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PALAEOGENE MARINE SEDIMENTS BETWEEN GŁOGÓW AND SIEROSZOWICE (LOWER SILESIA — POLAND)

(Pl. I—II and 2 Figs)

Morskie osady paleogenu między Głogowem a Sieroszowicami (Dolny Śląsk — Polska)

(Tabl. I—II i 2 fig.)

Abstract: On the basis of lithology and microfauna marine sediments of Upper Eocene, Lower Oligocene and Upper Oligocene in the Głogów — Sieroszowice region are stated. They are clastic sediments with intercalation of limestones, sandy glauconitic limestones and marls separated by erosional surface.

INTRODUCTION

The boreholes drilled during the last few years on the Fore-Sudetic Monocline (Frankiewicz, Matl, 1975) south and south-west of Głogów (Lower Silesia, Fig. 1) penetrated an interesting section of beds of marine origin in the lowermost part of the Cenozoic cover. The beds overlie directly the surface of the Mesozoic basement showing a diversified relief, characterized by a prevalence of morphological forms striking NW-SE (concordantly with the main tectonic dislocations of the Middle Odra zone).

The lithological type of the sediments, as well as abundant macro- and microfauna found in them, point to their marine origin.

The microfauna was mentioned by Odrzywolska-Bieńkowa (1973), who based her investigations, on 4 samples derived from boreholes in the region of Sieroszowice. Sediments with similar lithological features are assigned at present to the Oligocene, to the s.c. Lubusz Formation (Dyjor, 1970, 1974) and correlated, partly incorrectly, with various stratigraphic units of the Oligocene of Polish Lowland established by Ciuk (1970, 1974).

A thorough study of microfauna related to the lithological features of the sediments encouraged the present authors to suggest a new approach to the stratigraphic units in the area in question. The microfaunal assemblages represent a profile comprising sediments from the Upper Eocene to the bottom of the Upper Oligocene with stratigraphic hiatus in the Middle Oligocene. Those sediments fill the greatest depressions in the basement surface, the younger units usually overlapping the older ones. The relationships between the morphology of the basement and occurrence of sediments becomes obliterated only in the Upper Oligocene, the boundary of which is delimited by lines of regional significance.

Upwards, marine sediments pass, for the most part continously, into continental coal-bearing deposits of the upper parts of the Upper Oligocene.

The whole Palaeogene attains in some localities (Jakubów, Jerzmanowa) a thickness of 96 m (Fig. 2) averaging 60 m. The thickness of marine sediments amounts to 54 m, being actually much smaller since it does not generally exceed 30 m in individual profiles.

DESCRIPTION OF SEDIMENTS

Upper Eocene. The Upper Eocene sediments have the smallest extent. They fill the greatest depressions in the basement, forming an isolated and elongated cover which extends over an area of 15 km^2, between Bukwica in NW and Jerzmanowa and Bądzów in SE. The sediments rest directly with a considerable stratigraphic hiatus on the intensely lithified, red Keuper sandstones.

The remnants of the Upper Eocene cover are recorded 7—8 km SW and S of Głogów. They are isolated and in no direct contact with sediments of similar age, lying farther to the north (e.g. in the region of Wschowa or Góra), thereby occupying the southernmost position. This fact indicates that the Upper Eocene transgression in the West Poland had a substantially greater extent than it has been assumed so far.

Upper Eocene sediments have been found in six boreholes (Fig. 2) at a depth of less than 400 m; their thickness varies from 14 to 20 m. There is either a continuous sedimentary succession between the Upper Eocene and the Lower Oligocene, or an erosional surface, and then the Upper Eocene comes into direct contact with sediments of the middle parts of the Upper Oligocene. The Upper Eocene sediments are, as a rule, strongly calcareous, dark glauconitic sands and green, fine- and medium grained quartz-glauconitic sands. Glauconite forms numerous grey-green concentrations (up to 45%) in the quartz-glauconitic sand, which also contains fine concentrations of black phosphorites.

A characteristic feature of the profile from Bukwica (borehole S — 380) is the presence of glauconitic sandy marls and oölitic limestones which form six intercalations from 0.05 to 0.8 m in thickness in the upper part of the sand complex. In places, the sands pass into strongly calcareous glauconitic sandstones. The profile in question is eroded at the top of the last, uppermost limestone intercalation, which implies that it is incomplete and reduced.

In all types of the Upper Eocene sediments of the profile from Bukwica, abundant and diversified macro- and microfauna has been found.

A complete profile of the uppermost parts of the Upper Eocene has been ascertained in boreholes in the region of Jerzmanowa and Jakubów (S — 350 and S — 365). SE of Bukwica, calcareous quartz glauconitic sands with phosphorites and, occasionally with intercalations of sandy limestones or calcareous sandstones have been noted. They pass continuously into the Lower Oligocene sandy glauconitic sediments. The Upper Eocene — Lower Oligocene boundary is marked both by microfaunal assemblages and by the lithological character of the sediments.

Lower Oligocene. There is a continuous sedimentary succession between the Upper Eocene and the Lower Oligocene. The latter is represented exclusively by calcium-free fine- and medium-grained quartz sands with a low glauconite content. Their thickness in the regions of Jakubów and Jerzmanowa is 15 m and 23 m, respectively.

The Lower Oligocene sands are characterized by:

— a substantial decrease in the glauconite content,
— the lack of calcium and the absence of limestone and marl intercalations or phosphorite concretions,
— disapperaence of nummulites in the microfaunal assemblage and a substantially higher content of planctonic foraminifera,
— a smaller amount of both macro- and microfauna.

