего оксфорда этой части страны аммониты до сих пор не встречались. Можно предполагать, что виды перечисленных родов мигрировали в среднеоксфордский бассейн Польши с северо-запада. Об этом свидетельствует обильное количество представителей родов *Cawtoniceras* и *Maltoniceras* в английской юре, а также их многочисленное распространение в юре Северной Германии, Северной франции, Гренландии и Западной Канады. Кроме того, такое направление миграции доказывается находками в скважине Грудзёндз ИГ I вида *Goliathiceras chamoussetiforme* Arkell, известного также в подзоне *Cardioceras vertebrale* в юре Англии (Дж. К. Урайт, 1972). О слабом сообщении с морем на территории России свидетельствует отсутствие в отложениях соответствующего возраста в Польше моллюсков рода *Aucella*, а в центральной зоне русского бассейна — дифференцированных видов рода *Perisphinctes*, которые в изобилии представлены в юре Польши. Следует также отметить, что подроды рода *Perisphinctes*, распространенные в юрских отложениях Польши, сходны с экземплярами, встречающимися в Англии и Северной Германии. В особенности это касается подрода *Arisphinctes*.

В промежутке времени, приходящемся на верхний горизонт среднего оксфорда, соединение с русским бассейном через Припятский прогиб было вероятно более широкое. Фаунистические данные с территории Польши подтверждают предположения Н. Т. Сазонова (И. Г. Сазонова, Н. Т. Сазонов, 1967), считающего, что через Припятский прогиб Днепровско-Донецкий бассейн мог соединяться с морем на территории Польши. Доказательством такой связи может являться наличие моллюсков рода *Aucella* в среднеоксфордских отложениях Краковско-Ченстоховской юры, в частности вида *Aucella bronni* Rouillier, который отличается широким распространением в бореальной зоне и отсутствует в южной зоне Польши.

ОБЪЯСНЕНИЯ К ФИГУРАМ

Фиг. 1. Распространение нижнего и среднего оксфорда в Польше

1 — граница современного распространения отложений, *2* — линия Карпатского надвига; регионы, упоминающиеся в работе: *A* — обрамление Свентокшиских гор, *B* — Пьенинская зона утесов

Фиг. 2. Корреляция избранных фаунистических профилей нижнего интервала нижнего оксфорда внекарпатской Польши (по данным К. Дайчак-Цаликовской, Я. Дембовской, С. З. Ружицкого и автора).

1 — хлоритовые песчаники, *2* — песчанистые алевролиты, *3* — алевролиты, *4* — глинистые и алевритистые сланцы, *5* — известняки, *6* — мергелистые известняки, *7* — оолитовые известняки

Фиг. 3. Направления миграции бореальной и южной фауны в польский бассейн в первой (I) и второй (II) половине раннего оксфорда и в среднем оксфорде (III)

1 — суша (западная часть русского бассейна по Н. Т. Сазонову в: И. Г. Сазонова, Н. Т. Сазонов, 1967), *2* — предполагаемые материки, *3* — направления миграции южной фауны; направления миграции бореальной фауны: *4* — в раннем оксфорде и в первой половине среднего оксфорда, *5* — во второй половине среднего оксфорда; *S* — виды южной фауны, согласно таблице 3

Q — *Quenstedticeras*, *Cad* — *Cadoceras*, *L* — *Longaeviceras*, *K* — *Kosmoceras*, *Pel* — *Peltoceratoides*, *P* — *Peltoceras*, *T* — *Taramelliceras*, *Col* — *Collotites*, *C* — *Cardioceras*, *G* — *Goliathiceras*, *Pa* — *Pachycardioceras*, *A* — *Aucella*, *Caw* — *Cawtoniceras*, *M* — *Maltoniceras*. *Am* — *Amoeboceras*, *At* — *Amoebites*, *As* — Aspidoceratidae, *O* — Oppeliidae, *Hap* — Haploceratidae, *Per* — Perisphinctidae, *H* — Hecticoceratinae

