

A remarkable foraminiferal assemblage from the Quaternary of northeast Greenland

ROLF W. FEYLING-HANSSSEN



Feyling-Hanssen, R. W.: A remarkable foraminiferal assemblage from the Quaternary of northeast Greenland. *Bull. geol. Soc. Denmark*, vol. 38, pp. 101–107. Copenhagen, April 25th, 1990. <https://doi.org/10.37570/bgsd-1990-38-10>

A fossil foraminiferal assemblage with abundant *Islandiella inflata* (Gudina) from the Ymer Formation in northeasternmost Greenland is described and compared with similar occurrences in Siberia and in Baffin Island. Some of these occurrences seem to be of Holsteinian (Yarmouthian) age.

R. W. Feyling-Hanssen, Geological Institute, University of Aarhus, DK-8000. October 10th, 1989.

Near Nordostrundingen in northeasternmost Greenland, at a locality called Kilen, at 81°10' north latitude (Fig. 1), C. Hjort of Lund University, Sweden, investigated sedimentary outcrops, and established the Ymer Formation. This is a 6–10 m thick sequence, with a rich fossil content of foraminifera, molluscs and cirripeds, reflecting interglacial climatic conditions. Absolute age determination by radiocarbon gave a minimum of 40,300 years before present, Uranium/Thorium gave 103,000 years B.P., thermoluminescence method gave 190,000–220,000 B.P., and amino-acid-derived estimates were 220,000–270,000 B.P. The Ymer Formation is, therefore, probably of Holsteinian (Yarmouthian) age (Hjort, 1981; Hjort and Feyling-Hanssen, 1987).

Two sediment samples from the Ymer Formation, collected by Hjort, were investigated for their content of fossil foraminifera. The faunas were briefly dealt with in a paper by Hjort and Feyling-Hanssen (1987), but the remarkably abundant occurrence of the species *Islandiella inflata* (Gudina) justifies a closer account of the matter. *Islandiella inflata* – in abundance – may well turn out to be an Upper Mid-Pleistocene marker in the Arctic.

One of the samples, CHT 8, was taken 7 m above present-day sea level from stratified sand with many dropstones, the other, CHT 13, at 8 m a.s.l. from horizontally stratified, well sorted medium sand.

Both samples contained fossil benthonic foraminifera, 1,900 specimens/100 g sediment in sam-

ple CHT 8, 2,400/100 g in sample CHT 13. Preservation was mainly poor, a number of specimens had later chambers broken off and most had corroded test surfaces, particularly those from sample CHT 13. Acidic ground-water percolating through the sandy sediments may have affected the calcium carbonate tests of the foraminifera. In this respect it is interesting to note that many coal and lignite particles occurred in the samples, particularly CHT 13. However, identification of the specimens was not impeded by this corrosion (cf. Plates 1–3).

The assemblages are both of Quaternary age, but differ in composition. This was most probably caused by difference in water depth during deposition, rather than by any considerable difference in age.

The *Islandiella inflata* assemblage of sample CHT 8

The sample was processed and examined in the standardized way (Feyling-Hanssen, 1983). The results of the analysis are presented in Table 1.

The characteristic feature of this sample is the high frequency of the conspicuous and quite large species *Islandiella inflata* (Gudina), which accounts for 32% of the counted fauna. Three specimens of this species from sample CHT 8 are illustrated on plate 1, figs 8–14. Figs 8–10 show three views of a megalospheric specimen, 11–14



Fig. 1. Some of the localities mentioned in the text.

illustrate two microspheric specimens. The figured specimens have quite an acute peripheral margin. However, most of the specimens had a more bluntly angled, almost rounded periphery as illustrated by Gudina (1966, pl. 6, figs 4–6).

Because of the many specimens of *Islandiella inflata* in sample CHT 8 the assemblage is here called the *Islandiella inflata* assemblage, even though another species, *Nonion orbiculare* (Brady) is the dominant one, amounting to 35% of the fauna.