The profile of the Lower Oligocene ends with an erosional surface that determines the contact with sediments of the middle part of the Upper Oligocene. In none of the boreholes the sediments of the Eocene--Lower Oligocene sea have been found to pass directly into Middle Oligocene continental deposits. It appears, therefore, that the emergence of older sediments and their erosion took place in that period. Nevertheless, it seems that the presence of remnants of the Middle Oligocene continental sediments in the area under examination is very probable.

Upper Oligocene. The profile of Palaeogene marine deposits in the area between Głogów and Sieroszowice is terminated by a sedimentary complex representing the lower parts of the Upper Oligocene. The Upper Oligocene sediments have been recorded in two boreholes (S-382 and S-376), 9 km apart, localized on the northern and eastern side of the Eocene cover near Bukwica-Dankowice and Kurów (Fig. 1). In one bore-

hole they rest directly on the Triassic basement, while in the other on continental deposits of indefinite age. The position of the latter under the Upper Oligocene marine sediments may point indirectly to their Middle Oligocene age.

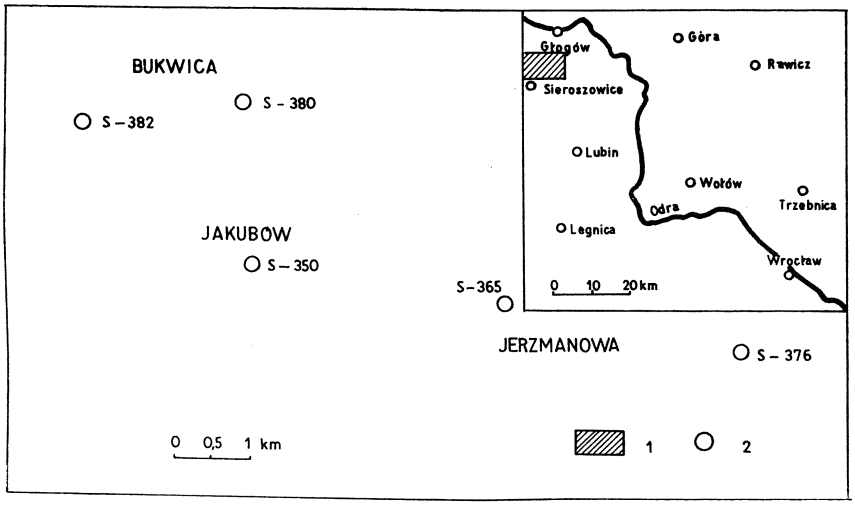


Fig. 1 — Localization of boreholes that penetrated the marine Palaeogene in the region of Bukwica and Jerzmanowa. 1 — investigated area; 2 — localization of bore holes

Fig. 1 — Szkic sytuacyjny otworów wiertniczych przebijających paleogen morski w rejonie Bukwicy i Jerzmanowej

Upwards, the marine sediments pass, presumably continuously, into continental sandy-micaceous deposits and, higher up, into coal-bearing deposits of the middle and upper part of the Upper Oligocene.

At Bukwica-Dankowice, the Upper Oligocene marine deposits attain to a thickness of 8 m. They are represented (Fig. 2) by clayey-calcareous sediments made up of marly clays with glauconite and 1—2 beds of grey marly limestones (up to 0.4 m thick) with animal burrows. In both types of sediments nests and dolls of pyrite have been noted.

In the upper part of the profile there have been recorded grey marly clays with a considerable sand content and dark-grey argillaceous mudstones with glauconite and macrofauna shells.

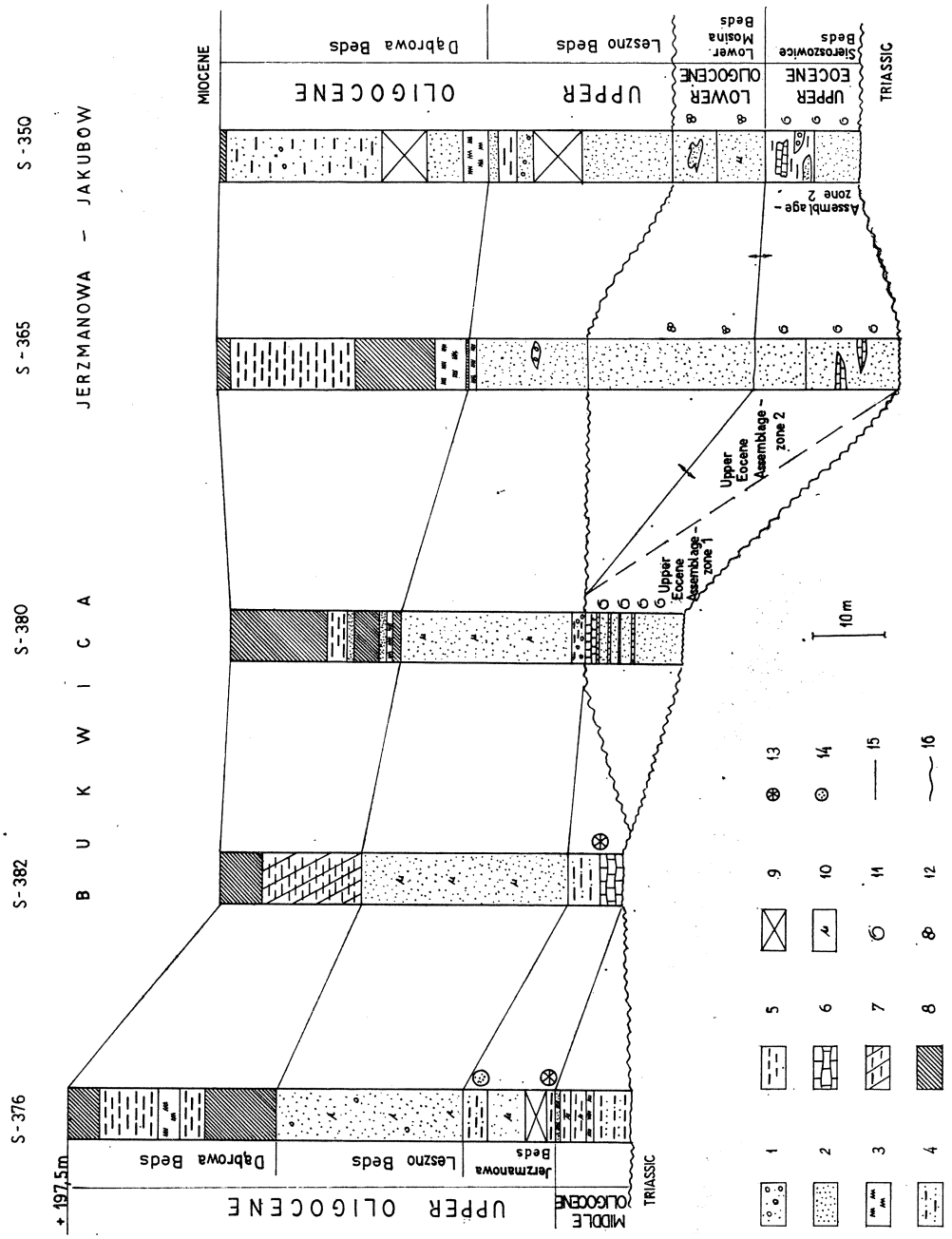
A facially different sediments has been encountered near Kurów. They consists mainly of quartz sands with a high mica (muscovite) content and two horizons of quartz-glauconitic argillaceous sands, lying about 10 m apart. A characteristic feature of that profile is a substantial concentration of white mica flakes both in the quartz sands and in the sands with glauconite.