СПИСОК ТАБЛИЦ

Табл. 1. Распространение видов родов *Quenstedticeras*, *Praecardioceras*, *Kosmoceras*, *Cadoceras*, *Longaeviceras* (*?*) в нижнем интервале нижнего оксфорда Польши

Табл. 2. Распространение видов семейства Cardioceratidae в верхнем интервале оксфорда Польши

Табл. 3. Количественное сопоставление видов аммонитов и наутилоидей в слоях с *Cardioceras* (верхний интервал нижнего оксфорда) в Польше

Табл. 4. Биостратиграфия среднего оксфорда в северной и центральной частях Польши

Табл. 5. Количественное сопоставление экземпляров отдельных видов семейства Cardioceratidae в среднем оксфорде Польши

Табл. 6. Корреляция фаунистических профилей нижнего и среднего оксфорда Польши с профилями Франции, Англии и СССР

Перевод Ежи Федак

Lidia MALINOWSKA

FAUNISTYCZNE WPŁYWY BOREALNE W OKSFORDZIE DOLNYM I ŚRODKOWYM POLSKI

(z 3 fig. i 3 tabl.)

Streszczenie

Abstrakt. W niniejszym opracowaniu zestawiono obszary występowania osadów oksfordu dolnego i środkowego w Polsce oraz omówiono zespoły amonitowe charakterystyczne dla poszczególnych regionów. Przedstawiono aktualny podział biostratygraficzny równocześnie korelując wyróżnione poziomy z poziomami stosowanymi dla południowej i wschodniej części basenu paryskiego, jury angielskiej i zachodniej oraz centralnej części Związku Radzieckiego. Obszary północnej i centralnej Polski o zdecydowanej przewadze fauny borealnej zaliczono do prowincji subborealnej. Szczegółowo omówiono kierunki migracji organizmów i ich geograficzne rozprzestrzenienie.

Przenikające od wschodu i północnego zachodu faunistyczne wpływy borealne zdecydowały o charakterze poziomów wyróżnianych w Polsce w obrębie warstw oksfordu dolnego i środkowego. Ogólnie można przyjąć, że poziomy faunistyczne charakteryzują zazębianie się na obszarze Polski w tym okresie dwóch zoogeograficznych prowincji: subborealnej i submedyterańskiej.

Wpływy borealne w oksfordzie dolnym i środkowym Polski przeanalizowano na podstawie obecności i liczebności następujących rodzajów: *Quenstedticeras, Cadoceras, Longaeviceras* (?), *Praecardioceras, Cardioceras, Goliathiceras, Pachycardioceras, Cawtonicears, Maltoniceras, Amoeboceras, Amoebites* i *Kosmoceras* a także małżów rodzaju *Aucella.* Równocześnie prześledzono ilość gatunków medyterańskich występujących w osadach oksfordu dolnego i środkowego i porównano ją z liczbą tych gatunków na obszarze jury południowej Francji oraz Jury Szwabskiej i Frankońskiej.

Dla niższej części oksfordu dolnego wyróżnia się warstwy z *Quenstedticeras.* Mają one szerokie rozprzestrzenienie w Polsce pozakarpackiej. Zostały rozpoznane prawie na całym obszarze kraju, z wyjątkiem obszaru sudeckiego, wyniesienia Łeby i rejonu Hrubieszowa gdzie brak jest osadów tego wieku (fig. 1). Brak jest dotychczas danych faunistycznych o występowaniu tych warstw na obszarze podkarpackim i karpackim. Najbardziej wysuniętym na południe rejonem, gdzie są znane warstwy z *Quenstedticeras,* jest jura krakowska (Podłęże, na południowy zachód od Krakowa) i jura przemyska (Kruhel Wielki koło Przemyśla — K. Wójcik, 1910, 1913). Warstwy te są wykształcone w dwóch facjach. Osady facji marglisto-wapiennej występują w jurze krakowsko-wieluńskiej, w obrzeżeniu Gór Świętokrzyskich oraz

we wschodniej i centralnej Polsce. Natomiast osady facji mułowcowej są znane w północnej i północno-zachodniej Polsce.

