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# Foraminifera from cores from the Rockall area

Internal Report IR/02/002



BRITISH GEOLOGICAL SURVEY

INTERNAL REPORT IR/02/002

# Foraminifera from cores from the Rockall area

I.P. Wilkinson

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## Summary

Four boreholes were examined for foraminifera:

57-16/17 contained faunas no older than Late Miocene.

57-16/18 yielded Pleistocene to late Miocene foraminifera throughout, but species restricted to the late Miocene occur at some samples.

57-16/19 contained evidence for a position close to the Lower/Middle Miocene boundary, although most evidence places the borehole within the Mid Miocene.

58-12/9 yielded, low diversity, poorly preserved Quaternary faunas.

Water depths consistent with a slope environment were observed, although in some samples, the lower slope or even bathyal conditions are suggested. Borehole 58-12/9 contained foraminifera characteristic of the Transitional faunal Province, although there is an indication of a cooler phase passing up into a warmer phase.

# 1 Introduction

Nineteen samples (deposited in the BGS collections under MPA50620-50638) were analysed for foraminifera in order to provide biostratigraphical age determinations and palaeoecological conclusions. Sample details are set out in the attached appendix.

## 2 Foraminifera

### 2.1 BOREHOLE 57-16/17

Core 57-16/17, which penetrated muddy sands and sandy muds to a depth of 3.48m, was collected from the West Rockall Bank in 602m of water. Five samples were collected for foraminiferal analysis in order to provide palaeoenvironmental and biostratigraphical determinations.

The lowest sample analysed, from 2.40-2.42m, contained granitic and basaltic fragments. It was slightly shelly and echinoid spines were also observed. Of the benthonic foraminifera, *Cibicidoides kullenbergi/mundulus* (the two are probably synonymous) was common. Although a diverse association was seen, the remainder of the species were rare or very rare. Agglutinated taxa (e.g. *Bigenerina cylindrica* and *Textularia* sp.) were rare. The planktonic element was dominated by two species, abundant *Globigerina bulloides* (although some of these may be the Miocene species *G. praebulloides*) and frequent *Globorotalia* cf *continiosa* and very rare *Globigerina ciperoensis*. Two species of *Orbulina* were present, although very rare- *Orbulina universa* and *Orbulina suturalis*.

A similar association was recovered from a depth of 2.01-2.03m in a shelly sand with small quartz, schist and basalt fragments). Foraminifera were common, the fauna being dominated by *Gyroidinoides* sp, although benthonic species were generally rare. *Paromalina crassa*, *Cibicidoides kullenbergi/mundulus* and *Cibicidoides* sp occurred in rare proportions, but the remainder were very rare. Of the planktonic element, *Globigerina bulloides* was again abundant and *Globorotalia* cf *continiosa* was common, but the remaining species were rare (*Orbulina universa*, *Globigerina quinquiloba* and *Neogloboquadrina pachyderma*) or very rare (*Globorotalia crassaformis*). *N. acostaensis* are more characteristic of colder waters and *G. crassaformis* is unusual north of the Transitional Zone.

Although present in small numbers in the lower two samples, *Paromalina crassa* becomes abundant in the shell sample from 1.38-1.40m and *Rectoglandulina* is frequent. Other species include *Sigmoilopsis schlumbergeri*, *Melonis barleeianum* and *Oridorsalis umbonatus*, although in very small numbers. *Globigerina bulloides* and *Globorotalia* cf *continiosa* continue to dominate the planktonic element, but sinistral *Neogloboquadrina acostaensis* becomes frequent at this level and very rare *Globorotalia crassaformis* and *Orbulina universa* are also present.

There is a slight change in the fauna at 0.94-0.98m where common *P crassa* is joined by frequent *Planularia ariminensis* and *Cibicides refulgens*. However, the number of large, robust specimens is noticeably reduced in the sample, compared to that at 1.38-1.48m, and diversity is also reduced. The presence of very rare *Pullenia bulloides*, *Bulimina marginata* and *Cibicidoides kullenbergi/mundulus* are worth noting. *Neogloboquadrina acostaensis* are both present in rare proportions, *Orbulina universa* fragments were noted and *G. bulloides* is again abundant.

The highest sample examined, from 0.51-0.53m was shelly and foraminifera were very abundant and diverse. The benthonic element is dominated by *Paromalina crassa*, but *Cibicidoides* sp, *Cibicidoides kullenbergi/mundulus* and *Oridorsalis umbonatus* are frequent. *Uvigerina venusta saxonica* and *Epistominella exigua*, *Trifarina angulosa*, *Karreriella novangliae* and *Sigmoilopsis schlumbergeri* also occur in small numbers.

In conclusion, the presence of *Orbulina universa* throughout the borehole (and very rare *O. suturalis*) indicates an age no older than the mid Miocene, at which horizon its inception forms an important datum. Very rare specimens of *Globigerina ciperoensis* are probably reworked from the Oligocene/early Miocene. At several horizons, *Neogloboquadrina acostaensis* was recorded suggesting a *late Miocene to early Pliocene* age.