Lithostratigraphic units and correlation of Palaeogene sediments Table 1

/Fore-Sudetic Monocline/

Podział litostratygraficzny i korelacja osadów paleogenu na monoklinie przedsudeckiej

		Lithostratigraphic units /Jednostki litostratygraficzne/		
		E. Ciuk /1970, 1974/	S. Dyjor /1974/	K. Matl, T. Śmigielska /1977/
Oligocene /Oligocen/	Upper /Górny/	Dąbrowa Beds /Warstwy dąbrowskie/	Lubin Beds /Warstwy lubińskie/	Dąbrowa Beds /Warstwy dąbrowskie/
		Leszno Beds /Warstwy leszczyńskie/	Polkowice Beds /Warstwy polkowickie/	Leszno Beds /Warstwy leszczyńskie/
		Upper Mosina Beds /Warstwy mosińskie górne/	Upper Mosina Beds /Warstwy mosińskie górne/	Jerzmanowa Beds /Warstwy jerzmanowskie/
	Middle /Środkowy/	Czempin Beds /Warstwy czempińskie/	Jerzmanowa Beds /Warstwy z Jerzmanowej/	Czempin Beds /Warstwy czempińskie/
	Lower /Dolny/	Lower Mosina Beds /Warstwy mosińskie dolne/	Lower Mosina Beds /Warstwy mosińskie dolne/	Lower Mosina Beds /Warstwy mosińskie dolne/
Upper Eocene /Górny eocen/		Pomerania Beds /Warstwy pomorskie/	-	Sieroszowice Beds /Warstwy sieroszowickie/


S-376
S-382
S-380
S-365
S-350
B U K W I C A
JERZMANOWA - JAKUBOW
+ 197,5m
UPPER OLIGOCENE
MIDDLE OLIGOCENE
TRIASSIC
Dąbrowa Beds
Leszno Beds
Jerzmanowa Beds
MIOCENE
UPPER OLIGOCENE
LOWER OLIGOCENE
UPPER EOCENE
Lower Mosina Beds
Sierosławice Beds
Assemblage - zone 2
Upper Eocene Assemblage - zone 1
Upper Eocene Assemblage - zone 2
10 m
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

The Upper Oligocene marine horizon is overlain by a thick (up to 25 m) complex of continental quartz sands with white mica flakes and gravel pebbles (Fig. 2). The marine ingression was short, its effects disappear gradually towards the south-east.

THE CHARACTER AND DISTRIBUTION OF FAUNA

In all the marine sediments between Głogów and Sieroszowice, older and younger Palaeogene microfauna have been found. Some samples contain rich and well-preserved microfaunal assemblages composed of benthonic, mainly calcareous and rarely agglutinating, foraminifers. Large foraminifers are represented by nummulites, fairly abundant in some samples, and single operculines. In other samples a few planktonic foraminifers, globigerines have been found.

Apart from foraminifers, scarce radiolarians and other protozoans included among Tintinnida may be encountered, as well as macrofauna remains, e.g. very rare skeleton elements of sponges, corals, tubes of annelids, bryozoans, brachiopods, pelecypods, gastropods, spines of echinoids, ostracods, fish scales, teeth and otoliths.

Typical foraminiferal microfauna characteristic of the Upper Eocene sediments, consisting of abundant, well-developed and diversified forms, has been found in the lower part of the profile S-365 (at a depth of 497—498.8 m). In a sand-glauconitic sediment the microfaunal assemblage is represented (Pl. I) by numerous Miliolidae (*Spiroloculina, Quinqueloculina, Triloculina, Spirophtalmidium, Lacazinella*), Polymorphinidae (*Reussella* sp., *Biapertorbis* cf. *brandenburgensis* Kiesel et Lotsch, *Baggina iphigenia* (Samoilova), *Asterigerina rotula haeringensis* Lühr (abundant), *Pararotalia lithothamnica* (Uhlig) (abundant), *Pararotalia inaermis* (Terquem), *P. audouini* (d'Orbigny), *Cibicides carinatus* (Terquem), *Cibicidoides bellus* Mjatluk). Nummulites are represented here by two species: *Nummulites concinnus* Jarceva and *N. orbignyi* (Galeotti). Moreover, Tintinnidae, numerous ostracods, mainly thick-shelled with sculpture, and the macrofauna remains, listed above, have been found in this part of the profile.