Największą miąższość warstw z *Quenstedticeras*, około 12,5 m, stwierdzono w otworze wiertniczym Osowa (arkusz Wolin) w północno-zachodniej Polsce. Warstwy z *Quenstedticeras* można prześledzić w odsłonięciach tylko w obrębie jury krakowsko-wieluńskiej i obrzeżenia Gór Świętokrzyskich. Obszerne dane o tych warstwach uzyskano jednak z licznych wierceń. Dane te pozwoliły na przeprowadzenie korelacji faunistycznej w obrębie niższej części oksfordu dolnego Polski pozakarpackiej (fig. 2). Z rdzeni wiertniczych i odsłonięć Polski pozakarpackiej uzyskano bardzo liczne okazy fauny borealnej należącej głównie do rodzajów *Quenstedticeras, Praecardioceras, Kosmoceras* a także pojedyncze okazy *Cadoceras* i *Longaeviceras* (?) (tab. 1). Poszczególne odcinki rdzeni były przepełnione okazami rodzaju *Quenstedticeras,* przykładem czego może być otwór wiertniczy Rokita (Pomorze zachodnie) (tabl. I).

Dla wyższej części oksfordu dolnego wyróżnia się warstwy z *Cardioceras.* W Polsce mają one szerokie rozprzestrzenienie; nie występują jedynie na obszarze sudeckim. Brak jest dotychczas kardiocerasowej dokumentacji dla osadów tego wieku we wschodniej Polsce (rejon Lublina). Ogólnie biorąc warstwy z *Cardioceras* są wykształcone w dwóch facjach: wapienno-marglistej z częstą dolomityzacją, biohermami gąbkowymi i wapieniami krynoidowymi, rozprzestrzenioną w centralnej, wschodniej i południowej Polsce oraz piaszczysto-mułowcowej dominującej w północno-zachodniej Polsce. Miąższość warstw z *Cardioceras* waha się od kilku do maksymalnie 75 m (Lulewiczki pod Białogardem — zachodnia Polska).

Warstwy z *Cardioceras* można obserwować w odsłonięciach tylko w obrzeżeniu Gór Świętokrzyskich, w obrębie jury krakowsko-częstochowskiej i na obszarze karpackim. Dane o tych warstwach uzyskano także z wielu otworów wiertniczych. Z rdzeni wiertniczych i odsłonięć zanotowano liczne okazy amonitów należących do rodzajów: *Cardioceras, Goliathiceras, Pachycardioceras* (tab. 2), mających związek ze strefą borealną, a także okazy typowe dla strefy południowej (tab. 3). Ilość gatunków strefy południowej jest znacznie mniejsza w osadach znajdujących się bardziej na północy Polski.

Osady oksfordu środkowego mają również szerokie rozprzestrzenienie. Znane są tak w Polsce pozakarpackiej jak i na obszarze karpackim. Brak ich jedynie w rejonie sudeckim. W północnej i zachodniej Polsce dominują osady facji mułowcowo-marglistej, a bardziej ku peryferiom zbiornika — osady facji mułowcowo-piaszczystej. Na pozostałym obszarze Polski rozwinęła się facja węglanowa, z różnymi odmianami biofacjalnymi. Zazębianie się tych dwóch facji zachodzi w zachodniej części centralnej Polski (J. Dembowska, 1962b). Największą miąższość osadów oksfordu środkowego wynoszącą 120 m stwierdzono w centralnej Polsce. Naturalne odsłonięcia osadów tego wieku obserwuje się na obszarze jury krakowsko-częstochowskiej, gdzie tworzą malownicze pasmo jurajskie oraz w obrzeżeniu Gór Świętokrzyskich i na obszarze karpackim. Wiele danych o tych osadach dostarczyły otwory wiertnicze z całej Polski.