The fauna reflects arctic but somewhat ameliorated conditions; probably milder than at present under these high latitudes. Gudina (1966, p. 21) considers *Islandiella inflata* as an indicator of boreo-arctic conditions, and the faunal diversity (Walton, 1964) of the assemblage is as high as 13, with 25 different foraminiferal species present in the sample. These are high values for an area at 81°N latitude. For comparison, four Recent assemblages from northern East Greenland, collected by the present author at depths between 10 m and 30 m, contained 4, 15, 16 and 24 different species. As the present-day conditions in the area are of an interglacial character, it is highly probable that the CHT 8 assemblage also represents an interglacial.

An age estimate of this *Islandiella inflata* assemblage is attempted below:

Gudina (1966) described *Islandiella inflata* from Quaternary deposits of Northwest Siberia where it occurred in "Obskij sloi" which was considered as Holsteinian in age. It was also reported – albeit very rarely – in "Salemalskie sloi" of Saale age. In 1969 Gudina again found *I. inflata* in "Turukhanskij sloi" – also considered Holsteinian in age – in the northern Yenisey lowland, and in the same paper she also recorded

it as abundant in "Kazantsevie sloi" which is considered Eemian in age. In Gudina's comprehensive paper of 1976 it is reported as common both in Eemian and Holsteinian deposits of the northern U.S.S.R.

In Baffin Island, Arctic Canada, fossil foraminiferal assemblages with many (up to 19%) *Islandiella inflata* were found in the *Cassidulina teretis* zone (Upper Pliocene/Lowermost Pleistocene) and in the *Islandiella islandica* zone (Pleistocene) of Clyde Foreland (Feyling-Hanssen, 1976a) and in zone G (Upper Pliocene/Lowermost Pleistocene) and zones F and D (Pleistocene) of the Qivituq Peninsula (Feyling-Hanssen, 1980a). At Qivituq (Fig. 6 in Feyling-Hanssen, 1980a) *Islandiella inflata* is quite frequent – together with *Cassidulina teretis* Tappan – in zone G, is less frequent in the climatically severe zone F, avoids the distinctly ameliorated zone E, and reappears – but at low numbers – in the less ameliorated zone D. Zones E and D reflect an interglacial within the Pleistocene of unknown age. But Ee-

Table 1, the *Islandiella inflata* assemblage. Sample CHT 8, unit C, weight 100 g.

Species	Percentage
<i>Nonion orbiculare</i> (Brady)	35
<i>Islandiella inflata</i> (Gudina)	32
<i>Elphidium hallandense</i> Brotzen	5
<i>Buccella frigida</i> (Cushman)	4
<i>Elphidium excavatum</i> (Terquem)	4
<i>Cassidulina reniforme</i> Nørvang	3
<i>Elphidium asklundi</i> Brotzen	3
<i>Cassidulina teretis</i> Tappan	2
<i>Cibicides lobatulus</i> (Walker and Jacob)	2
<i>Islandiella helenae</i> Feyling-Hanssen and Buzas	2
<i>Buccella tenerrima</i> Bandy	1
<i>Glabratella wrightii</i> (Brady)	1
<i>Islandiella islandica</i> (Nørvang)	1
<i>Nonionella auricula</i> Heron-Allen and Earland	1
<i>Elphidium albumbilicatum</i> (Weiss)	<1
<i>Elphidium frigidum</i> Cushman	<1
<i>Elphidiella arctica</i> (Parker and Jones)	<1
<i>Epistominella vitrea</i> Parker	<1
<i>Fissurina laevigata</i> Reuss	<1
<i>Guttulina glacialis</i> (Cushman and Ozawa)	<1
<i>Islandiella norcrossi</i> (Cushman)	<1
<i>Nonion barleeianum</i> (Williamson)	<1
<i>Nonion niveum</i> Lafrenz	<1
<i>Oolina borealis</i> Loeblich and Tappan	<1

Counted 474 benthonic specimens = 1/4 of the sample.

Quinqueloculina longa Gudina was observed in the uncounted part of the sample.

Number of benthonic species: 25.

Number of specimens/100 g sediment: 1,900.

Faunal dominance: 35, Faunal diversity: 13.

Shallow water specimens: 45%.

