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Lower Cretaceous foraminifera assemblages in Middle Poland

The studies on the Neocomian foraminifera in the Kujawy region reveal that agglutinated foraminifera decidedly predominate over the calcareous ones. This is related to the terrigenous nature of the sediments. Agglutinated foraminifera are especially numerous in the sediments representing the periods of regressions and falls of sea-level, as well as increased freshwater inflow.

The most complete Lower Cretaceous sequence with the richest microfossil assemblage is known to occur in the Kujawy area, Middle Poland. The microfossil assemblage consists of agglutinated and carbonaceous foraminifera occurring in varying proportions. The agglutinated genera are represented chiefly by: *Haplophragmoides*, *Ammobaculites*, *Lagenammina*, *Trochammina*, *Trochamminoidea*, *Dorothia* and *Glomospirella*. The abundance and contents of the foraminifera assemblages differ from horizon to horizon. In Middle Poland the Lower Cretaceous basin shows repeated shallowing and frequent changes of its salinity (S. Marek, 1988; S. Marek et al., 1989; A. Raczyńska, 1979; J. Szejn, 1969). With the freshening of the basin and decrease of its salinity, the agglutinated foraminifera grow in number and finally become predominant, due to a lesser intensity of CaCO_3 dissociation.

The first Lower Cretaceous appearance of agglutinated foraminifera is known from Early Riazanian marine-brackish sediments, ostracoda horizon A. This appearance is related to the first marine incursions into the earlier, already brackish (ostracoda horizon B) Purbeckian basin in the Upper Volgian. These incursions causing an already slight salinity of the basin favoured the development of agglutinated foraminifera. In the horizon A shales, mostly marly, have been formed. The genera predomina-

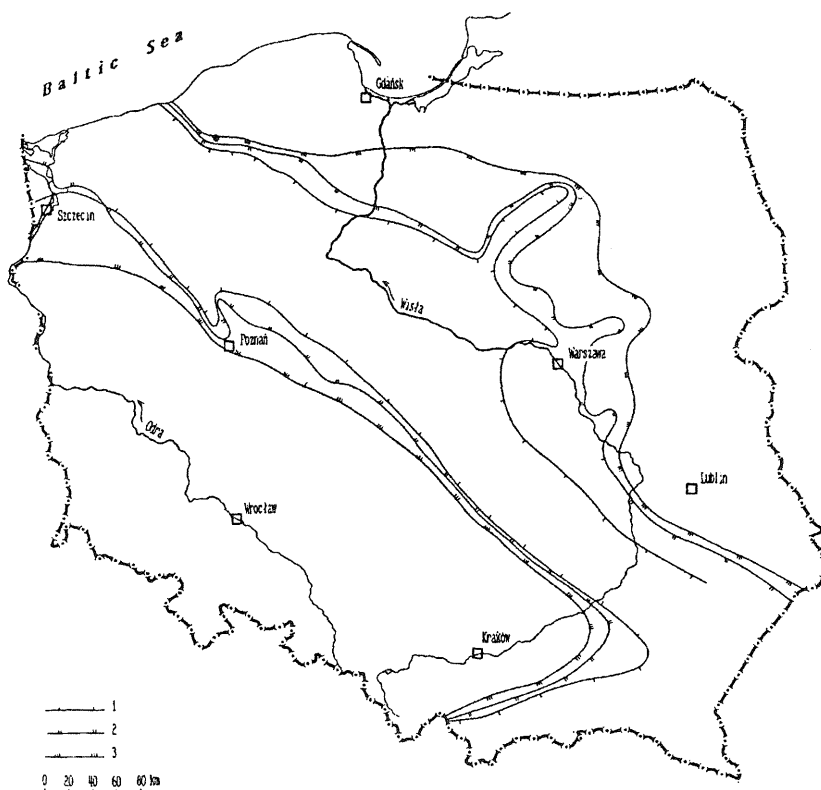


Fig. 1. Original extent of Neocomian-Hauterivian sediments in Poland (after S. Marek, 1988)

1 – Lower Valanginian, 2 – Upper Valanginian, 3 – Hauterivian

Pierwotny zasięg osadów neokomu-hoterywu w Polsce (według S. Marka, 1988)

1 – walażyn dolny, 2 – walażyn górny, 3 – hoteryw

ting in these sediments are: *Ammobaculites kcyniensis* Szejn and *A. pseudospirale gracilis* Lacroix.