Cechą charakterystyczną osadów oksfordu środkowego północnej Polski jest stwierdzona w kilkunastu wierceniach przerwa kardiocerasowa (tab. 4). Stratygraficznie przypada ona na granicę między dolnym a górnym poziomem oksfordu środkowego.

W obrazie faunistycznym oksfordu środkowego Polski zarysowuje się pewna strefowość. W osadach północnej Polski wyjątkowy rozwój osiągają rodzaje i gatunki należące do rodziny Cardioceratidae przy podrzędnym występowaniu gatunków i rodzajów rodziny Perisphinctidae. Natomiast w centralnej Polsce główne tło faunistyczne tworzą gatunki i rodzaje rodziny Perisphinctidae, Oppeliidae i Haplo-

ceratidae z dość liczebnymi jeszcze gatunkami rodziny Cardioceratidae. W południowej Polsce utrzymuje się przewaga gatunków rodziny Perisphinctidae, Oppeliidae, Haploceratidae z tym, że notuje się już częste występowanie tak gatunkowe, jak i ilościowe przedstawicieli rodzin Phylloceratidae, Lytoceratidae i Aspidoceratidae. Rodzina Cardioceratidae jest reprezentowana przez pojedyncze gatunki.

Przedstawiony w niniejszej pracy podział biostratygraficzny oksfordu dolnego i środkowego Polski został oparty na szczegółowej analizie fauny uzyskanej z kilkudziesięciu odsłonięć i kilkudziesięciu profilów wiertniczych. Szczegółowe opracowania stratygraficzno-paleontologiczne i paleontologiczne fauny oksfordu dolnego i środkowego z poszczególnych odsłonięć i otworów wiertniczych Polski są już w większości opublikowane i na tej podstawie można opracować aktualny i rzeczywisty podział.

Analiza gatunków amonitów występujących w obrębie oksfordu dolnego i środkowego Polski pozwala na pewne uogólnienia co do kierunku migracji organizmów, ich geograficznego rozprzestrzenienia i związku z odpowiednią prowincją zoogeograficzną. Północna i centralna część basenu polskiego w omawianym okresie była niewątpliwie pod faunistycznym wpływem borealnym, o czym świadczą ilościowe zestawienia gatunków. Na tej podstawie obszar ten zaliczono w niniejszym opracowaniu do prowincji subborealnej (tab. 6) wyróżniając w podziale biostratygraficznym odpowiednie poziomy amonitowe. Południową część zbiornika natomiast, odpowiadającą dzisiejszemu obszarowi na południe od linii Kraków — Przemyśl, zaliczono do prowincji submedyterańskiej. Wydzielone poziomy faunistyczne oksfordu dolnego i środkowego Polski skorelowano z poziomami południowej i wschodniej części basenu paryskiego, Anglii oraz centralnej i zachodniej części Związku Radzieckiego.

Obserwacje materiału faunistycznego uzyskanego z osadów niższej części oksfordu dolnego Polski potwierdzają słuszność poglądu N. T. Sazonowa (I. G. Sazonowa, N. T. Sazonow, 1967), który przyjmuje, że połączenie basenu Polski z basenem rosyjskim odbywało się w tym czasie obniżeniem prypeckim. Na obszar jury litewskiej, z uwagi na rozkład stref lądowych, gatunki rodzaju *Quenstedticeras* i *Kosmoceras* przedostawały się ze zbiornika polskiego (fig. 3). Na połączenie z basenem północnoniemieckim wskazują gatunki rodzaju *Quenstedticeras*. Epikontynentalny basen Polski w niższej części oksfordu dolnego miał niewątpliwie utrudnione połączenie z basenem karpackim. Wskazuje na to fakt, że dotychczas nie stwierdzono gatunków rodzaju *Quenstedticeras* w osadach tego wieku na obszarze karpackim.

