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**The biostratigraphical and palaeo-ecological application
of calcareous microfaunas from the Utsira Formation
in Norwegian Well 15/9-A-23
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Basin Analysis and Stratigraphy Group



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Central North Sea (Danish Sector)

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Foraminifera & Ostracoda

Miocene-Pliocene

Biostratigraphy/Palaeoecology

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**Biostratigraphical and palaeo-ecological application
of calcareous microfaunas from the Utsira Formation
in Norwegian Well 15/9-A-23**

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Introduction

A single sample (MPA48995) from a drilled depth of 1085-1086m in Norwegian Well 15/9-A-23 was submitted for biostratigraphical and palaeoenvironmental analysis.

Fauna list

A rich fauna of benthonic foraminifera was recovered from this sample, together with sparse planktonic foraminifera. Planktonic taxa such as Bolboforma (calcareous algae) and Radiolaria were not observed in the sample and ostracods were very rare. The following species of foraminifera were recorded (and arranged in the order of recovery).

Benthonic foraminifera

Uvigerina venusta saxonica,
Ammonia sp cf. *becarii*
Buccella tenerrima
Discorbitura cushamni
Elphidium groenlandicum
Cibicides lobatulum
Hoeglundina cf. *elegans*
Pullenia bulloides
Cibicides sp. cf. *C. grossa*
Siphotextularia sculpturata
Fissurina orbigny
Elphidium cf. *inflatum*
Melonis baarleeaanum
Cassidulina laevigata
Nonion cf. *crassesaturatum*
Nodosaria sp
Florilus boueanus

Lenticulina sp
Quinqueloculina cf. *seminulum*
Cassidulina reniforme
Bulimina cf. *elongata*
Bulimina aculeata
Cibicidoides sp

Planktonic foraminifera

Neogloboquadrina atlantica (sinistrally coiled)
Globigerina bulloides

Ostracoda

"*Falunia*" sp (juvenile)
Microcytherura broeckiana
Cytheretta sp. cf. *C. moosi* (worn)
Pterygocythereis continens of Wouters MS
Cushmanidea sp cf. *C. haskinsi*

Biostratigraphical conclusions

The presence of *Uvigerina venusta saxonica* places the fauna into North Sea foraminiferal zone NSB13b (*sensu* King, 1989). This zone straddles the Miocene/Pliocene boundary. In the Norwegian Sector it compares closely with the eponymous zone of Eidvin *et al* (in press). In addition, the inception of *Cassidulina laevigata* is at the base of the same zone and *Florilus*

boueanus indicates that the age of the assemblage is no younger than the early Pliocene. *Elphidium groenlandicum* is rare in the assemblage and is assumed to be close to its inception in the early Pliocene.

Turning to the planktonic species, the occurrence of sinistral *Neogloboquadrina atlantica* is a strong indicator of the latest Miocene and Pliocene according to Poore & Berggren (1975), Weaver & Clement (1986) and King (1989). According to Weaver & Clement the turnover from predominantly dextrally coiled to predominantly sinistrally coiled took place 6.15-7.24 Ma in DSDP holes 609, 610 and 611 in the North Atlantic. Its occurrence also suggests that the assemblage can be placed into King's (1989) planktonic foraminiferal subzone NSP15c, which he places at c.6.5 to 4 million year Ma.

Comparison with Norwegian Well 15/12-3 (Eidvin *et al.*, in press) the fauna can be placed into the *Globigerina bulloides* - *Neogloboquadrina atlantica* (sinistral) planktonic foram zone and the *Cibicidoides limbatusuturalis-Uvigerina venusta saxonica* benthonic foraminiferal zone. The concurrent range of these species is shown by those authors to be in the Lower Pliocene. In Borehole 2/4-C11 a similar situation is indicated.

The absence of *Bolboforma* in MPA48995 may indicate an age above the upper Miocene, at which point the group becomes particularly scarce (although they continue to be present into the early Pliocene in more oceanic regions (such as the Northern North Atlantic). The ostracods are very rare and there is no guarantee that they are *in situ*. They are late Miocene in aspect, but the early Pliocene is not ruled out.

There is some evidence of reworking, for example the specimens identified as *Elphidium inflatum* are of early and Mid Miocene age.

In summary the assemblage can be latest Miocene to early Pliocene in age and the Pliocene appears to be the best fit based on the species present.

Palaeoecological conclusions

Planktonic taxa

The absence of planktonic organisms such as *Bolboforma* and Radiolaria in sample MPA48995 suggests that the influence of open ocean waters is not great, as both are present in sediments of this age in the North Atlantic. This does not necessarily imply that water depths, in which the Utsira Formation accumulated, were not deep. In Recent samples from the North Sea, planktonic foraminifera are rare throughout much of the basin and it is only in the area of the Orkney and Shetland Islands that they become common. Planktonic foraminifera are less numerous than might be expected in deeper waters with marked oceanic influence, but they are what might be expected in deeper waters of a more enclosed basin.

Eidvin *et al.* (in press) show that both *Bolboforma* and Radiolaria are present in the lower part of the Utsira Formation. There seems to be a vertical change in the planktonic microfossil assemblages through the unit. As only a single sample was examined for this report, no comment can be made, but changes in environment may account for this.

Benthonic taxa

Benthonic taxa are somewhat mixed in terms of their preferred depth range. *Elphidium* and *Ammonia* are shallow water genera, being particularly common in waters less than about 50m deep, although they are sometimes found deeper. *Buccella* is generally found on the shelf, generally down to 100m. However, *Melonis barleeanum* is a species commonly found below about 30m depth in Recent environments, and is found on the the outer shelf and continental slope. *Pullenia* is another genus that is indicative of deeper water, at its shallowest it lives in areas of outer shelf, but it also occurs down to bathyal depths. *Uvigerina* often occurs in waters of more than about 100m depth, where it shows a preference muddy substrates and cooler waters. *Hoeglundina* can be found in outer shelf to bathyal depths, often in cold, muddy sediment. This mix of shallower and deeper taxa suggests reworking and movement of material from the shallower areas.

The fauna is almost entirely calcareous, agglutinating species being rare and confined to *Siphotextularia sculpturata*. In this respect it compares with the Sleipner area rather than the Ekofisk area as outlined by Eidvin *et al.* (in press). The implication is that the water was better aerated and circulation less restricted compared to Ekofisk.

The ostracods are shelf forms, in modern waters Pterygocythereis it is often found in depths of 30m or more. All forms are marine

In summary, there seems to be some indication of middle to outer shelf water depths at the time of deposition, but connection with oceanic conditions (at least at the time MPA48995 accumulated) was not great. Water temperatures were cool, salinities were fully marine and there were probably muds accumulating at the same time as the sands in parts of the Utsira Formation.

References

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