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Biostratigraphical correlations around the Oxfordian/Kimmeridgian boundary

ABSTRACT: Within the ammonite faunas occurring in the Bimammatum and the Planula Zones of the Upper Oxfordian in Central Poland, there occur aside of the overdominating Submediterranean forms, also those of the Subboreal/Boreal affinity. The oldest are some *Ringsteadia* and *Amoeboceras* indicating the approximate correlation of the lowermost part of the Bimammatum Zone with a lower, but possibly not the lowest, part of the Pseudocordata Zone. The younger is *Amoeboceras bauhini* (OPPEL) occurring from the lower part of the Planula Zone which indicates the correlation of the major part of the Planula Zone with a lower part of the Baylei Zone. This shows that the boundary of the Oxfordian and Kimmeridgian in the Submediterranean zonal scheme runs relatively too high when compared with that of the Subboreal/Boreal zonal schemes.

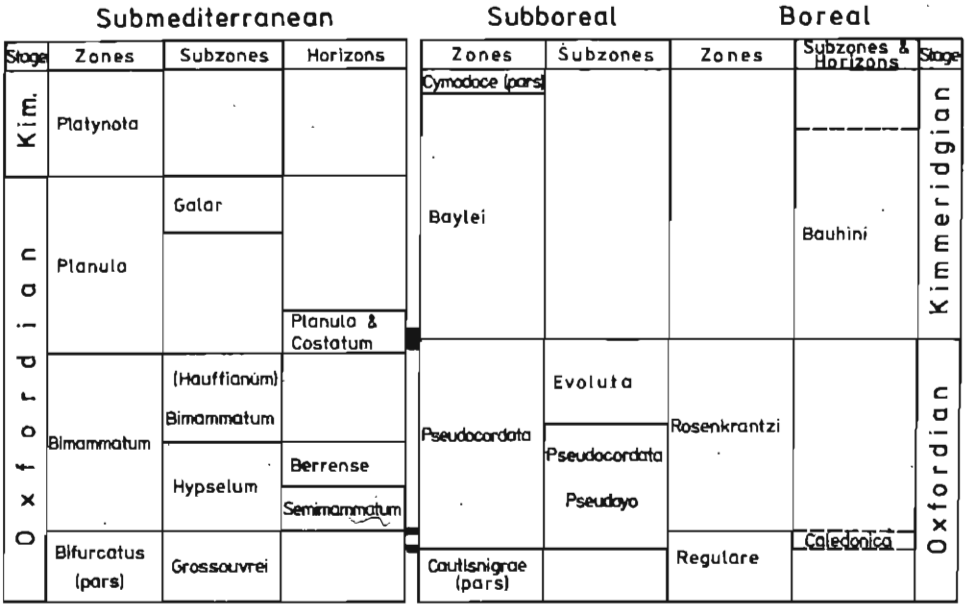
INTRODUCTION

The Upper Oxfordian deposits in Central Poland (Wieluń-Cracow Upland, Holy Cross Mts) have yielded numerous ammonites, well located in the succession. As the bulk of these ammonites is of the Submediterranean origin, the Submediterranean standard ammonite zones, *viz.* the Bimammatum and Planula Zones may be easily recognized (MATYJA 1977, WIERZBOWSKI 1978, MATYJA & *al.* 1989). In contrast, ammonites of northern affinity are less commonly found. Of these, there occur in Central Poland some aulacostephanids (*Ringsteadia, Microbiplices*, and *Prorasenia*), rather sparsely but uniformily distributed in the succession, and cardioceratids (*Amoeboceras*), concentrated mostly in a few, thin "*Amoeboceras* layers" (MATYJA & WIERZBOWSKI 1988). So far, neither the aulacostephanids, nor the cardioceratids, have offered the firm premises needed to recognize precisely the Boreal/Subboreal ammonite zones in this succession. The presence of the ammonites of northern affinity in the Upper Oxfordian of Central Poland is however of some importance as it provides new arguments for a closer correlation of the Submediterranean zonal scheme with the Subboreal and Boreal ones.

It should be remembered that Poland is possibly the best place in Europe for making such a correlation. This is due to the fact that ammonites of northern affinity are known to occur here more commonly than in the other areas where the Upper Oxfordian successions with profuse faunas have been described (southern Germany, France, Switzerland). This observation corresponds well to the more northerly position of the area under question within the Submediterranean Province in Late Oxfordian and Early Kimmeridgian times.