←

Fig. 2 — Correlation of the Palaeogene profiles in the area between Głogów and Sieroszowice. 1 — gravel; 2 — sand; 3 — silt; 4 — sandy clay; 5 — clay; 6 — limestone or marl; 7 — coal clay; 8 — brown coal; 9 — borehole section without drill core; 10 — muscovite concentration; 11 — microfaunal assemblage with nummulites; 12 — microfaunal assemblage with globigerines; 13 — microfaunal assemblage with *Asterigerina gürichi gürichi*; 14 — radiolarians; 15 — correlation lines; 16 — surfaces of erosional discontinuity

Fig. 2 — Zestawienie korelacyjne profilów paleogenu w rejonie między Głogowem a Sieroszowicami. 1 — żwir; 2 — piasek; 3 — mułek; 4 — ił zapiaszczony; 5 — ił; 6 — wapień lub margiel; 7 — ił węglisty; 8 — węgiel brunatny; 9 — odcinek otworu pozbawiony rdzenia wiertniczego; 10 — koncentracja muskowitu; 11 — zespół mikrofauny z numulitami; 12 — zespół mikrofauny z globigerinami; 13 — zespół mikrofauny z *Asterigerina gürichi gürichi*; 14 — radiolarie; 15 — linie korelacyjne; 16 — poziomy nieciągłości erozyjnych.

In the higher part of the profile microfauna becomes finer (Pl. II. Fig. 1). At a depth of 480—483 m globigerines, represented by, e.g., *Globigerina danvillensis* Howe et Wallace and *G. officinalis* Subbotina, as well as by other foraminifers have been found. They are: *Svratkina perlata* (Andreae), *Chilogümbelina gracillima* (Andreae), *Bolivina fastigia* Cushman, *B. tereta* (Cushman), *Alabamina wolterstorfii* (Franke), some species of *Cibicides* and related genera, and various species of Polymorphinidae. That assemblage may be regarded as representative of the Eocene/Oligocene boundary or of the lower part of the Lower Oligocene (Marks and Vessem, 1971).

Since the logging has been incomplete and there are gaps in the upper part of the profile (at a depth of 460—480 m), it is impossible to give its full characterization on the basis of microfauna. In the higher beds (at a depth of 457—460 m) organic fossils are missing, and at a depth of 437—442 m only flora remains have been found.

An Eocene foraminiferal assemblage has been also recorded in the borehole S-380, from which 50 samples were investigated. It consists partly of the species reported from the Upper Eocene sediments, e.g. *Pararotalia lithothamnica, Cibicides carinatus,* but also some others, e.g. *Melonis ornatissimum* (Cushman), *Oolina sphaericostata* (Grzybowski) have been noted there. However, *Asterigerina rotula haeringensis,* the species very common in the borehole S-365, is missing altogether.

Small foraminiferal microfauna is relatively scarce in this profile. On the other hand, it is interesting to note, that nummulites are abundant there. Thus, at a depth of 420.25—423.25 m, *Nummulites* ex gr. *variolarius* (Lamarck) and *N. orbignyi,* and higher *N. orbignyi* (f. A and f. B) have been found. From 414.75 m upwards, both *N. orbignyi* and *N. concinnus* are present. This sequence of nummulites may indicate that, up to a depth of 410 m, the profile under study represents a slightly older Upper Eocene sediment than that reported from the borehole S-365. This assumption can be supported by the presence of *Nummulites* ex gr. *variolarius* in the lower part of the profile S-380, whose species is known to occur from the Middle Lutetian to the Middle Bartonian, resembling *N. paravariolarius* Jarceva. The author of the species assumes that it is an intermediate link between *N. variolarius* and *N. orbignyi,* and her opinion has been supported by the studies of the present material. Moreover, the simultaneous occurrence of abundant *N. orbignyi* with scarce *N. concinnus* may also evidence the fact that the investigated part of the profile represents a somewhat lower horizon of the Upper Eocene.

Nummulites concinnus is reaching the highest part of the Upper Eocene; it has been noted even in Lattorfian sediments (Jarceva et al., 1968). In the discussed interval it did not attain, however, its maximum development in contradistinction to *N. orbignyi,* which appears in the

Upper Lutetian and does not go beyond the Upper Eocene boundary. That species is abundant in the present material.

In the material under examination no microfauna representing the Middle Oligocene — Rupelian, which corresponds to the German Septaria-clay horizon, has been found. The characteristic species such as *Ceratobulimina contraria* (Reuss) or *Rotaliatina bulimoides* (Reuss) are absent there (Wolańska, 1962; Gortyńska, 1962).

Upper Oligocene microfauna (Pl. II, Fig. 2) has been found in the borehole S-376. Numerous foraminifers of the species *Asterigerina gürichi gürichi* (Franke), *Angulogerina gracilis tenuistriata* Cushm. et Edw., *A. gracilis germanica* Cushm. et Edw., *Sphaeroidina variabilis* Reuss, *Cribrononion subnodosum* (Roemer), *Elphidium hiltermanni* Hagn, *Protelphidium roemeri* (Cushm.), *Melonis affine* (Reuss) have been noted at a depth of 404 m. The occurrence of the species *Asterigerina gürichi gürichi* is of particular significance; it defines the s.c. „Asterigerina zone", assigned by most of the West-European investigators to the lower part of the Upper Oligocene — the Chattian (Batjes, 1958; Ellermann, 1958; Indans, 1958; Kiesel, 1962). Other accompanying species have also been reported from younger Oligocene sediments of North Germany, Belgium (Batjes, 1958) and Poland, e.g. near Izbica Kujawska (Pożaryski, 1953).

