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A preliminary foraminiferal biozonation of the Chalk Group
(In preparation for the Holostrat Project: Upper Cretaceous)

Ian P. Wilkinson

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UK and continental shelf

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Biostratigraphy

British Geological Survey, Keyworth, Nottinghamshire, UK

M.A.Woods
Biostratigraphy Files

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Ian Wilkinson

The Holostrat Project on the Upper Cretaceous of the UK is in preparation. As part of that project a biozonation of the foraminifera from the Chalk Group was prepared to include data from the UK and its continental shelf, notably the Southern North Sea Basin. Twenty seven zones were recognised and, together with a number of additional marker horizons, result in a high resolution subdivision of the Chalk Group. This report will be incorporated into the Web site on completion of the project. The diagrams were constructed by M.A. Woods.

Foraminiferal Biozones

Foraminifera from the British Chalk have been taxonomically described for many years and since the 1970's biostratigraphical applications have also been discussed. It is becoming more evident that foraminiferal inceptions and extinctions can be tied in with marl seams, flint bands, sponge beds, Inoceramus-rich beds and so on, to provide a very detailed subdivision of the Chalk Group. Unfortunately, detailed stratigraphical and lithological information of sample positions was not always given in the earlier biostratigraphical publications, limiting their usefulness somewhat. The scheme given below is based on several publications and unpublished findings. The unpublished PhD theses by Bailey (1978) and Swiecicki (1980) provide valuable information for the Middle and Upper Chalk and, together with Bailey et al. (1983, 1984) and Hart *et al*. (1989), forms the basis for the zonal scheme adopted here. The Cenomanian and Turonian foraminiferal associations are more difficult to relate to the detailed lithostratigraphy, but they can be linked with the macrofaunal zonation scheme and work by Carter & Hart (1977), Hart (1982), Mortimore (1986) and Jarvis et al. (1988) are important sources.

Foraminifera from offshore areas of the North Sea Basin were summarised by King *et al.* (1989). As most of the data from offshore is derived from hydrocarbon exploration, it is based on boreholes drilled by open hole methods. Core from the North Sea Basin is not widespread. Biostratigraphy is based on the extinction horizon ('Last Appearance Datum' or 'First Downhole Occurrence') of key taxa, the first appearance uphole or inception cannot be used as caving causes error.

The zones below are related to the UKB zones of Hart *et al.* (1989) and to the macrofaunal zones. Where possible lithostratigraphical marker horizons are also included.

Foraminiferal biozones

B.G.S. Zone 1 (=UKB1 and 2)

Base:
The inception of *Plectina mariae* and *Hagenowina anglica*. *Flourensina intermedia* and *Hagenowina advena* become common. The extinction of the Albian taxa such as *Arenobulimina chapmani* and *Arenobulimina sabulosa*.

Top:
The inception of the succeeding zonal index

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Vialovella praefrankei becomes extinct in the lower *carcitanense* Subzone.

Subzones:
1i. Facies related taxa such as *Bulbophragmium aequale folkestonensis*, which is found in the Glauconitic Marl of southeastern Kent, was used by Hart et al (1989) to define his UKB 1 Zone. It should probably be treated as a biomarker, but to maintain some consistency it is given subzonal status herein.

Age:
M. mantelli Zone.

B.G.S. Zone 2 (UKB3)

Base:
The inception of *Pseudotextulariella cretosa* and the extinction of *Flourensina intermedia*.

Top:
The extinction of *Marssonella ozawai* and *Quinqueloculina antiqua*.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:

Subzones:

Age:
Early *M. dixoni* Zone.

B.G.S. Zone 3 (=UKB4)

Base:
The extinction of *Marssonella ozawai* and *Quinqueloculina antiqua.*

Top:
The inception of *Flourensina mariae* and *Plectina cenomana*.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Lingulogavelinella jarzevae becomes extinct in the basal part (low to mid *dixoni* zone).
Rotalipora reicheli appears for the first time in the upper part of the zone (late *dixoni* zone), but is rare.