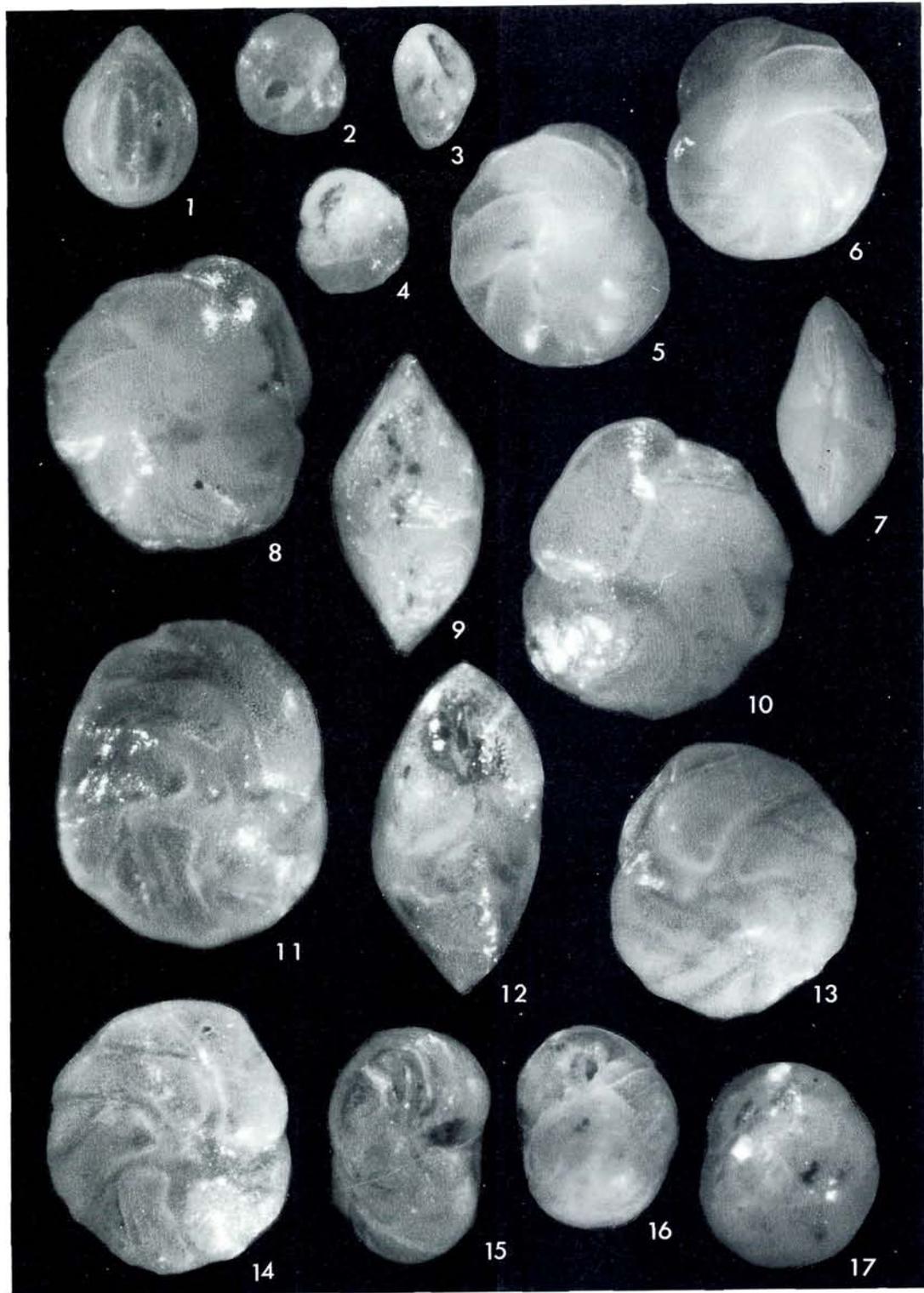


Plate 1 (All $\times 75$).

Fig. 1. *Oolina borealis* Loeblich and Tappan. Specimen from sample CHT 8.

Figs 2-4. *Cassidulina reniforme* Nørvang. 2 and 4, opposite sides; 3, edge view of a specimen from sample CHT 8.