The successive microfauna fossil remains occur higher up, only at a depth of 393 m. They are scarce radiolarians — *Cenosphaera* sp., *Spongiomma* sp. — which, according to Soviet authors (Subbotina, Pishvanova, Ivanova, 1960), are characteristic of the Lower Miocene. Apart from them, sporadic globigerines, remains of pyritized foraminifers and fragments of ostracods have been noted there.

The microfaunal assemblage found in only one sample from the borehole S-382 is similar to that noted in the lower part of the profile discussed above. It is represented by single specimens of *Nodosaria ewaldi* Reuss (fragments), *Lenticulina* sp., some species of Polymorphinidae, single *Asterigerina gürichi gürichi* and *Angulogerina* sp., abundant *Cibicides sulzensis* (Hermann), scarce *Melonis affine* and *Elphidium hiltermanni,* and macrofauna remains: tubes of annelids, pelecypods, gastropods, spines of echinoids and fish remains. The above assemblage is poorer both in quality and quantity and less characteristic than that found in the borehole S-376. It represents presumably a somewhat lower stratigraphic horizon, maybe at the boundary of the Rupelian and Chattian, which is evidenced by the scarcity of *Asterigerina gürichi gürichi* and the abundance of *Cibicides sulzensis.* It seems that this part of the profile may be correlated with the s.c. Boom clay sediments extending throughout NW Europe and being a unit of the Oligocene at the boundary of the Rupelian and Chattian.

CONCLUSIONS

A nearly complete profile of Palaeogene sediments of West Poland is preserved in the area between Głogów and Sieroszowice. It comprises sediments from the Upper Eocene up to the bottom of the Miocene, which rest directly on the Triassic basement. All the fundamental stratigraphic units made up of marine sediments are fully documented by microfauna. Their palaeontological distinctness has been also confirmed by lithological character of the sediments.

Due to the index microfaunal assemblages, two marine ingressions have been identified in the studied profile: older, having occurred in the Upper Eocene and the Lower Oligocene, and younger in the Upper Oligocene.

The Upper Eocene ingression took place during a somewhat extended period of time. Its beginning may date back to the middle part of the Upper Eocene (Middle Bartonian — region of Bukwica, the borehole S-380), which is documented by the abundance of *Nummulites* ex gr. *variolarius* known from the Lower Lutetian to the Middle Bartonian. This species disappears in the upper part of the Bartonian in the region in question and is also missing in other boreholes investigated so far (S-350 and S-365). The basin changed its character at the turn of the Eocene and Lower Oligocene (disappearance of nummulites, evolution of lithological features of the sediment), but marine sedimentation went on uninterrupted. Furthermore, this is one of the few localities in Poland where it was possible to demonstrate the continuity of the profile at the Eocene/Oligocene boundary (Odrzywolska-Bieńkowa, 1966).

The sedimentation was interrupted only after the Lower Oligocene (or during its culmination), the discontinuity comprising presumably a considerable part of the Middle Oligocene (Rupelian) and, in some profiles, also lower parts of the Upper Oligocene (Chattian). In the whole area in question there is no typical equivalent of the Middle Oligocene sediments with distinctive phytogenic accumulation, and neither is this unit documented by microfauna. Moreover, Upper and Lower Oligocene marine sediments are missing in several places.

The successive, younger marine ingression occurred in the lower part of the Upper Oligocene. It has a substantially greater regional extent, covering the area occupied by the Upper Eocene and Lower Oligocene sediments. Fauna has been found in the profiles of the NW part of the region (Bukwica, Dankowice, Kurów). A characteristic feature of the Upper Oligocene sea is a microfaunal assemblage with the index species *Asterigerina gürichi gürichi* and single radiolarians. Towards SE (SE of Jerzmanowa), marine sands with glauconite form thin intercalations (0.4—1.0 m) in the brackish and, presumably, also continental quartz sands. Microfauna gradually disappears in the same direction.

The Upper Eocene microfauna found in the investigated samples is clearly of a shallow-water character, which is evidenced by a high content of foraminifers from families Miliolidae, Polymorphinidae, Rotaliidae, Nummulitidae, and the subfamily Cibicidinae. It is the fauna that some German authors have defined as fauna of the "Calau" type (Kiesel, Lotsch, 1963; Kiesel, 1970), i.e. shallow-water, thermophilous, found in seas of normal salinity.

Similar conclusions emerge from the study of macrofauna, which is represented by, e.g. annelids, bryozoans, remains of echinoderms, ostracods, usually thick-shelled with sculpture, living in littoral, well aerated waters, and Tintinnida from protozoans. The latter have been also reported from the Upper Eocene sediments, in which some of them occur in sand-glauconitic marly clays, in assemblages containing foraminifers, molluscs, fragments of echinoderms, i.e. similar to the assemblage in question. Tintinnida found in the Tertiary sediments, particularly those reported from the Eocene, are included among organisms living in relatively shallow waters of normal salinity. The presence of nummullites, which are frequently very abundant, as well as the prevalence of calcareous forms among the foraminifers imply that the sea water was rich in Ca ions.

The Palaeogene profile in the region between Głogów and Sieroszowice may be correlated with the lithostratigraphic division of Ciuk (1970, 1974) and Dyjor (1974), as it is shown in Table 1.