The benthonic species, are characterised by *Paromalina crassa*, *Oridorsalis umbonatus*, *Planularia ariminensis*, *Epistominella exigua* are deep water forms and found on the slope off Europe today. Although extant today, *Planularia ariminensis* first appeared in the mid Miocene (N16) and is particularly found in water depths between about 300 and 500m although it has been recorded down to c.800m. The Miocene age is confirmed by the presence of rare *Uvigerina venusta saxonica*, which is apparently confined to the Late Miocene, although it has been found in the early Pliocene (reworked?) in the North Sea.

## 2.2 BOREHOLE 57-16/18

The fauna recovered from borehole 57-16/18 is essentially similar to that of borehole 57-16-17. The borehole penetrated 2.71m muddy sands, silty muds and highly calcareous muds. Five samples were examined.

The stratigraphically lowest sample from 2.36-2.38m depth, which was very shelly, contained abundant *Paromalina crassa* and frequent *Cibicides refulgens*. Very rare *Uvigerina venusta* cf *saxonica*, *Trifarina angulosa*, *Cibicides lobatulus*, *Cibicidoides kullenbergi/mundulus*, *Pyrgo murrhina* and *Sigmoilopsis schlumbergeri*. Common *Globorotalia* cf *continua* and *Neogloboquadrina acostaensis* together with frequent *Globigerina bulloides/praebulloides* dominate the planktonic element. However, *Orbulina universa* and *Globorotalia scitulus* are also present.

At 1.53-1.55m was similar to that from 2.36-2.38, although diversity was reduced. *Paromalina crassa* dominated, *Cibicides refulgens* was common, and rare or very rare specimens of *Pyrgo murrhina*, *Melonis barleeanum*, *Pullenia bulloides*, *Sigmoilopsis schlumbergeri* and *Planulina araminensis* also occurred. Of the planktonic foraminifera, *Globigerina bulloides* and *Globorotalia continua* are common and *Orbulina universa* and *Neogloboquadrina acostaensis* are rare. The assemblage at 1.01-1.03m is essentially similar to that at 1.53-1.55m.

At 0.65-0.67m the benthos is diverse, dominated by *Paromalina crassa*, but the remaining species were generally rare or very rare. *Oridorsalis umbonatus*, *Bulimina marginata* and *Trifarina angulosa* were amongst these. *Rupertina stabilis*, a species which ranges from the Miocene to Recent, also occurred in small numbers. The latter species is a deep water form characteristic of the lower slope and water depths in excess of 2000m although in the cold waters of the Faroe Channel (North Atlantic) it has been found in waters of about 1100m depth. It was used by Murray (1979) to indicate deep waters for the Pleistocene west of the Rockall Bank. The planktonic element of the fauna is identical to that described above.

The highest sample examined, from a depth of 0.31-0.33m, contained abundant *Paromalina crassa*, common *Cibicides refulgens* and frequent *Uvigerina venusta saxonica* and *Cibicidoides kullenbergi/mundulus*. Other species include rare or very rare *Quinqueloculina*

'seminulum', *Rupertina stabilis*, *Oridorsalis umbonatus*, *Sigmoilina schlumbergeri* and *Epistominella exigua*. The planktonic element is as described above.

It may be concluded that the age of the sequence within the borehole is within the upper part of the Miocene. *Orbulina universa*, which is found rarely throughout the borehole indicates the age is no older than mid Miocene (N9) and the presence of *N. acostaensis* implies an age no older than the late Miocene (N16-17). At times, the water depths appear to have been much deeper than those for borehole 57-16/17, for the presence of *Rupertina* suggests depths of at least 1100m and perhaps more.

### 2.3 BOREHOLE 57-16/19

This borehole penetrated 3.07m of pale calcareous mud, from which four samples were examined for foraminifera.

The lowest sample, from a depth of 2.98-3.0 was found to be extremely shelly including echinoid plates and frequent bryozoa. The benthonic foraminiferal association was dominated by abundant *Planularia ariminensis*, common *Cibicidoides kullenbergi*, and frequent *Uvigerina semiornata*, *Lenticulina* spp and *Cibicidoides dutemplei*. Planktonic species were found rarely in the sample, with the exception of *Globigerina bulloides/praebulloides* (these two species are difficult to separate at the latitude of the boreholes), which is more frequent. The absence of *Orbulina universa* is possibly significant here, for that form appears in N9, in the lowest Middle Miocene. Unlike the other boreholes discussed above, the foraminifera community is dominated by the benthos.

At 2.52-2.54m, bryozoa are abundant. Foraminifera are less numerous and less diverse, although frequent *Cibicidoides kullenbergi*, *Cibicidoides dutemplei* and *Fontbotia wuellerstorfi* were present. The last named species is characteristic of cold, bathyal conditions and first appeared at the base of the Middle Miocene (in N9). Planktonic species were very rare. A similar fauna was recorded from 1.70-1.72m.