Figs 5-7. *Cassidulina teretis* Tappan. 5, side view showing narrow apertural lip paralleling the periphery; 6, the opposite side and 7, edge view of a specimen from sample CHT 8.

Figs 8-14. *Islandiella inflata* (Gudina). 8, side view; 9, edge view; 10, other side of a specimen from sample CHT 8. 11, side view of another specimen from sample CHT 8 showing characteristically clavate chambers; 12, edge view of the same specimen showing broad aperture and free apertural tongue. 13 and 14, opposite sides of a third specimen from sample CHT 8.

Figs 15-17. *Islandiella islandica* (Nørvang). 15, edge view, showing broad aperture and apertural tongue of a specimen from sample CHT 8. 16 and 17, edge and side view of another specimen from the same sample.

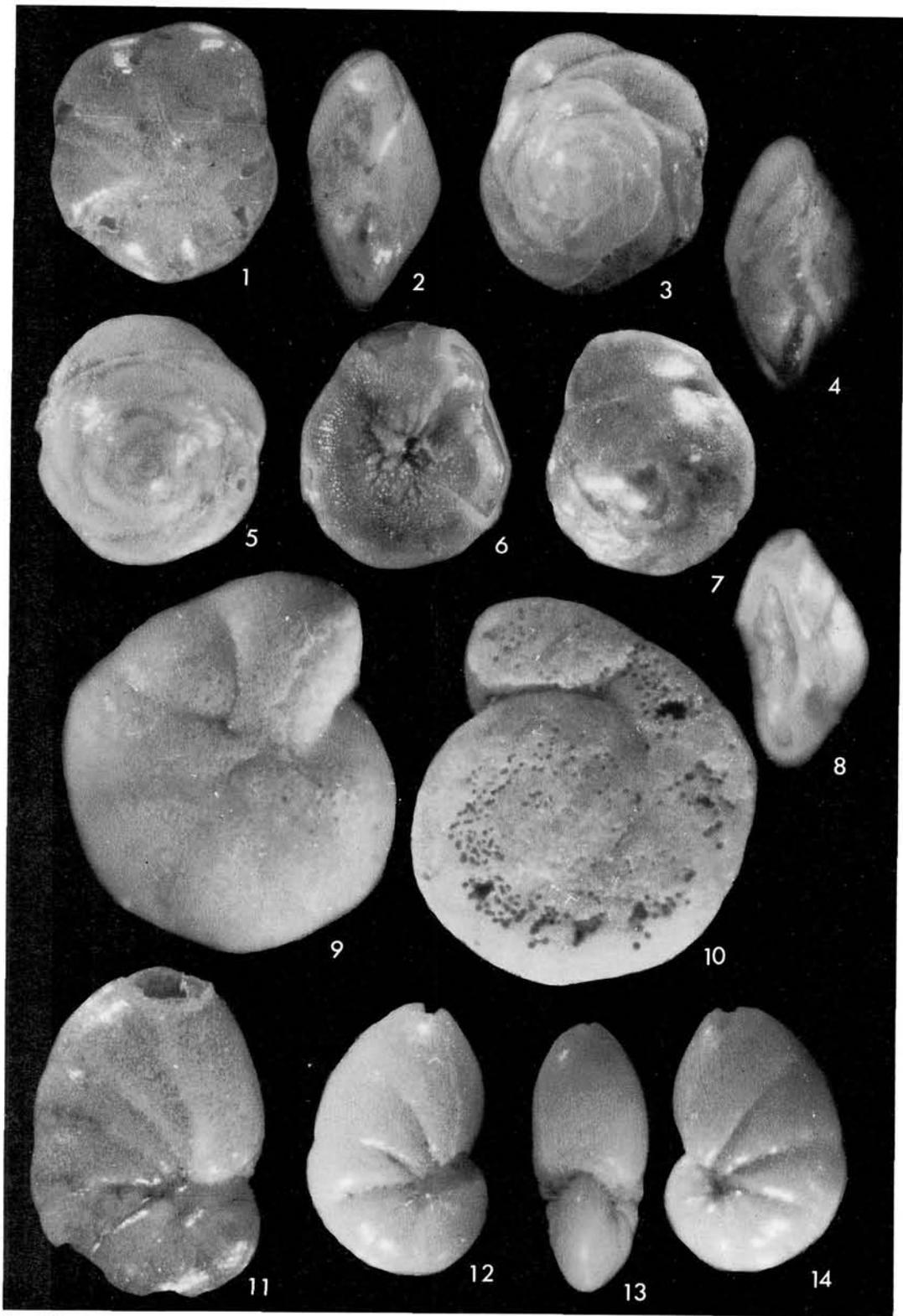


Plate 2 (All $\times 75$).

Figs 1-3. *Buccella frigida* (Cushman). 1, umbilical side; 2, edge view; 3, spiral side of a specimen from sample CHT 8.

Figs 4-5. *Buccella tenerrima* (Bandy). 4, edge view; 5, spiral side of a specimen from sample CHT 8.

Figs 6-8. *Glabratella wrightii* (Brady). 6, umbilical view; 7, spiral side; 8, edge view of a specimen from sample CHT 13.

Figs 9-10. *Cibicides lobatulus* (Walker and Jacob). 9, umbilical side; 10, the flat spiral side of a specimen from sample CHT 13.

Figs 11-14. *Nontionella auricula* Heron-Allen and Earland. 11, spiral side of a specimen from sample CHT 8. 12, spiral side; 13, apertural view; 14, umbilical side of another specimen from sample CHT 8.



Plate 3 (All $\times 75$).

Figs 1-4. *Nonion orbiculare* (Brady). 1, edge view; 2, side view of a specimen from sample CHT 8; 3, side view; 4, edge view of another specimen from sample CHT 8.