During the Late Riazanian (*Riasanites rjasanensis* horizon) a typical marine environment persisted (S. Marek, 1988; J. Szejn, 1985). The Upper Riazanian sequence – from the bottom upwards – consists of sandstone with calcite cement and devoid of microfossils followed by sandy, locally limy, siltstones with claystone intercalations. In the above horizon a foraminifera assemblage with an evident predominance of agglutinated genera has been found in Middle Poland. These are: *Trochammina kcyniensis* Szejn, *T. inflata* (Montagu), *Trochamminoides proteus* (Karrer), *Haplophragmoides cushmani* Loeblich et Tappan, *Dorothia* aff. *kummi* (Zedler) and *Glomospirella gaultina* (Berthelin). The agglutinated foraminifera are accompanied by relatively few calcareous forms among which noteworthy are: *Eoguttulina witoldi* Szejn, *Reinholdella*

valendisensis Bartenstein et Brand, *Epistomina anterior* (Bartenstein et Brand) and *Lenticulina muensteri* (Roemer).

In the lower portion of the Lower Valanginian (horizon with *Platylenticeras*) the marine regime still persists. In this portion of the sequence limeless shales and silty shales with sandy agglomerations have been laid down. Compared with that of the Upper Riazanian sediments, their microfossil assemblage is impoverished, but the agglutinated species still predominate over the calcareous ones. The agglutinated foraminifera are represented chiefly by: *Lagenammina difflugiformis* (Brady), *Dorothia* aff. *kummi* (Zedler), *Trochammina kcyeniensis* Szejn, *T. inflata* (Montagu), *Trochamminoides proteus* (Karrer), *Haplophragmoides cushmani* Loeblich et Tappan. In addition to the mentioned above, single calcareous specimens – *Lenticulina muensteri* (Roemer) and *Eoguttulina witoldi* Szejn – appear in the horizon with *Platylenticeras*.

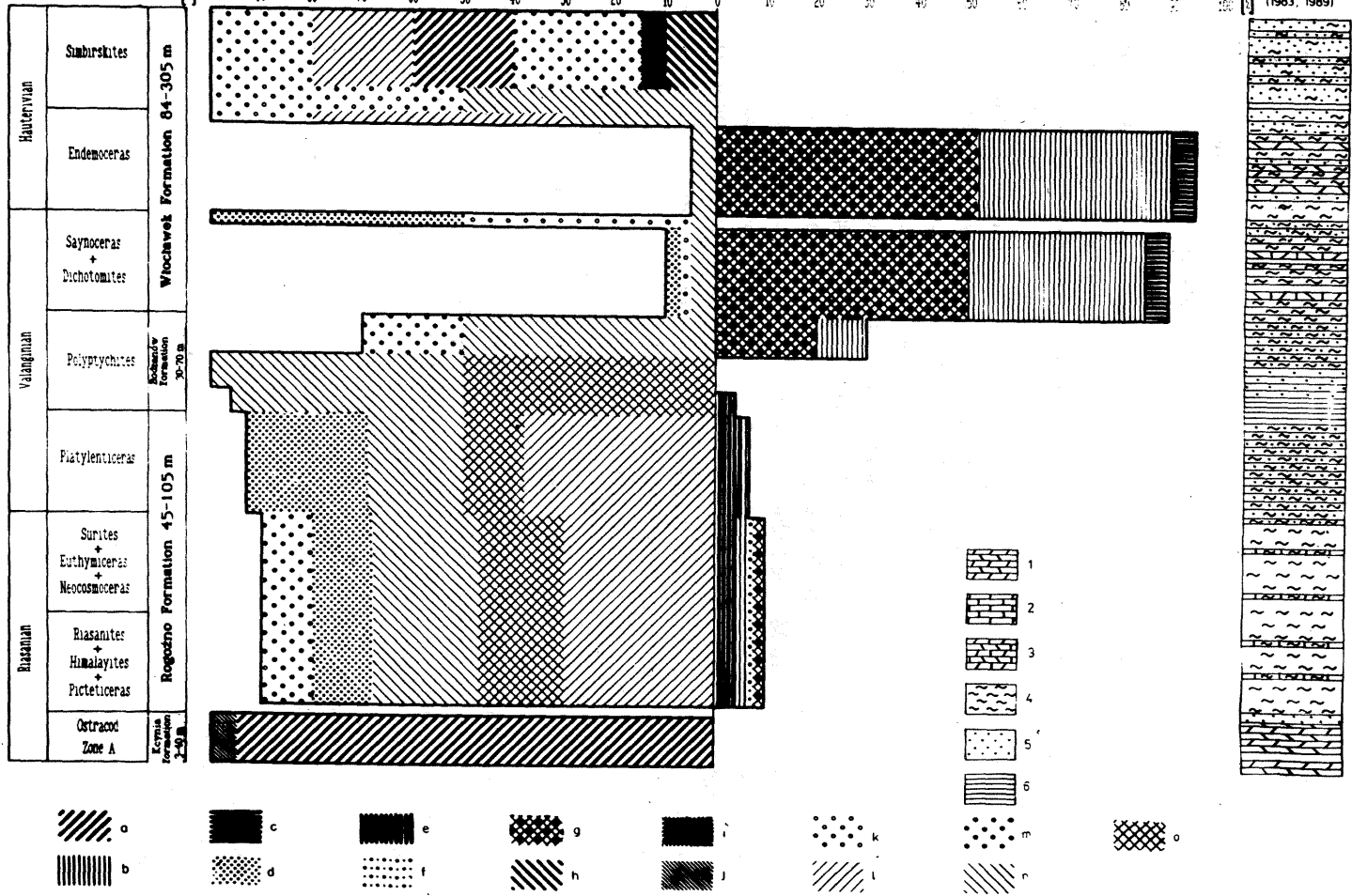
In the upper portion of the Lower Valanginian (horizon with *Polyptychites*) the marine influence on the depositional environment is less pronounced (S. Marek, 1983; J. Szejn, 1969; J. Szejn et al., 1984). The *Polyptychites* beds in the Polish Lowlands are made up chiefly of sandy formations with rhizoids and wood fragments indicative of a shallowing and freshening environment substantially influencing the foraminifera assemblage occurring in this basin. Sediments of the upper portion of the Lower Valanginian are tripartite. In Middle Poland in the lower series composed mainly of shales, only a few foraminifera species have been noted with agglutinated tests decidedly outnumbering the calcareous ones. The following specimens have been found: *Haplophragmoides cushmani* (Loeblich et Tappan), *Trochamminoides proteus* (Karrer), *Lenticulina muensteri* (Roemer), *Eoguttulina witoldi* Szejn.