Table 1

Correlation of the Submediterranean and the Boreal/Subboreal zonal schemes



It is now firmly established that the Submediterranean Province gradually overlapped with the Subboreal/Boreal Provinces in the Peribaltic Depression, stretching from north-eastern Poland to Lithuania, where the abundant ammonites of the northern affinity have been discovered in boreholes (ROTKYTE 1987, MESEZHNIKOV & *al.* 1989). The still high number of Submediterranean ammonites in north-eastern Poland in the Upper Oxfordian as well as in the lowermost Kimmeridgian (MALINOWSKA 1986, 1988; *cf. also* DEMBOWSKA & MALINOWSKA 1974), shows a marked decrease eastwards away from the Polish countries.

AMMONITES AND CORRELATION

The oldest ammonites of the genera *Ringsteadia* and *Microbiplices* occur in Central Poland in the Semimammatum horizon, *i.e.* in the lower part of the Hypselum Subzone representing the lower part of the Bimammatum Zone. The specimens of the genus *Ringsteadia* seem to be similar to *R. caledonica* SYKES & CALLOMON. On the other hand, there are known also specimens from the Hypselum Subzone which almost certainly can be placed into *R. pseudoyo* SALFELD. Of the genus *Microbiplices* the most typical in the Hypselum Subzone is *M. microbiplex* (QUENSTEDT) and some closely related forms. No ammonites of the genus *Prorasenia* have been described from the Hypselum Subzone.

In the Subboreal succession the ammonites of the genus *Ringsteadia* are known to occur in the Pseudocordata Zone, where three successive subzones based on the ammonites have been distinguished: the Pseudoyo Subzone, the Psudocordata Subzone, and the Evoluta Subzone (SYKES & CALLOMON 1979). The stratigraphical succession of these has been established at South Ferriby, eastern England, summarized by BIRKELUND & CALLOMON (1985, pp. 17–18: note, however, that the sequence as given there is in error — Psudoyo above Psudocordata — CALLOMON *in lit.*, 1990). As the boundaries between Pseudoyo and Pseudocordata have however not yet been clearly described, the two subzones are treated together in the present paper (Table 1). The oldest species of the genus *Ringsteadia* described in the Boreal Province is *R. caledonica* from the upper part of the Regulare Zone in Scotland. This part of the zone corresponds approximately to the lowermost part of the Pseudocordata Zone or to the non-sequence at the base of this zone in England (SYKES & CALLOMON 1979).

The data given strongly suggest that the Hypselum Subzone can be correlated approximately with the lower, and possibly, some middle parts of the Pseudocordata Zone, partly including at least the Pseudoyo and the Pseudocordata Subzones.

It is also worth noting the occurrence in the Semimammatum horizon of Central Poland of the microconch species *Amoeboceras ovale* (QUENSTEDT), closely comparable with microconchs of the Boreal *Amoeboceras regulare* group. This is in good accordance with the correlation presented. It indicates also, that the lowermost part of the Bimammatum Zone cannot be correlated with any horizon lying below the base of the Pseudocordata Zone in the Subboreal zonal scheme, and/or below the upper part of the Regulare Zone in the Boreal zonal scheme (MATYJA & WIERZBOWSKI 1988). Moreover, a recent discovery of the species *Amoeboceras ovale* (QUENSTEDT) in the upper part of the Bifurcatus Zone, *i.e.* in the Grossouvrei Subzone, suggests that the base of the Pseudocordata Zone should be traced even somewhat below the base of the Bimammatum Zone (MATYJA & WIERZBOWSKI, *in press*).

—The ammonites of the genus *Prorasenia* are known to occur in the succession of Central Poland beginning from the middle part of the Bimammatum Zone, *i.e.* from the Bimammatum Subzone (WIERZBOWSKI 1987, Pl. 3, Fig. 8). The genus is

well represented in the Planula Zone and some specimens from the lower part of that zone from Central Poland are very similar to the Subboreal species *Prorasenia hardyi* SPATH (*cf.* WIERZBOWSKI 1987, Pl. 3. Fig. 9; *and* SPATH 1935, Pl. 15, Fig. 5). The latter species was said to come from the "Lower Kimmeridge Clay" (*see* SPATH 1935), but BIRKELUND & CALLOMON (1985) have suggested that it occurs mostly in the upper part of the Pseudocordata Zone, *i.e.* in the Evoluta Subzone.