The specific lithological type of the Upper Eocene sediments in the region of Głogów gives grounds for the distinction of the Sieroszowice Beds as a separate lithostratigraphic horizon. Microfaunal studies also justify the transfer of the Jerzmanowa Beds of Dyjor (1974) to the Upper Oligocene.

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STRESZCZENIE

Wiercenia wykonane w ostatnich latach na monoklinie przedsudeckiej między Głogowem a Sieroszowicami odsłoniły interesujący profil osadów trzeciorzędowych, w tym również morskie osady paleogenu. Szczególną

uwagę, ze względu na jakość materiału, bogactwo fauny i charakter przejść stratygraficznych, poświęcono osadom morskim w otworach: S-382, S-380, S-365, S-350, i S-376 (fig. 1) z rejonu Dankowic, Bukwicy, Jakubowa, Jerzmanowej i Kurowa.

Maksymalna miąższość osadów paleogenu wynosi 96 m, średnio zaś waha się w granicach 60 m. Z tego na osady morskie z fauną przypada 54 m (w profilu syntetycznym), zwykle jednak w żadnym z otworów grubość ich nie przekracza 30 m

Rozkład miąższości osadów morskich oraz ich rozmieszczenie związane jest z charakterem morfologii podłoża triasowego.

W profilu paleogenu (fig. 2) wydzielono osady reprezentujące górny eocen (S-365, S-350, S-380), dolny oligocen (S-350, S-365) oraz górny oligocen (S-376, S-382). W większości otworów brak jest całkowicie osadów środkowego oligocenu. W żadnym z otworów nie stwierdzono także obecności pełnego profilu paleogenu. Wynika to z obecności powierzchni erozyjnych przypadających w różnych okresach wiekowych.

Eocen górny (14—20 m) budują w przewadze piaski wapniste, glaukonitowe i glaukonitowo-kwarcowe z fosforytami, zawierające zwykle bogatą mikro- i makrofanuę. Miejscami (np. S-380) występuje do 6 wkładek i warstw wapieni glaukonitowych piaszczystych, wapieni oolitowych i piaskowców wapnistych.

W niektórych profilach (S-365) zespół mikrofauny (tabl. I) składa się z licznych, na ogół dobrze zachowanych otwornic zaliczanych do Miliolidae (*Sproloculina, Quinqueloculina, Triloculina, Spirophtalmidium, Lacazinella*); Polymorphinidae, oraz innych np. *Reussella* sp., *Biapertorbis brandenburgensis* Kiesel et Lotsch, *Baggina iphigenia* (Samoilova), *Asterigerina rotula haeringensis* Lühr, *Pararotalia audouini* (d'Orbigny), *P. inaermis* (Terquem), *P. lithothamnica* (Uhlig), *Cibicides carinatus* (Terquem), *Cibicidoides bellus* Mjatluk, a także numulitów: *Nummulites concinnus* Jarcewa i *N. orbignyi* (Galeotti). Oprócz otwornic występują w materiale pierwotniaki — Tintinnidae oraz szczątki innych organizmów jak: małżoraczki, rurki pierścienic, ramienionogi, mszywioły, mięczaki, kolce jeżowców, otolity ryb.

W innych profilach (S-380) znaleziono niewiele małych otwornic, natomiast liczne numulity reprezentujące kilka gatunków. W zbadanym interwale o miąższości około 15 m, stwierdzono też sukcesję gatunków *Nummulites* ex gr. *variolarius* (Lamarck) — *N. orbignyi* (Galeotti) — *N. concinnus* Jarcewa.

Utwory eocenu górnego wykazują stopniowe i ciągłe przejście do oligocenu dolnego. Dla tego poziomu charakterystyczne są globigeriny (Marks, v. Vessem, 1971). Znaleziono tu kilka gatunków globigerin, (tabl. II, fig. 1) wśród nich *Globigerina danvillensis* Howe et Wallace, *G. officinalis* Subbotina oraz inne otwornice jak *Svratkina perlata* (Andreae), *Chilogümbelina gracillima* (Andreae), *Bolivina*

fastigia (Cushman), *B. tereta* (Cushman), *Alabamina wolterstorfii* (Franke).

Osady oligocenu dolnego (15—23 m) odznaczają się wybitnym spadkiem zawartości glaukonitu, brakiem wapnistości, nieobecnością wkładek wapiennych i marglistych oraz konkrecji fosforytowych, zanikiem numulitów oraz pojawieniem się drobnej mikrofauny z udziałem otwornic planktonicznych.

Profil oligocenu dolnego obcięty jest od góry poziomem erozyjnym.

Zespół osadów morskich stwierdzono po raz ostatni w dolnej części górnego oligocenu. W jednym z otworów (S-376) znaleziono piaski kwarcowe silnie łyszczykowe z dwoma wkładkami piasków ilastych kwarcowo-glaukonitowych (13 m), w drugim natomiast (S-382) osady ilasto-wapienne (8 m), zbudowane z iłów silnie marglistych z glaukonitem oraz 1—2 warstw szarych wapieni marglistych z konkrecjami pirytu.

W otworze (S-376) stwierdzono liczne otwornice (tabl. II, fig. 2) z gatunków *Asterigerina gürichi gürichi* (Franke), *Angulogerina gracilis tenuistriata* Cushm. et Edw., *A. gracilis germanica* Cushm. et Edw., *Sphaeroidina variabilis* Reuss, *Cribrononion subnodosum* (Roemer), *Protelphidium roemeri* (Cushm.), *Melonis affine* (Reuss). Najważniejszym stratygraficznie gatunkiem jest tu *Asterigerina gürichi gürichi*, występująca stosunkowo licznie i wyznaczająca tzw. „poziom asterigerinowy" zaliczany do górnego oligocenu. Gatunek ten znaleziono również w wapieniach z otworu S-382, jednak tylko jako pojedyncze okazy w zespole z *Cibicides sulzensis* (Hermann), *Melonis affine* i *Elphidium hiltermanni* Hagn, co może sugerować, że warstwy tu występujące mają nieco niższe położenie stratygraficzne w stosunku do profilu S-376.