Almost throughout the basin the middle series of these beds is made up of sandy sediments. Only in its middle portion in the Kujawy area sandy shales have been deposited. They contain very scarce agglutinated forms: *Haplophragmoides cushmani* (Loeblich et Tappan) and *Trochamminoides proteus* (Karrer).

The upper series is built of predominant sandy shales and siltstones with a foraminifera assemblage richer than that of the middle series and with agglutinated forms still prevailing over calcareous ones. Here noteworthy is the presence of: *Haplophragmoides concavus* (Chapman), *H. cushmani* Loeblich et Tappan, *Lagenammina difflugiformis* (Brady), *Epistomina caracolla* (Roemer), *E. cretosa* Ten Dam and *Lenticulina muensteri* (Roemer).

After the shallowing and partial freshening of the basin in the Lower Valanginian, a repeated marine transgression takes place in the Upper Valanginian (horizon with *Dichotomites* and *Saynoceras*). In the lower portion of this horizon silty-clayey sediments with local ash-grey marly limestones intercalations have been laid down in Middle Poland. Numerous micro- and macrofossils have been found in this portion of the Upper Valanginian sequence.

The foraminifera assemblage differs drastically from that occurring in the Older Neocomian sediments. Here the predominating calcareous forms make up more than 90% of the entire population, the most significant ones being: *Epistomina caracolla*



(Roemer), *E. cretosa* Ten Dam, *E. lewinski* (Liszka), *Lenticulina muensteri* (Roemer), *L. nodosa* (Reuss) and *Citharina seitz* Bartenstein et Brand. The agglutinated foraminifera assemblage constituting only a minor part of the entire population contains species such as: *Haplophragmoides concavus* (Chapman), *Glomospirella gaultina* (Berthelin) and *Dorothia* aff. *oxycona* (Zedler).

In the late Upper Valanginian sediments acquire a well-pronounced sandy character due to slight shallowing of the depositional basin. In this portion again a substantial change in the foraminifera assemblage is visible. The specimens are scarce, the calcareous tests disappear completely and the agglutinated assemblage is represented by: *Dorothia* aff. *kummi* (Zedler) and *Glomospirella gaultina* (Berthelin).