The ammonites of the genus *Ringsteadia* occurring in the Bimammatum Subzone of Central Poland belong *int. al.* to the involute species *R. submediterranea* WIERZBOWSKI (*see* WIERZBOWSKI 1978, Pl. 3, Figs 1–3). The species is unknown in the Subboreal Province and probably belongs to a distinct Submediterranean *Ringsteadia* lineage. The same work deals with some ammonites of this genus from the Planula Zone, and especially with *R. flexuoides* (QUENSTEDT) which may represent a still younger link in the same lineage. It should be remembered that the latter species differs in morphology and in stratigraphical occurrence from *Ringsteadia salfeldi* DORN of a lower part of the Bimammatum Zone (WIERZBOWSKI 1970, 1978), and cannot be compared with *R. caledonica* of the upper part of the Regulare Zone of Scotland (*cf.* SYKES & CALLOMON 1979, pp. 890–891). Only a few ammonites of the genus *Ringsteadia* coming from the lower part of the Planula Zone of Central Poland are at all similar to those from the Subboreal Province, namely to *R. evoluta* SALFELD, typical of the upper part of the Pseudocordata Zone (WIERZBOWSKI 1970).

In the lowermost part of the Planula Zone (Planula & Costatum horizon) in Central Poland there occurs also a thin "*Amoeboceras* layer" rich in ammonites of the genus. These show a wide, but continuous spectrum of variability and may be easily placed in the single species *Amoeboceras praebauhini* (SALFELD). Some specimens are however (*see* MATYJA & WIERZBOWSKI 1988) morphologically very similar to *A. bauhini* (OPPEL). The species *A. bauhini* has recently been regarded as indicative of the lower part of the Baylei Zone, *i.e.* the lowermost Subboreal/Boreal Kimmeridgian. Moreover, a few specimens of the genus *Amoeboceras* found in Central Poland in beds somewhat younger than the "*Amoeboceras* layer", but still in lower as well as middle parts of the Planula Zone, belong to *Amoeboceras bauhini* (OPPEL) and are closely comparable with the type specimen of the species (*cf.* WIERZBOWSKI 1978, Pl. 2, Fig. 15; *and* SYKES & CALLOMON 1979, Pl. 121, Fig. 1).

The above records indicate that the interval from the upper Bimammatum Zone up to the lowermost Planula Zone in the Submediterranean zonal scheme possibly correlates with the upper Pseudocordata Zone, *i.e.* the Evoluta Subzone of the Subboreal subdivision and the corresponding parts of the Boreal subdivision (upper Rosenkrantzi Zone). Moreover, it seems highly probable that some parts of the Planula Zone, below its uppermost part (= Galar Subzone), correspond in fact to the lower part of the Baylei Zone in the Subboreal zonal scheme. This would indicate that the boundary of the Oxfordian and Kimmeridgian in the Submediterranean zonal scheme is currently drawn too high when

compared with the boundary in Subboreal/Boreal schemes (MATYJA & WIERZBOWSKI 1988).

DISCUSSION

The correlation of the Upper Oxfordian and the Lower Kimmeridgian of the Boreal/Subboreal Provinces with the substages of the Submediterranean Province has presented long-standing problems which have been repeatedly discussed also in the last decades. The most important question of the correlation remained the position of the Oxfordian/Kimmeridgian boundary in the standard succesions. SYKES & CALLOMON (1979, p. 894) stated "*that the boundary in the Submediterranean Province must be drawn lower than normally accepted putting most, if not all of the Planula Zone into the Kimmeridgian*". This opinion is very close to that given in the present paper.