The sample from 1.27-1.29m again contained abundant bryozoa. *Epistominella exigua* and *Fontbotia wuellerstorfi* are frequent, but this species also contained rare *Siphonina tenuicarinata*, a species that ranges through from the Eocene to the early Miocene and has also been reported from the earliest Mid-Miocene (N9). Planktonic species are again rare, but include rare *Globigerina bulloides/praebulloides*.

The shelly sample from 0.67-0.69m was again rich in bryozoa and echinoid spines were also present. *Cibicidoides kullenbergi* and *C. dutemplei* are frequent and *Fontbotia wuellerstorfi* is common. A single specimen of *Marginulina* sp cf *M. wetherelli* (an early Tertiary species) also occurred in the sample.

The overlying sample (from 0.17-0.19m) was essentially similar, but significantly very rare *Orbulina universa* was present. This is the only record of the species in the borehole, but indicates an age no older than N9.

In conclusion, this borehole appears to be very close to the Early/Middle Miocene boundary. The lower sample is Lower to Middle Miocene in age, but the sample at 2.52-2.54m is considered to be of Mid Miocene age on the basis of the occurrence of species such as *Fontbotia wuellerstorfi*. *Orbulina universa*, the diagnostic species marking N9, is not present until the highest sample examined at 0.17-0.19m. Water depths were deep, Murray (1991) places his *wuellerstorfi* association at 1360-4280m in the cold parts of the Atlantic Ocean, where it is associated with the North Atlantic Deep Water mass.

## 2.4 BOREHOLE 58-12/9

Three samples were taken from this borehole, but all yielded only low diversity faunas of a generally poor preservation.

The lowest sample from 3.28-3.30m contained rare *Globorotalia inflata* and very rare *Neogloboquadrina pachyderma* (sinistrally coiled). The latter is a cold water Quaternary species, however conclusions cannot be drawn from this poor fauna.

Diversity was improved in the sample from 0.51-0.53m depth. Planktonic species dominated with frequent *Globorotalia crassaformis* and *Globigerina bulloides* together with rare *Orbulina universa* and *Globorotalia inflata*. This fauna places the borehole within the Transitional Fauna Province (sensu Bé, 1977) with temperatures between 10 and 18°C. However, the presence of frequent sinistrally coiled *Neogloboquadrina pachyderma* and only rare dextrally coiled forms, places the assemblage into the cooler part of the province. The sinistral form is more characteristic of waters cooler than the 7.2°C Spring isotherm. Benthonic species are rare, but include *Sigmoilina schlumbergeri*, *Pullenia quinqueloba* and *Fontbotia wuellerstorfi* and the association is indicative of bathyal waters with temperatures up to about 4°C and probably associated with the NADW.

The sample at 0.06-0.08 was extremely small and dominated by planktonic foraminifera, including frequent dextrally *Neogloboquadrina pachyderma*, *Globigerina bulloides* and *Globorotalia inflata*, very rare *Orbulina universa* and common indeterminate planktonic fragments. This places the site within the Transitional foraminiferal Province and unlike the previously described association, the frequent dextrally coiled *N. pachyderma* places it in the warmer part of the province.

## 3 References

- BÉ, A.W.H. 1977. An ecological, zoogeographic and taxonomic review of Recent Planktonic foraminifera. In: Ramsey, A.T.S. (ed.) *Oceanic Micropalaeontology, Volume 1*, 1-100 [Academic Press, London]
- MURRAY, J.W. 1979. Cenozoic Biostratigraphy and paleoecology of sites 403 to 406 based on foraminifers. Initial Report of the DSDP, 48, 415-430.
- MURRAY, J.W. 1991. *Ecology and palaeoecology of benthic foraminifera*. 397pp. [Longman Scientific & Technical]

# Appendix

## BGS Registration

| Number (MPA) | Borehole | Depth (m) |
|--------------|----------|-----------|
| 50620        | 56-16/17 | 0.51-0.53 |
| 50621        |          | 0.94-0.96 |
| 50622        |          | 1.38-1.40 |
| 50623        |          | 2.40-2.42 |
| 50624        | 57-16/18 | 2.01-2.03 |
| 50625        |          | 0.31-0.33 |
| 50626        |          | 0.65-0.67 |
| 50627        |          | 1.01-1.03 |
| 50628        | 57-16/19 | 1.53-1.55 |
| 50629        |          | 2.36-2.38 |
| 50630        |          | 0.17-0.19 |
| 50631        |          | 0.67-0.69 |
| 50632        | 58-12/9  | 1.17-1.29 |
| 50633        |          | 1.70-1.72 |
| 50634        |          | 2.52-2.54 |
| 50635        |          | 2.98-3.00 |
| 50636        | 58-12/9  | 0.06-0.08 |
| 50637        |          | 0.51-0.53 |
| 50638        |          | 3.28-3.30 |