Subzones:

Age:
M. dixoni Zone.

B.G.S. Zone 4 (=UKB 5)

Base:
The inception of *Flourensina mariae* and *Plectina cenomana*.

Top:
The extinction of *Praeglobotruncana delrioensis.*

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Rotalipora reicheli becomes extinct late in the *T. costatus* Zone.
Hagenowina anglica, Spiroloculina papyracea and *Favusella washitensis* disappear from the record at the *costatus/acutus* boundary.

Subzones:
4i. Un-named subzone between the base of the zone and the inception of *Praeglobotruncana stepheni.*
4ii. *Praeglobotruncana stepheni* Subzone. Base defined by the inception of the index species at the base of the *A. rhotomagense* Zone (and *T. costatus* Zone). Top defined by the incoming of *Rotalipora cushmani*
4iii. *Rotalipora cushmani* Subzone. Inception at base of the *acutus* Zone. *Rotalipora greenhornensis* accompanies the subzonal index. Upper boundary is the top of the zone.

Age:
C. inerme to earliest *jukesbrownei* Zone.

B.G.S. Zone 5 (=UKB6)

Base:
The extinction of *Praeglobotruncana delrioensis* and acme of *Flourensina mariae*.

Top:
Inception of *Lingulogavelinella globosa*.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:

Subzones:

Age:
A. jukesbrownei Zone.

B.G.S. Zone 6 (=modified UKB7)

Base:
Inception of *Lingulogavelinella globosa*.

Top:
Extinction of *Hagenowina advena* in the base of the Plenus Marl.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Dicarinella hagni and *Dicarinella algeriana* appear in the upper part of the Zone (late *C. guerangeri* Zone).

Subzones:

Age:
Very latest *A. jukesbrownei* Zone and *M. geslinianum* Zone.

B.G.S. Zone 7 (=lower UKB 8)

Base:
Extinction of *Hagenowina advena* in the base of the Plenus Marl.

Top:
Inception of *Dicarinella imbricata, Whiteinella archaeocretacea, Heterohelix globosus, Marginotruncana marginata*, together with the extinction of *Rotalipora cushmani*

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Extinction of *Rotalipora greenhornensis*, *Gavelinella cenomanica, Tritaxia macfadyeni, Plectina cenomana* at the top of Bed 1 of the Plenus Marl.
Extinction of *Gavelinella baltica* and *Gavelinella intermedia* in Bed 2 of the Plenus Marl.
Rotalipora cushmani extinction at the top of Bed 3 of the Plenus Marl.

Subzones:

Age:
Early to 'mid' *M. geslinianum* Zone.

B.G.S. Zone 8 (=upper UKB8 and basal UKB9)

Base:
Inception of *Whiteinella archaeocretacea, Dicarinella imbricata, Heterohelix globosus, Marginotruncana marginata*, together with the extinction of *Rotalipora cushmani*

Top:
Inception of *Valvulineria lenticularis* and *Praeglobotruncana helvetica*.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Gavelinella ammonoides appears near the top of the zone and *Arenobulimina preslii* becomes more consistently present (in the upper part of the *N. juddi* Zone).
Praeglobotruncana stephani disappears from the record at the top of Bed 5 of the Plenus Marl.
Gavelinella reussi becomes extinct at the top of Bed 7 of the Plenus Marl.

Subzones:

Age:
Late *M. geslinianum* Zone to late *N. juddi* Zone

B.G.S. Zone 9 (=UKB9 excluding the basal part)

Base:
Inception of *Valvulineria lenticularis* and *Praeglobotruncana helvetica.*

Top:
Inception of *Globorotalites michelinianus* and extinction of *Lingulogavelinella globosa*.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Whiteinella aprica appears in the early *Mytiloides* spp Zone.
The extinction of *Dicarinella hagni* and *D algeriana* together with the inception of *Marginotruncana sigali* in the 'mid' *Mytiloides* spp Zone.
Gavelinella tourainensis generally temporarily disappears from the record at the top of the zone (Lazarus effect).