On the other hand, HANTZPERGUE (*in:* ENAY & MELÉNDEZ 1984, pp. 92–93) and HANTZPERGUE (1988) considered the upper boundary of the Planula Zone (*i.e.* of the Galar Subzone = Grandiplex Subzone) as approximately isochronous with the upper boundary of the Rosenkrantzi Zone (Pseudocordata Zone), accepting thus the traditional correlation of the Oxfordian/Kimmeridgian boundary in the Submediterranean and Boreal/Subboreal zonal schemes. This interpretation is based mostly on the occurrence of the Subboreal ammonite *Rasenia cymodoce* (d'ORBIGNY) which marks a faunal horizon in the Submediterranean succession in Aquitaine. The detailed correlation of the different zonal schemes within a wider interval around the Oxfordian/Kimmeridgian boundary based on such fragmentary data seems however debatable. Moreover, some positive objections may be raised. It should be remembered that the base of the Lower Kimmeridgian Cymodoce Zone in the Boreal/Subboreal successions as recently proposed by BIRKELUND & CALLOMON (1985) is difficult to locate in Aquitaine, as the horizon with *Rasenia cymodoce* (d'ORBIGNY) occurring there corresponds in fact only to some middle parts of the zone. Hence, in the Aquitaine succession it is difficult to recognize the boundary between the Subboreal Cymodoce and Baylei Zones as well as the boundaries of the older Subboreal/Boreal zones. Moreover, although the detailed correlation in the Lower Kimmeridgian must await a careful study of *Amoeboceras* faunas from the Platynota — Hypselocyclum Zones of the Submediterranean succession, there appear already indications that some upper parts of the Platynota Zone may be correlated with the Cymodoce Zone, and not with the Baylei Zone of the Subboreal succession. They rest on the presence in the Platynota Zone in northern Poland of the ammonites of the genus *Amoeboceras* which, although erronously attributed to the species *Amoeboceras bauhini* (OPPEL) by MALINOWSKA (1988, Pl. 1, Figs 4, 6), are in fact very similar to the microconchs of *Amoeboceras subkitchini* SPATH from the Cymodoce Zone (*cf.* BIRKELUND & CALLOMON 1985, Pl. 3, Figs 4, 7–9, 11).

The other problem actively discussed in last years has dealt with position in the Subboreal zonal scale of the lower boundary of the Bimammatum Zone, sometimes treated in the Submediterranean succession as the base of the Upper Oxfordian. The boundary cannot be correlated with any level below the base of the Pseudocordata Zone (and upper part of the Regulare Zone), as indicated by the character of *Amoeboceras* and *Ringsteadia* faunas occurring there (*see also* MATYJA & WIERZBOWSKI 1988). Hence, it is possibly not suitable for wider acceptance as the primary standard for the lower boundary of the substage.

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KORELACJE BIOSTRATYGRAFICZNE WOKÓŁ GRANICY OKSFORDU I KIMERYDU

(Streszczenie)

Wśród amonitów występujących w poziomach Bimammatum i Planula w górnym oksfordzie Polski środkowej, oprócz dominujących form submedyterańskich, spotyka się także formy pochodzenia subborealnego i borealnego. Dzięki współwystępowaniu tych amonitów możliwym się stało rozważenie korelacji biostratygraficznych różnych podziałów amonitowych w kluczowym dla stratygrafii jury przedziale przy granicy oksfordu i kimerydu.

Najstarsze amonity subborealne i borealne pojawiają się w horyzoncie Semimammatum wyznaczającym najniższą część poziomu Bimammatum. Występuje tu, obok rodzaju *Ringsteadia*, także rodzaj *Amoeboceras*, reprezentowany przez mikrokonchy z grupy *A. regulare*. Znaleziska te wskazują, że dolna granica poziomu Bimammatum nie może przebiegać poniżej dolnej granicy subborealnego poziomu Pseudocordata i jednocześnie górnej części borealnego poziomu Regulare (*patrz* tabela 1). Występowanie form subborealnych, takich jak *Ringsteadia pseudoyo* SALFELD, w podpoziomie Hypselum odpowiadającym dolnej części poziomu Bimammatum, jak również form zbliżonych do *Ringsteadia evoluta* SALFELD w dolnej części poziomu Planula, wskazuje na możliwość korelacji poziomu Bimammatum i niższej części poziomu Planula z poziomem Pseudocordata. Korelacja taka znajduje potwierdzenie w pojawieniu się amonitów z rodzaju *Prorasenia*, nieznanych poniżej najwyższej części poziomu Pseudocordata, już w środkowej części poziomu Bimammatum.

Na szczególną uwagę zasługuje obecność gatunku *Amoeboceras bauhini* (OPPEL) w obrębie poziomu Planula, i to poczynając od jego dolnej części. Gatunek ten znany jest z subborealnego poziomu Baylei — z jego dolnej części, która tym samym może być korelowana z przeważającą częścią poziomu Planula. Ponieważ granica oksfordu i kimerydu w podziale submedyterańskim wyznaczana jest na granicy poziomów Planula i Platynota, zaś w podziale subborealnym na granicy poziomów Pseudocordata i Baylei, przedstawione rozważania wskazują (*patrz* tabela 1), iż granica obu pięter w dyskutowanych podziałach biostratygraficznych odpowiada różnym przedziałom wiekowym.