U stropu górnooligoceńskich osadów morskich (S-376) stwierdzono ponadto występowanie pojedynczych okazów radiolarii z rodzaju *Cenosphaera* sp. i *Spongiomma* sp. (Subbotina et al., 1960).

Morskie utwory górnego oligocenu przechodzą w sposób nieprzerwany w lądowe, węglonośne osady górnego oligocenu, a następnie miocenu.

Górnoeoceński odcinek profilu paleogenu, z uwagi na specyficzny typ litologiczny i charakterystyczny zespół mikrofauny, proponuje się nazwać warstwami sieroszowickimi.

Warstwy z Jerzmanowej, zaliczone przez Dyjora (1974) do środkowego oligocenu, wydają się być odpowiednikiem osadów morskich dolnej części górnego oligocenu (tabela 1).

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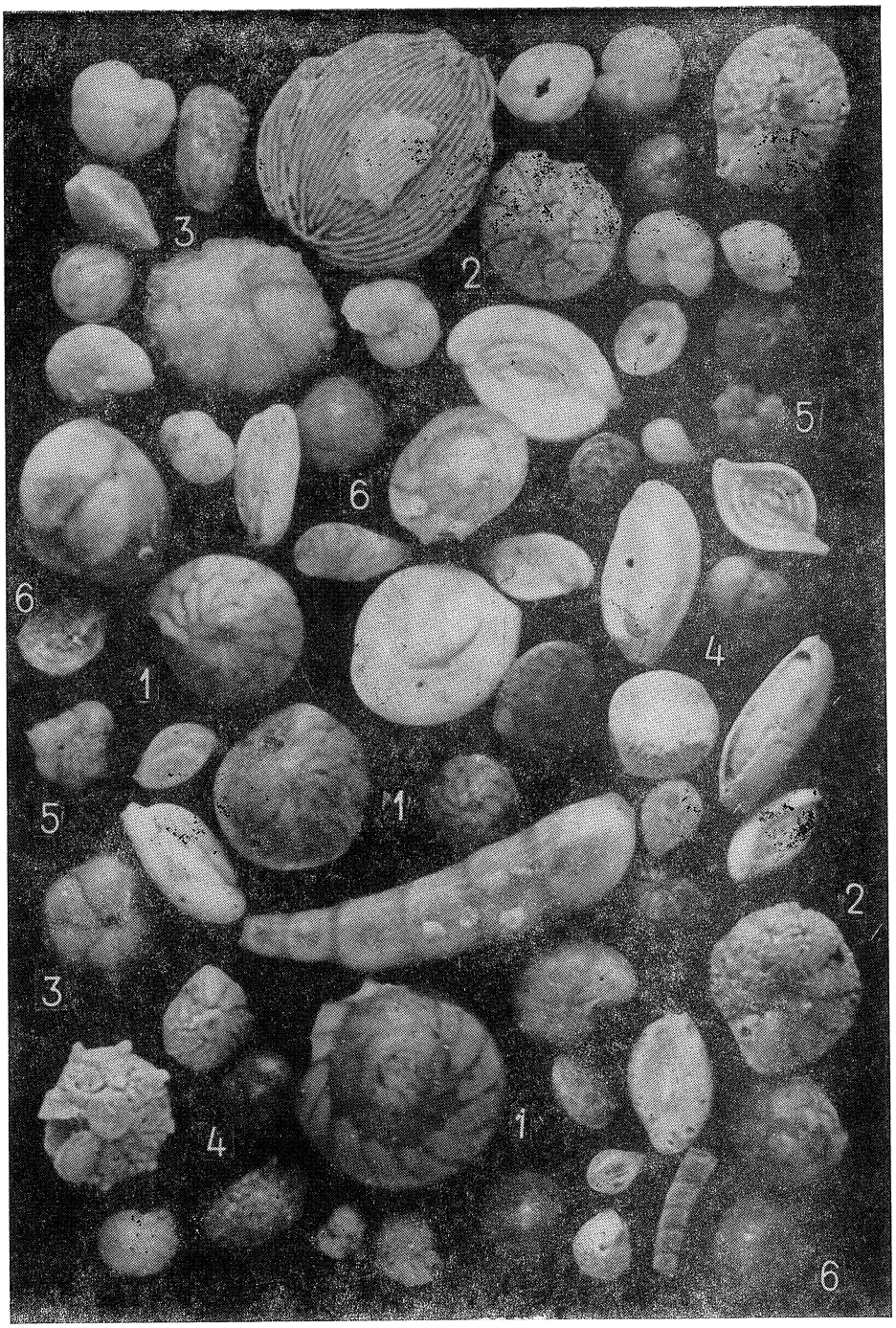
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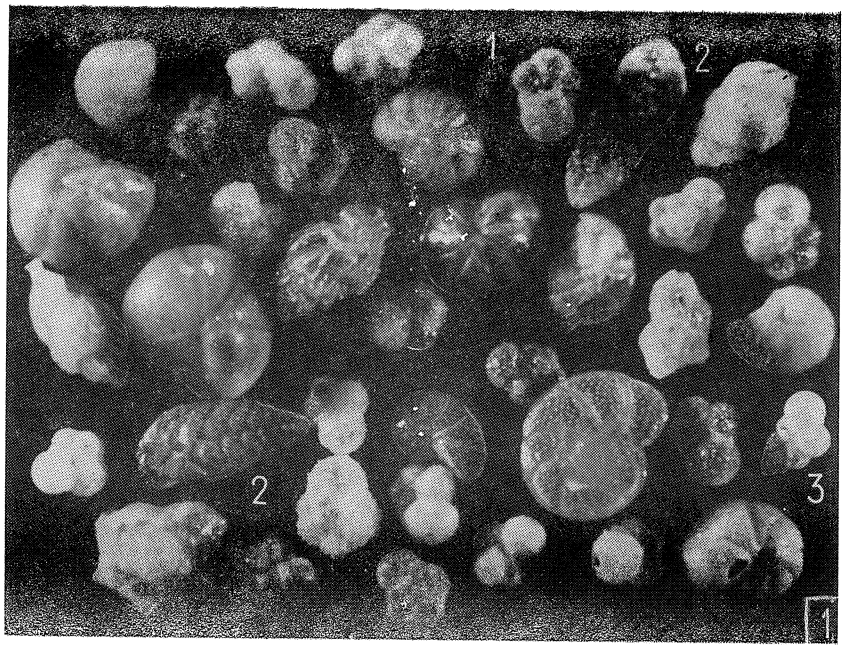
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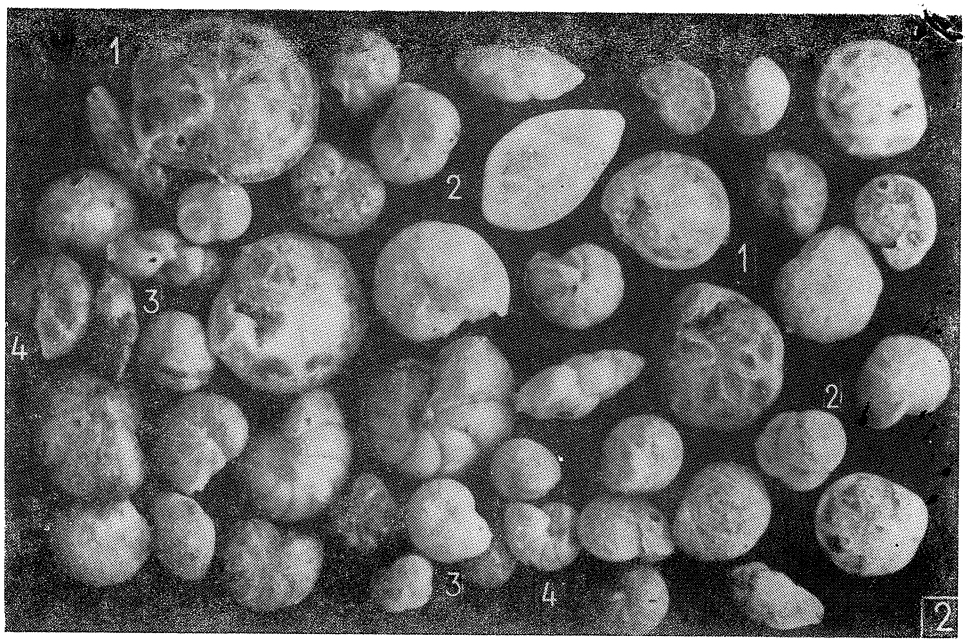
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EXPLANATION OF PLATES
OBJAŚNIENIA TABLIC