Subzones:

Age:
Latest *N. juddi* Zone to late *Mytiloides* Zone

B.G.S. Zone 10 (=basal UKB10)

Base:
Inception of *Globorotalites michelinianus* and extinction of *Lingulogavelinella globosa*.

Top:
Inception of *Marginotruncana pseudolinneiana*.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
The Lazarus effect causes a general disappearance of *Gavelinella tourainensis* at the base of the zone, but the species reappears in the upper part of the Turonian.
Although a long-ranging taxon, the inception of common *Coskinophragma* is characteristic of the New Pit Chalk (at New Pit Marls) in south eastern England (upper part of the foraminiferal zone and lower part of the *T. lata* Zone).

Subzones:

Age:
Late *Mytiloides* spp zone to early *T. lata* Zone.

B.G.S. Zone 11 (=lower and middle UKB10)

Base:
Inception of *Marginotruncana pseudolinneiana*.

Top:
Inception of *Marginotruncana coronata*.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
The extinction of *Globigerinoides bentonensis* is at the basal boundary of the zone.

Subzones:
The extinction of *Marginotruncana sigali* takes place in the lower part of the zone (lower T. lata Zone). The concurrent range of that species with *Marginotruncana pseudolinneiana*. Is considered to be of subzonal significance.
The upper part of the zone, which lacks *M. sigali,* is characterised by agglutinating species such as *Coskinophragma*, sp., *G. laevigata* and *S. praelongata*.

Age:
'Mid' *T. lata* Zone.

B.G.S. Zone 12 (=upper UKB10)

Base:
Inception of *Marginotruncana coronata*.

Top:
Inception of *Verneuilina muensteri*.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Praeglobotruncana helvetica extinction in the lower part of the foraminiferal zone (upper part of the *T. lata* zone).
The top of the interval of common *Coskinophragma* (in the Southerham Marls, Lewis Nodular Chalk of south eastern England) is in the upper part of the *T. lata* Zone.
The reappearance of *Gavelinella tourainensis* in the highest *T. lata* Zone.
Dicarinella imbricata in the middle part of the foraminiferal Zone (at or little above the base of the *S. plana* Zone)
Reussella kelleri appears for the first time in the upper part of the foraminiferal zone (lower *S. plana* macrofaunal zone), immediately above the Bridgewick Marls of southern England, although it is rare and patchily distributed in the early part of its range.
Lingulogavelinella arnagerensis appears for the first time in the upper part of the Zone (upper part of the *S. plana* Zone) immediately above the Kingston Nodular Chalks of southern England. It is rare and patchily distributed in the lower part of its range.

Subzones:

Age:
Late *T. lata* and *S. plana* zones.

B.G.S. Zone 13 (=UKB11)

Base:
Inception of *Verneuilina muensteri.*

Top:
Inception of *Stensioeina granulata granulata*

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Stensioeina granulata levis accompanies the first specimens of *V. mu*ensteri immediately above the Navigation Hardground through to the Hope Gap Hardground (basal *M. cortestudinarium* Zone) in southern England, but it is very rare.
Gavelinella pertusa appears within the lower part of the zone, although the exact stratigraphical position of its inception is difficult to place due to its rarity in the earliest part of its range.
In the very highest part of the foraminiferal zone (highest *M. cortestudinarium* Zone) *Globorotalites michelinianus* generally disappears from the record in southern England (Lazarus effect).
Gavelinella tourainensis becomes extinct at the top of the foraminiferal zone at the East Cliff/Shoreham 2 Marl (*cortestudinarium/coranguinum* zonal boundary).

Subzones:

Age:
M. cortestudinarium Zone.