The short-lived Upper Valanginian regression is followed by a repeated transgression in the Upper Hauterivian – horizon with *Endemoceras* (S. Marek, 1988; A. Raczyńska, 1979). In Middle Poland the deposition commences with claystones and slightly marly siltstones with frequent sandy claystone intercalations. Here, like in the transgressive Upper Valanginian sediments, numerous micro- and macrofossils have been found. The foraminifera assemblage found in the *Endemoceras* horizon is very close to that of the transgressive horizon with *Dichotomiceras* and *Saynoceras* (J. Szejn, 1984). It contains predominant calcareous species and of the agglutinated forms noteworthy is only *Haplophragmoides concavus* (Chapman).

The repeated shrinkage of the basin in the uppermost portion of the Lower Hauterivian results in sandy deposition. The microfossils are impoverished and the calcareous forms disappear completely. Only a few *Trochammina inflata* (Montagu) and *Haplophragmoides nonioninoides* (Reuss) specimens have been encountered.

The Upper Hauterivian (horizon with *Simbirskites*) is the time of decided shallowing and partial freshening of the depositional basin. In the Polish Lowlands – the Kujawy area – sandy sediments with claystone and siltstone intercalations have been formed in the lower portion of the Upper Hauterivian (S. Marek, 1983; A. Raczyńska, 1979). From these intercalations single agglutinated species have been identified (J. Szejn, 1984): *Glomospirella gaultina* (Berthelin) and *Haplophragmoides concavus* (Chapman).

In the upper portion of the Upper Hauterivian claystones bear more abundant microfossils but represented only by agglutinated species. Among others the following ones have been found: *Trochammina globigeriniformis* (Jones et Parker), *Lagenammina difflugiformis* (Brady), *Ammobaculites irregulariformis* Bartenstein et Brand, *Glomospirella gaultina* (Berthelin) and *Reophax guttifer* (Brady).

Fig. 2. Distribution of agglutinated and calcareous foraminifers in the area of Polish Lowlands

1 – marly claystones, 2 – limestones, 3 – marly limestones, 4 – mudstones, 5 – sandstones, 6 – claystones; a – *Ammobaculites*, b – *Lenticulina*, c – *Citharina*, d – *Dorothia*, e – *Eoguttulina*, f – *Reinholdella*, g – *Epistomina*, h – *Rheophax*, i – *Glomospira*, j – *Saccamina*, k – *Glomospirella*, l – *Trochammina*, m – *Lagenammina*, n – *Haplophragmoides*, o – *Trochamminoides*

Rozprzestrzenienie otwornic zlepieńcowatych i wapiennych na Niziu Polskim

1 – ilowce margliste, 2 – wapień, 3 – wapień margliste, 4 – mułowce, 5 – piaskowce, 6 – ilowce

The above data clearly indicate that in the Polish Neocomian, due to the terrigenous nature of the sediments, the agglutinated foraminifera decidedly predominate over the calcareous ones. The agglutinated forms are particularly abundant in sediments representing periods of regression, shallowing of the sea and increased fresh water supply.

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OTWORNICE DOLNOKREDOWE W POLSCE ŚRODKOWEJ

Streszczenie

Osady kredy dolnej najpełniej są rozwinięte w Polsce Centralnej, na Kujawach; tu również stwierdzono najbogatszy zespół otwornic. Tworzą one zespoły z przewagą otwornic zlepieńcowatych lub wapiennych. Zespół otwornic zlepieńcowatych we wczesnym riazaniu (poziom małżoraczkowy A) stanowi 100% tej grupy organizmów. Podobnie otwornice zlepieńcowate stanowią całość zespołu w górnej części walanżynu dolnego

(środkowa część poziomu z *Polyptychites*), a w stropowej części walażynu górnego (górną część poziomu z *Dichotomites* + *Saynoceras*) oraz w górnym hoterywie (poziom z *Symbirskites*). Najmniej otwornic zlepieńcowatych (5 – 10%) stwierdzono w walażynie górnym, poza jego częścią stropową, i w hoterywie dolnym. Badania na Kujawach pozwalają stwierdzić wyraźnie zdecydowaną dominację neokomskich otwornic zlepieńcowatych nad otwornicami wapiennymi. Jest to związane z terygenicznym charakterem osadów. Szczególnie licznie występują otwornice zlepieńcowate w osadach reprezentujących okresy regresji i obniżania się poziomu morza oraz wzmożonego dopływu wód słodkich.