W wyższej części oksfordu dolnego kontakt z basenem rosyjskim utrzymuje się nadal poprzez obniżenie prypeckie. Liczne okazy kardiocerasów, które w basenie polskim miały wyjątkowo dobre warunki rozwojowe, spotykane są zarówno na obszarze centralnej Polski jak i w basenie dnieprzańsko-donieckim i moskiewskim. Z paleogeograficznych przesłanek wynika, że gatunki rodzaju *Cardioceras* wędrowały do zbiornika znajdującego się na obszarze dzisiejszej Litwy z basenu polskiego, podobnie jak to miało miejsce w niższej części oksfordu dolnego. O połączeniu z basenem północnoniemieckim w tym czasie świadczą gatunki rodzaju *Cardioceras* znalezione i oznaczone przez W. Hallera (inf. ustna) z wierceń Trieplatz i Seehausen. Jak daleko na południe sięgała migracja form borealnych rodzaju *Cardioceras* trudno dokładnie określić. Wiadomo jednak, że w osadach tego wieku Bułgarii, Rumunii i Jugosławii brak ich zupełnie. Pojedyncze okazy gatunku *Cardioceras (Cardioceras) cordatum* (Sowerby) zostały znalezione we wschodniej części Krymu (I. G. Sazonowa, N. T. Sazonow, 1967) i w Bachowicach (M. Książkiewicz, 1956). Liczniejsze stanowiska tej grupy notuje się w Cetechovicach na Morawach (J. Neumann, 1907), a także w Kruhelu Wielkim koło Przemyśla (K. Wójcik, 1913). Wydaje się, że dalsze

stanowiska faunistyczne potwierdzą przypuszczalnie, że kontakt z basenem południowym był bezpośredni.

W oksfordzie środkowym, w jego części dolnej przypadającej na okres występowania gatunków rodzaju *Cawtoniceras* i *Maltoniceras*, połączenie z basenem rosyjskim poprzez obniżenie prypeckie wydaje się być ograniczone. Śledząc ilościowe występowanie gatunków rodzaju *Cawtoniceras* i *Maltoniceras* stwierdzono, że największą ich liczbę notuje się w północnej Polsce, natomiast ku południowi ilość ich znacznie maleje. Brak jest danych o występowaniu tych rodzajów we wschodniej Polsce, gdyż w osadach oksfordu środkowego tej części kraju nie stwierdzono dotychczas amonitów. Można sądzić, że gatunki tych rodzajów przedostawały się w obręb środkowooksfordzkiego basenu polskiego z północnego zachodu. Świadczą o tym liczne gatunki rodzaju *Cawtoniceras* i *Maltoniceras* w jurze angielskiej, którą cechuje bujny ich rozwój, w jurze północno-francuskiej, północno-niemieckiej, Grenlandii i zachodniej Kanady. Ten kierunek migracji może też potwierdzać stwierdzony obecnie w wierceniu Grudziądz IG 1 gatunek *Goliathiceras chamoussetiforme* Arkell, który jest również znany z podpoziomu Cardioceras vertebrale jury angielskiej (J. K. Wright, 1972). Na utrudnione połączenie z basenem rosyjskim w tym okresie wskazuje także brak w osadach polskich małżów rodzaju *Aucella* z jednej strony i brak w centralnych częściach basenu rosyjskiego zróżnicowanych gatunków rodzaju *Perisphinctes*, tak licznie występujących w osadach jury polskiej, z drugiej. Na uwagę zasługuje fakt, że podrodzaje w obrębie rodzaju *Perisphinctes* występujące w osadach tego wieku na obszarze Polski są podobne do angielskich i północnoniemieckich. Dotyczy to szczególnie podrodzaju *Arisphinctes*.