B.G.S. Zone 14 (=lower and middle UKB12)

Base:
Inception of *Stensioeina granulata granulata* and extinction of *Gavelinella tourainensis*

Top:
Inception of *Stensioeina exsculpta exsculpta*

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Inception of *Osangularia cordieriana* and *Gavelinella thalmanni* at or immediately above the base of the zone.
Reussella kelleri generally disappears temporarily in southern England at the base of the zone. (Lazarus effect).
Globorotalites michelinianus reappears in southern England with in the zone.
Marginotruncana sinuosa evolves at or perhaps immediately below the base of foraminiferal zone (and the *M. coranguinum* Zone) and becomes extinct in the basal part of the foraminiferal and macrofaunal zone.
Dicarinella primitiva has its inception in the basal *M. coranguinum* Zone.

Subzones:

Age:
Early *M. coranguinum* Zone (base at upper Shoreham Marl/East Cliff Marl)

B.G.S. Zone 15 (=upper UKB12)

Base:
Inception of *Stensioeina exsculpta exsculpta*

Top:
Inception of *Loxostomum eleyi*.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:

Subzones:

Age:
Early *M. coranguinum* Zone (above the Upper Shoreham Marl, but below Hope Point Marl and lateral equivalents).

B.G.S. Zone 16 (=UKB13)

Base:
Inception *of Loxostomum eleyi*.

Top:
Inception of *Stensioeina granulata polonica*

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Stensioeina granulata granulata becomes rare at or near the upper boundary of the zone.
Subzones:

Age:
Early (but not basal) *M. coranguinum* Zone (Hope Point Marl and Belle Tout Marl 2) to mid *M. coranguinum* zone (Chartham Flints, Bailey's Hill Flints and lateral equivalents).

B.G.S. Zone 17 (=lower and middle UKB14)

Base:
Inception of *Stensioeina granulata polonica*

Top:
Inception of *Gavelinella cristata*.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Reappearance of *Reussella kelleri* immediately above Whittaker's 3" Flint and lateral equivalents.
Extinction of *Lingulogavelinella arnagerensis* a little above Whittaker's 3" Flint and lateral equivalents.

Subzones:
17i. Inception of *Stensioeina granulata polonica* (Chartham Flint and lateral equivalents) to the inception of *Cibicides beaumontianus*.
17ii. *Cibicides beaumontianus* inception at Whittaker's 3" Flint and Rough Brow Flint and lateral equivalents, to the inception of *Reussella szajnochae praecursor*.
17iii. *Reussella szajnochae praecursor* inception above Barrois Sponge Bed and lateral equivalents to the top of the zone.

Age:
Upper *M. coranguinum* Zone (Chartham Flint to immediately below Peake's Sponge Bed).

B.G.S. Zone 18 (=uppermost UKB14 and lower UKB15)

Base:
Inception of *Gavelinella cristata*.

Top:
Inception of *Bolivinoides culverensis.*

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Stensioeina granulata polonica extinction at Peake's Sponge Bed.

Stensioeina exsculpta gracilis inception in the middle part of the foraminiferal zone, at the Echinocorys elevata Band and lateral equivalents at the base of the *M. testudinarius* zone.

Subzones:

18i. Inception of *Gavelinella cristata* and *Gavelinella stelligera* to the inception of *Stensioeina granulata perfecta*

18ii. *Stensioeina granulata perfecta* Subzone marked by the inception of the index species in the 'mid' *U. socialis* macrofaunal zone.

18iii. *Bolivinoides strigillatus* Subzone marked by the inception of the subzonal index in the upper *U. socialis* Zone, a little below Hawks Brow Flint and lateral equivalents.

18iv. Inception of *Rosita fornicata, Rugoglobigerina pilula, Archaeoglobigerina cretacea* and *Heterohelix striata* at the base of the *U. anglicus* Zone.

Age:

Very latest *M. coranguinum* Zone (immediately below Peake's Sponge Bed and lateral equivalents) to the top of the *U. anglicus* Zone.

B.G.S. Zone 19 (=upper UKB15)

Base:

Inception of *Bolivinoides culverensis*.

Top:

Inception of *Gavelinella usakensis*.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:

Inception of very rare *Globotruncana arca* at the base of the foraminiferal zone.

Extinction of *Globigerinelloides rowei* in the basal *O. pilula* zone.