Plate — Tablica I

Fig. 1. The Upper Eocene foraminiferal assemblage (exclusive of Nummulites) (S--365). 1 — *Asterigerina rotula haeringensis* Lühr; 2 — *Pararotalia lithothamnica* (Uhlig); 3 — *Cibicides carinatus* (Terquem); 4 — *Baggina iphigenia* (Sam.); 5 — *Pararotalia audouini* (Orbigny); 6 — *Biapertorbis* cf. *brandenburgensis* Kiesel et Lotsch; × 26,5

Fig. 1. Górnoeoceński zespół otwornic (z wyłączeniem numulitów) (S-365), 1 — *Asterigerina rotula haeringensis* Lühr; 2 — *Pararotalia lithothamnica* (Uhlig); 3 — *Cibicides carinatus* (Terquem); 4 — *Baggina iphigenia* (Samoilova); 5 — *Pararotalia audouini* (Orbigny); 6 — *Biapertorbis* cf. *brandenburgensis* Kiesel et Lotsch; × 26,5

Plate — Tablica II

Fig. 1. Lower Oligocene foraminiferal assemblage with globigerines (S-365). 1 — *Globigerina danvillensis* Howe et Wallace; 2 — *Bolivina fastigia* Cushman; 3 — *Chilogümbelina gracillima* (Andreae); × 65

Fig. 1. Dolnooligoceński zespół otwornic z globigerinami (S-365). 1 — *Globigerina danvillensis* Howe et Wallace; 2 — *Bolivina fastigia* Cushman; 3 — *Chilogümbelina gracillima* (Andreae); × 65

Fig. 2. Upper Oligocene foraminiferal assemblage „Asterigerina zone" (S-376). 1 — *Asterigerina gürichi gürichi* (Franke); 2 — *Sphaeroidina variabilis* Reuss; 3 — *Elphidium hiltermanni* Hagn; 4 — *Melonis affine* (Reuss); × 50

Fig. 2. Górno-oligoceński zespół otwornic „poziomu asterigerinowego" (S-376). 1 — *Asterigerina gürichi gürichi* (Franke); 2 — *Sphaeroidina variabilis* Reuss; 3 — *Elphidium hiltermanni* Hagn; 4 — *Melonis affine* (Reuss); × 50