Figs 5-6. *Elphidium albumbilicatum* (Weiss). 5, edge view showing foramen of the penultimate septum; 6, side view showing tapering sutural fields of a specimen from sample CHT 13.

Figs 7-8. *Elphidium asklundi* Brotzen. 7, side view; 8, edge of a worn specimen from sample CHT 13.

Figs 9-11. *Elphidium excavatum* (Terquem). 9, side view of a specimen from sample CHT 8. 10, side view and 11, edge view of another specimen from the same sample.

Figs 12-15. *Elphidium hallandense* Brotzen (= *Elphidium subarcticum* Cushman). 12 and 13, side and edge view of a specimen from sample CHT 13. 14, side view and 15, edge view of a specimen from sample CHT 8.

Table 2, the *Elphidium hallandense* assemblage.
Sample CHT 13, unit D, weight 100 g.

Species	Percentage
<i>Elphidium hallandense</i> Brotzen	45
<i>Nonion orbiculare</i> (Brady)	30
<i>Elphidium albiumbilicatum</i> (Weiss)	14
<i>Buccella frigida</i> (Cushman)	5
<i>Elphidium asklundi</i> Brotzen	2
<i>Glabratella wrightii</i> (Brady)	2
<i>Elphidium frigidum</i> Cushman	1
<i>Elphidium incertum</i> Cushman	1
<i>Islandiella inflata</i> (Gudina)	1
<i>Cassidulina reniforme</i> Nørvang	<1
<i>Cibicides lobatulus</i> (Walker and Jacob)	<1
<i>Elphidiella arctica</i> (Parker and Jones)	<1
<i>Islandiella islandica</i> (Nørvang)	<1

Counted 332 specimens = 5/36 of the sample.

Guttulina glacialis (Cushman and Ozawa) and one reworked *Cibicides grossa* Ten Dam and Reinold occurred in the uncounted part.

Number of benthonic species: 14.

Number of specimens/100 g sediment: 2,400.

Faunal dominance: 45, Faunal diversity: 5.