W okresie przypadającym na górny poziom oksfordu środkowego połączenie z basenem rosyjskim przez obniżenie prypeckie wydaje się być bardziej swobodne. Dane faunistyczne z obszaru Polski potwierdzają sugestie N. T. Sazonowa (I. G. Sazonowa, N. T. Sazonow, 1967), który uważa, że mogło istnieć połączenie basenu dnieprzańsko-donieckiego z morzem Polski przez obniżenie prypeckie. O połączeniu tych dwóch zbiorników może świadczyć obecność małżów rodzaju *Aucella* w osadach oksfordu środkowego jury krakowsko-częstochowskiej, a szczególnie gatunku *Aucella bronni* Rouillier, który jest bardzo rozprzestrzeniony w strefie borealnej, a którego brak w strefie południowej Polski.

PLATE I

Fig. 1. Beds with *Quenstedticeras* filled with specimens of this genus. Natural size. Rokita borehole (Western Pomerania), depth 284.3 m

Слои с *Quenstedticeras* изобилующие экземплярами этого рода. Естественная величина. Буровая скважина Рокита (Западное Поморье), глуб. 284,3 м

Warstwy z *Quenstedticeras* przepełnione okazami tego rodzaju. Wielkość naturalna. Otwór wiertniczy Rokita (Pomorze zachodnie), głęb. 284,3 m



Lidia MALINOWSKA — Boreal Faunal Influences in the Lower and Middle Oxfordian of Poland

PLATE II

Fig. 1. *Quenstedticeras irinae* Sasonov
Natural size. Rokita borehole (Western Pomerania), depth 282.0 m; *a* — fragment of septal part and gerontic living chamber, b—c — fragmentary moulds with septal line preserved in part

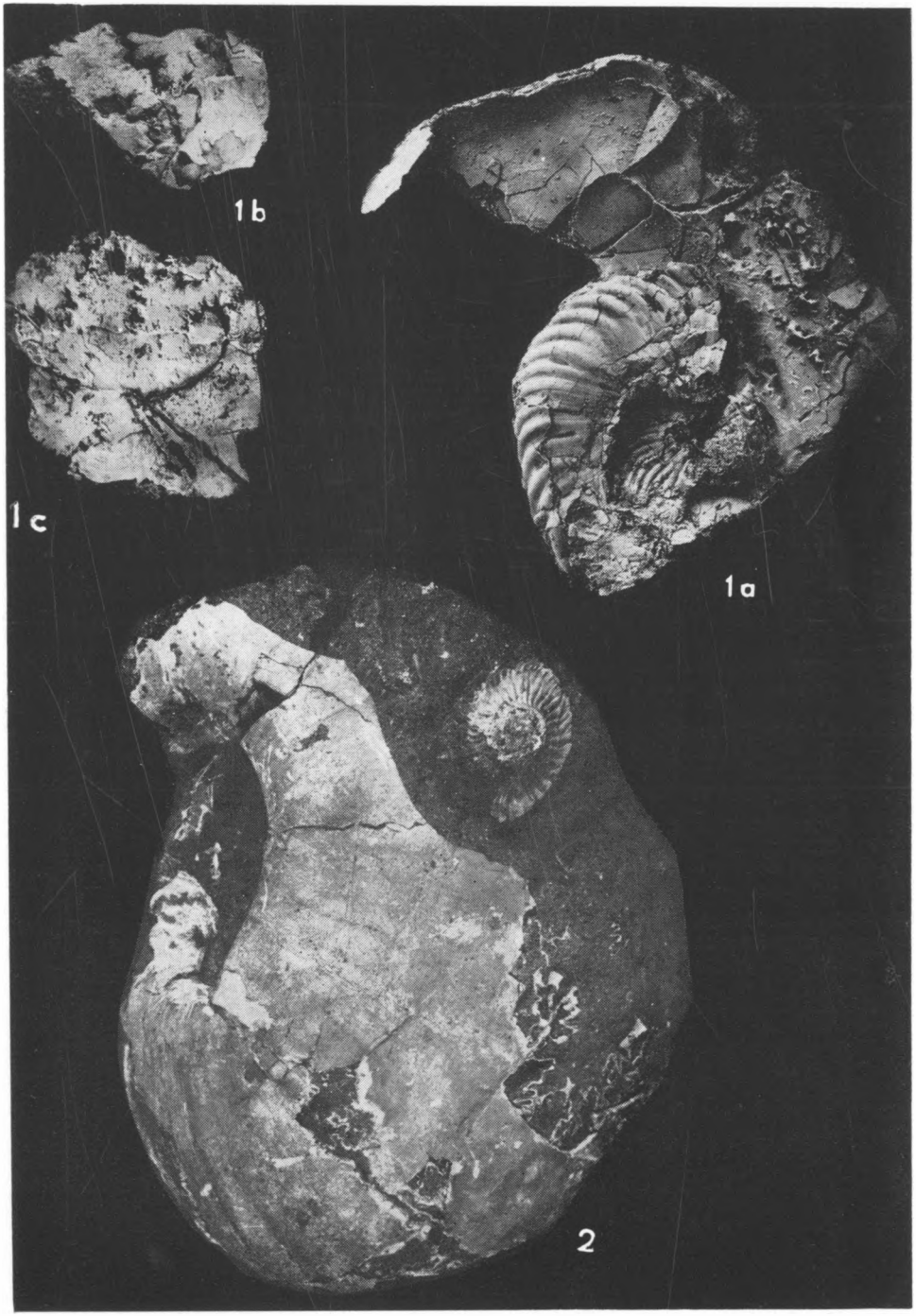
Естественная величина. Буровая скважина Рокита (Западное Поморье), глуб. 282,0 м; *a* — фрагмент перегородочной части и жилой геронтической камеры, *b*—*c* — фрагменты ядра с частично сохранённой перегородочной линией