Extinction of *Stensioeina exsculpta exsculpta* in the earliest *O. pilula* zone.

Stensioeina pommerana inception in the mid *O. pilula* zone (transitional specimens closely resembling this species occur in the late Santonian and early Campanian).

Eouvigerina gracilis and *Reussella kelleri* extinction immediately below the Arundel Sponge Bed and lateral equivalents.

Subzones:

Age:

Earliest *O. pilula* zone to very earliest *G. quadrata* Zone.

B.G.S. Zone 20 (=UKB16, except the very basal part)

Base:
Inception of *Gavelinella usakensis*.

Top:
Inception of *Gavelinella monterelensis*.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Eouvigerina gracilis and *Reussella kelleri* extinction at the base of the foraminiferal zone, immediately below the Arundel Sponge Bed and lateral equivalents.
Bolivinoides culverensis becomes common or abundant with the inception of *Gavelinella usakensis* immediately below the Arundel Sponge Bed.
Gavelinella cristata becomes extinct immediately above the Arundel Sponge Bed.
Rare *Gavelinella* cf. *voltziana* appears for the first time above the Lancing Flint. *Gavelinella trochus* is also present, although the exact stratigraphical position of its inception is not fully known due to rarity of the species in the earliest part of its range.
Gavelinella lorneiana generally disappears from the record, temporarily, immediately above the Lancing Flints and lateral equivalents (Lazarus effect). It reappears in the middle part of the foraminiferal zone (mid *quadrata* one) at the Cotes Bottom Flint.
Rugoglobigerina pilula, Stensioeina exsculpta gracilis and common *Gavelinella* stelligera disappear from the record at the top of the zone (at the Farlington Marls and lateral equivalents).

Subzones:
20i. From the base of the zone to the inception of *Eouvigerina galeata.*
20ii. *Eouvigerina galeata* Subzone. Index species has its inception between Pepper Box Marls and Lancing Flint
20iii. *Pullenia quaternaria* Subzone. Marked by the inception of the index species at Whiteclff Marl (upper *G. quadrata* Zone) *Gavelinella clementiana* and *Spiroplectammina baudouiniana* have their inception at the base of the Subzone, but are generally rare.
20iv. *Bolivinoides decoratus* Subzone is defined by the extinction of common *B. culverensis* and the inception of common *B. decoratus* at Scratchell's Marl1 in the uppermost *G. quadrata* macrofaunal zone.

Age:
G. quadrata zone (excluding the very earliest part).

B.G.S. Zone 21 (=UKB17 and lower UKB 18)

Base:
Inception of *Gavelinella monterelensis.*

Top:
Inception of *Reussella szajnochae szajnochae*.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Gavelinella voltzianus and *Globotruncana rugosa* as well as *Gavelinella monterelensis* have their inception at the Farlington Marls (at the *quadrata/mucronata* zonal boundary). *Gavelinella trochus* becomes extinct in the early *B. mucronata* zone (at the top of the Eaton Chalk).

Subzones:
21i. The concurrent range of *Gavelinella monterelensis* and *Gavelinella usakensis* in the lower part of the *B. mucronata* macrofaunal zone (between Farlington Marls and the top of the Eaton Chalk.
21ii. Between the extinction of *Gavelinella usakensis* and inception of *Coryphostoma pliata* through to the extinction of *Gavelinella lorneiana* and *Gavelinella thalmanni* and inception of *Globotruncana bulloides austinensis* and *Globotruncana plummerae* (lower Weybourne Chalk).
21iii. From the extinction of *Gavelinella lorneiana* and *Gavelinella thalmanni* and inception of *Globotruncana bulloides austinensis* and *Globotruncana plummerae* through to the extinction of consistent *Globorotalites michelinianus* and *Rosita fornicata* and inception of *Reussella szajnochae szajnochae* (upper Weybourne Chalk to the base of the Catton Sponge Bed).

Age:
Early *B. mucronata* Zone.