Shallow water specimens: 92%.

mian has been suggested (Feyling-Hanssen and Ulleberg, 1984). *Islandiella inflata* is absent in the youngest part of the sequence at Qivituq. At Pigojoat also on the northeast coast of Baffin Island (Feyling-Hanssen, 1980b; 1985) *I. inflata* accounted for 3% of an assemblage probably correlatable with zone D of Qivituq. The closest correlation is found between the present assemblage of sample CHT 8, and an assemblage from a sample (08087601) collected 12 m above sea level in the settlement of Broughton Village, south of Qivituq Peninsula, Baffin Island. *Islandiella inflata* comprised 21% of that assemblage, and was the dominant species (cf. Feyling-Hanssen, 1985, p.382 and 384). Again, that assemblage shows affinity to assemblages from Cape Broughton, on the northern tip of the island (Sample nos 11087404 and 11087405, Feyling-Hanssen 1976b, p. 165). The Cape Broughton deposits were originally (Feyling-Hanssen, 1976b) thought to be of Mid Wisconsin (Mid-Weichsel) interstadial age, but later (Feyling-Hanssen, 1980a, 1985) considered as Pre Wisconsin in age. They were dated by radiocarbon at >40,000 B.P. and later Miller (1985, p. 420) published an amino-acid-derived age of 210,000 years for the Cape Broughton deposits.

Foraminiferal species similar to *Islandiella inflata*, e.g. *Islandiella limbata* (Cushman and

Hughes), have been described from the Pliocene and Lower Pleistocene of California (e.g. Galloway and Wissler, 1927), from Plio/Pleistocene deposits of Amchitka Island, Alaska (Cushman and Todd, 1947) and from Miocene and Pliocene of Sakhalin (Voloshinova, Kusnetsova, Leonjenko, 1970). On the other hand, *I. inflata* has been recorded from Holocene deposits of the western Barents Sea (Lorange, 1977; Østby and Nagy, 1982).

The *Islandiella inflata* assemblage (sample CHT 8) of the Ymer Formation could, therefore, be anything in age from Upper Pliocene to Upper Pleistocene. However, the co-occurrence of *I. inflata* with a few *Cassidulina teretis* in this assemblage may preclude an uppermost Pleistocene age, whereas the absence of characteristic Lower Pleistocene shallow water species such as *Elphidiella hannai* Cushman and Grant and *E. rolfii* Gudina and Palovova from the zone precludes a Lower Pleistocene age (cf. Feyling-Hanssen, 1986). The deposit belongs to an interglacial, and on the basis of its foraminifera and independent dating results a Holsteinian age is suggested rather than an Eemian.

The assemblage of sample CHT 13

The results are presented in Table 2.

Islandiella inflata is also present in this assemblage, albeit in low numbers (1%). The dominant species is *Elphidium hallandense* Brotzen (= *E. subarcticum* Cushman) (45%) followed by *Nonion orbiculare* (30%) and *Elphidium albiumbilicatum* (Weiss) (14%). They are all shallow water species. *E. hallandense* is arctic in habitat, *N. orbiculare* also occurs in less severe environments, whereas *E. albiumbilicatum* seems to be boreo-arctic. The latter also indicates reduced salinity for instance as might be caused by an influx of glacial meltwater, which could easily have affected the benthos at such shallow waters as are indicated by this assemblage. Pronounced shallow-water specimens account for 92% of the fauna, and the waterdepth during its deposition might have been 10 m or less.

The age of this unit is most probably approximately the same as for the *Islandiella inflata* assemblage.

Acknowledgements – I want to thank W. Austin who critically read the manuscript of this paper, and corrected the English of the text, S. Aa. Meldgaard who processed the samples and made the photographs for the plates, and L. Ø. Mogensen who arranged and typed the manuscript.