Wielkość naturalna. Otwór wiertniczy Rokita (Pomorze Zachodnie), głęb. 282,0 m; *a* — fragment części przegrodowej i mieszkalnej komory gerontycznej, b—c — fragmenty ośródki z częścią zachowanej linii przegrodowej

Fig. 2. *Cadoceras* sp.
Natural size. Jamno IG 3 borehole, depth 226.0—232.0 m

Естественная величина. Ямно ИГ 3, глуб. 226,0—232,0 м

Wielkość naturalna. Jamno IG 3, głęb. 226,0—232,0 m



Lidia MALINOWSKA — Boreal Faunal Influences in the Lower and Middle Oxfordian of Poland

PLATE III

Fig. 1. *Lithacoceras (Discosphinctes) idelettae* (Riaz)
Fragment of septal part; natural size. Osona outcrop (Częstochowa Jurassic), Middle Oxfordian, Amoeboceras alternans and Perisphinctes wartae Zone

Фрагмент перегородочной части; естественная величина. Обнажение Осона (Ченстсховская юра), средний оксфорд, зона Amoeboceras alternans и Perisphinctes wartae

Fragment części przegrodowej; wielkość naturalna. Odsłonięcie Osona (jura częstochowska) oxford środkowy, poziom Amoebòceras alternans i Perisphinctes wartae