B.G.S. Zone 22 (=uppermost UKB18)

Base:
Inception of *Reussella szajnochae szajnochae.*

Top:
Inception of *Bolivinoides draco miliaris*.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Globorotalites hiltermanni, Bolivina incrassata and *Eponides beisseli* all appear for the first time together with *Reussella szajnochae szajnochae*.

Globotruncana bulloides bulloides becomes extinct at the top of the zone (at the top of the Beeston Chalk.

Subzones:

Age:
'Mid' *B. mucronata* zone.

B.G.S. Zone 23 (=UKB19)

Base:
Inception of *Bolivinoides draco miliaris* and *B. sidestrandensis*.

Top:
Inception of *Bolivinoides peterssoni*.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Heterohelix complanata has its inception at the base of the zone.
Reussella szajnochae szajnochae occurs in flood proportion immediately below the Maastrichtian.
A number of species become extinct at the upper boundary of the foraminifera zone, including *Reussella szajnochae szajnochae, Neoflabellina rugosa, Gavelinella monterelensis, Globorotalites hiltermanni* and *Osangularia cordieriana*.

Subzones:

Age:
Latest Campanian, late *B. mucronata* zone (in the Paramoudra Chalk)

B.G.S. Zone 24 (=UKB20)

Base:
Inception of *Bolivinoides peterssoni.*

Top:
Inception of *Bolivinoides paleocenicus*.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Globotruncanella havanesis and *Rugoglobigerina milamensis* are consistently present for the first time from the base of the zone (although very rare specimens may occur immediately below it).
A number of species appear for the first time at or immediately above the base: *Bolivinoides decurrens, Bolivinoides australis, Gavelinella bembix, Osangularia navarroana* and *Neoflabellina reticulata*. *Pyramidina minuta* has its inception in the highest *B. mucronata* zone (although it is very rare) and becomes more numerous in the early Maastrichtian.
Eponides beisseli and *Valvulineria lenticularis* become extinct at the top of the zone.

Subzones:
24i. Concurrent range of *Bolivinoides peterssoni* and *B. decoratus* (in the 'Pre-Porosphaera Chalk'). *Hedbergella holmdelensis* apparently becomes extinct at the top of the Subzone.
24ii. From the extinction of *B. decoratus* to the top of the zone (in the 'Porosphaera Chalk').

Age:
Early *B. lanceolata* zone.

B.G.S. Zone 25 (=UKB21)

Base:
Inception of *Bolivinoides paleocenicus*.

Top:
Inception of *Bolivinoides draco draco* (not seen onshore, but present in the North Sea Basin).

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
The 'Sidestrand Sponge Bed' and the lower part of the Little Marl Point Chalk ('White Chalk' of Peake & Hancock,1961, 1970) contain *Angulogavelinella bettenstaedti* together with *B. paleocenicus*.
Pseudouvigerina rugosa and *Tappanina selmensis* appear in the upper part of the Little Marl Point Chalk ('lunata Beds' of Peake & Hancock,1961, 1970) and Beacon Hill Grey Chalk ('Grey Beds' of Peake & Hancock, 1961, 1970).
In the North Sea *Hedbergella monmouthensis* appears in the upper part of the foraminifera zone.

Subzones:

Age:
Early occidentalis zone.

B.G.S. Zone 26(= lower part of UKB22)

Base:
Inception of *Bolivinoides draco draco* (not seen onshore, but present in the North Sea Basin).

Top:
Inception of *Abomphalus mayaroensis* (not seen onshore, but present in the North Sea Basin).

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Abomphalus intermedia and *Rosita patelliformis* appear at or near the base of the foraminifera Zone.

Subzones:

Age:
Early *B. occidentalis* and (?) junior zones.

B.G.S. Zone 27 (=upper part of UKB22)

Base:
Inception of *Abomphalus mayaroensis* and *Pseudotextularia elegans* (not seen onshore, but present in the North Sea Basin).

Top:
Base of the Danian.

Range of index species:

Key fauna:

Faunal abundance & preservation:

Biomarkers:
Rugoglobigerina rotundata is also found.

Subzones:

Age:
Casimir. Zone

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