References

- Cushman, J. A. and Todd, R. 1947: A foraminiferal fauna from Amchitka Island, Alaska. *Contributions from the Cushman Laboratory for Foraminiferal Research*, 23, pt 3, 60–72.
- Feyling-Hanssen, R. W. 1976a: The Clyde Foreland Formation, a micropaleontological study of Quaternary stratigraphy. 1st. Int. Symp. on Benthonic Foraminifera of Continental Margins, Pt.b: Paleoecology and Biostratigraphy. *Maritime Sediments*, Spec. Pub. 1, 315–377.
- Feyling-Hanssen, R. W. 1976b: A Mid-Wisconsinian interstadial on Broughton Island, Arctic Canada, and its foraminifera. *Arctic and Alpine Res.* 8, 2, 161–182.
- Feyling-Hanssen, R. W. 1980a: Microbiostratigraphy of young Cenozoic marine deposits of the Qivituq Peninsula, Baffin Island. *Marine Micropaleontology* 5, 153–184.
- Feyling-Hanssen, R. W. 1980b: An assemblage of Pleistocene foraminifera from Pigojoat, Baffin Island. *Jour. Forum. Res.* 10, 266–285.
- Feyling-Hanssen, R. W. 1983: Quantitative methods in micropaleontology. In Costa, L. I. (ed.): *Palynology-Micropaleontology: Laboratories, Equipment and Methods*, 109–128. *NPD-Bulletin* 2, Oljedirektoratet, Stavanger.
- Feyling-Hanssen, R. W. 1985: Late Cenozoic marine deposits of East Baffin Island and East Greenland, microbiostratigraphy-correlation-age. In J. T. Andrews (ed.): *Quaternary Environments: Eastern Canadian Arctic, Baffin Bay, and West Greenland*. Allen and Unwin, 354–393.
- Feyling-Hanssen, R. W. 1986: Grænsen mellem Tertiær og Kvartær i Nordsøen og i Arktis, fastlagt og korreleret ved hjælp af benthoniske foraminiferer. *Dansk geologisk Forening, Årsskrift for 1985*, 19–33.
- Feyling-Hanssen, R. W. and Ulleberg, K. 1984: A Tertiary-Quaternary section at Sarsbukta, Spitsbergen, Svalbard, and its foraminifera. *Polar Research* 2 n.s., 77–106.
- Galloway, J. J. and Wissler, S. G. 1927: Pleistocene Foraminifera from the Lomita Quarry, Palos Verdes Hills, California. *Journ. Paleontology* 1, 35–87.
- Gudina, V. I. 1966: Foraminifera and stratigraphy of the Northwest Siberian Quaternary. *Akad. Nauk SSSR, Siberian dept., Inst. Geol. and Geoph.* U.D.K.563.12 (119) (571.1). 132 pp.
- Gudina, V. I. 1969: The marine Pleistocene of Siberian lowlands. Foraminifera of the north part of Yenisei's lowlands. *Acad. nauk SSSR, Siberian dept. Institute of Geology and Geophysics* 63, 1–80.
- Gudina, V. I. 1976: Foraminifera, stratigraphy, and paleogeography of the marine Pleistocene of the northern U.S.S.R. *Akad. Nauk SSSR, Siberian Branch, Trud. Inst. Geol. Geoph.* 314, 126 pp.
- Hjort, C. 1981: Quaternary geology in northeasternmost Greenland, 114–115 in: Schytt, V. Boström, K. and Hjort, C.: *Geoscience during the Ymer-80 expedition to the Arctic. Geol. Fören. Stockholm Förh.* 103, 109–119.
- Hjort, C. and Feyling-Hanssen, R. W. 1987: The Ymer-Formation – an interglacial sequence in northeasternmost Greenland. *Polar Research* 5 n.s., 347–350.
- Lorange, K. 1977: *En mikropaleontologisk-stratigrafisk undersøkelse av kvartære sedimenter i nordvestre del av Barentshavet*. Thesis, Geological Institute, University of Oslo, 1–237.
- Miller, G. H. 1985: Aminostratigraphy of Baffin Island shell-bearing deposits. In J. T. Andrews (ed.): *Quaternary Environments: Eastern Canadian Arctic, Baffin Bay and Western Greenland*. Allen and Unwin, 394–427B.
- Voloshinova, N. A., Kusnetsova, V. N., Leonjenko, L. S. 1970: Foraminifera in the Neogene of Sakhalin. *"Nedra", Leningrad* 284, 1–303.
- Walton, W. R. 1964: Recent foraminiferal ecology and paleoecology, 151–237 in Imbrie, J. and Newell, N. D. (eds.): *Approaches to Paleoecology*. Wiley and Sons, New York.
- Østby, K. L. and Nagy, J. 1982: Foraminiferal distribution in the western Barents Sea, Recent and Quaternary. *Polar Research* 1, 53–95.