Fig. 2. *Lithoceras aeneas plana* (Simiradzki)
As above

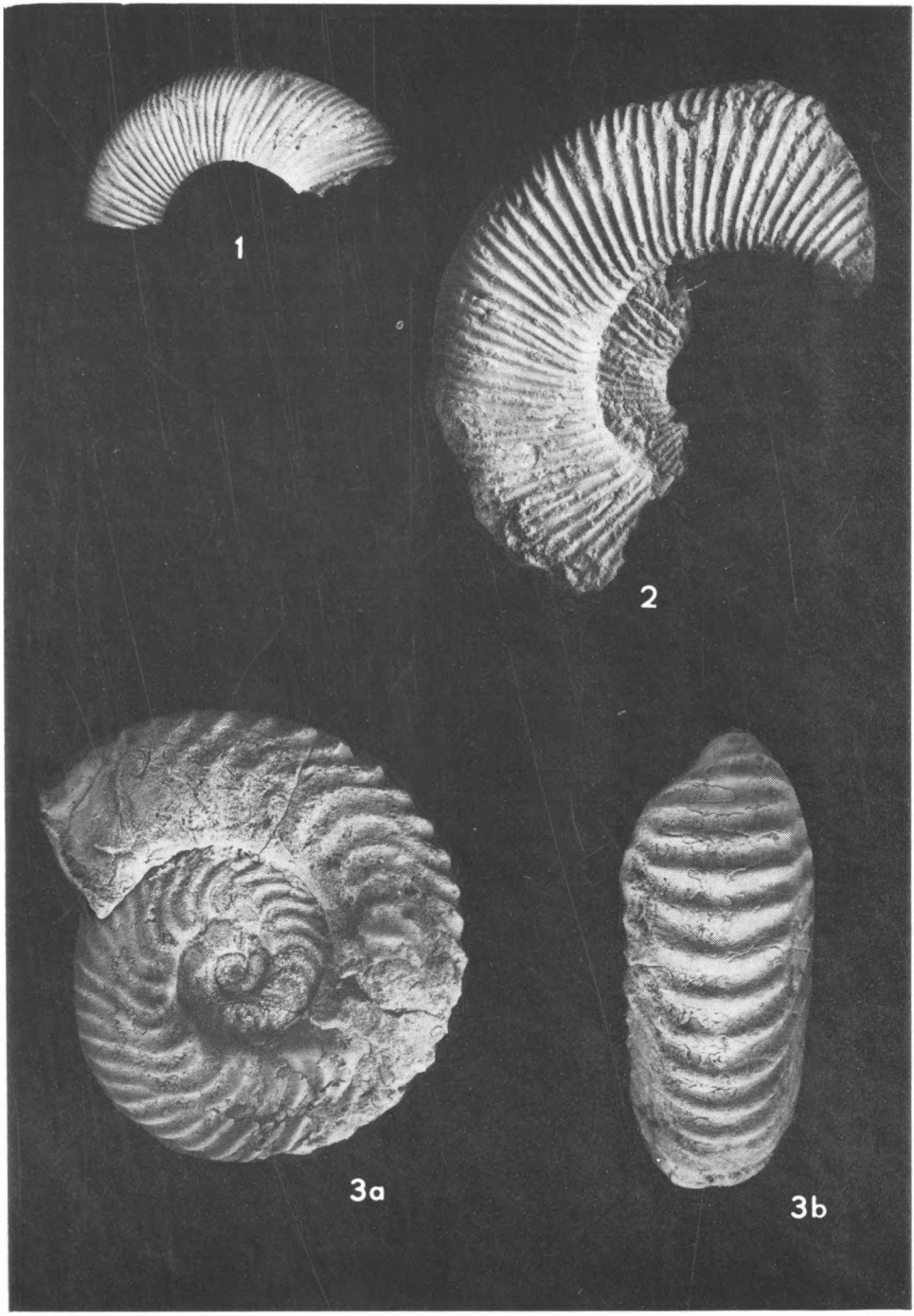
Как выше

Jak wyżej

Fig. 3. *Gregoryceras toucasi* (d'Orbigny)
Natural size. Vicinity of Nawojowa Góra, map sheet of Chrzanów, IG 51. II, Middle Oxfordian, Gregoryceras transversarium Zone; *a* — septal part and a fragment of gerontic living chamber, *b* — ventral side

Естественная величина. Район с. Навоёва-Гура, лист Хшанув, IG 51. II, средний оксфорд, зона Gregoryceras transversarium; *a* — перегородочная часть и фрагмент жилой геронтической камеры, *b* — брюшная сторона

Wielkość naturalna. Okolice Nawojowej Góry, arkusz Chrzanów, IG 51. II, oksford środkowy, poziom Gregoryceras transversarium; a — część przegrodowa i fragment komory mieszkalnej gerontycznej, *b* — strona brzuszna



Lidia MALINOWSKA — Boreal Faunal Influences in the Lower and Middle Oxfordian of Poland