

Appendix

C-14 dating of samples collected during the NORDQUA 86 expedition, and notes on the marine reservoir effect

compiled by Nils-Axel Mörner and Svend Funder

Radiocarbon age determinations of samples of bivalve shells (23) and organic detritus (4), collected by members of the NORDQUA expedition, are summarised below.

The ages were determined by conventional dating at Laboratoriet för isotopgeologi at Naturhistoriska Riksmuseet, Stockholm (samples marked St-), and at the C-14 Dating Laboratory of the Geological Survey of Denmark and the National Museum, Copenhagen (samples marked K-, by courtesy of the Geological Survey of Denmark). One sample has been determined by accelerator mass spectrometry (AMS) at the Physics Institute, Århus University (sample marked AAR, by courtesy of Mette Skovhus Thomsen). The conventional dates were corrected for isotopic fractionation according to measured values for C-13, while the AMS date was corrected for the standard isotopic fractionation in marine carbonates (0 ‰ PDB).

The results are reported according to the recommendations of Stuiver & Polach (1977), and include conventional and reservoir corrected ages (Rcorr). However, while the conventional ages from the laboratories in Stockholm and Århus are normalised to the standard activity in wood (-25 ‰ PDB C-13), those from Copenhagen are normalised to 0 ‰ PDB, and have a built-in 400 yr marine reservoir correction (see notes on determination of reservoir effect below).

While the laboratory in Stockholm calculates infinite ages as sample activity +1 σ , the laboratory in Copenhagen uses sample activity +2 σ , and therefore gives lower minimum ages.

Marine reservoir effect in the Thule area (Rcorr)

Three samples of contemporary shells from northern West Greenland have been C-14 dated by H. Tauber. The samples were supplied by the Zoological Museum in Copenhagen through the kind help of G. Høpner Petersen. The results appear at the end of the dating

list, and the activity is expressed as per cent of modern, i.e. 0.95 of the activity of the oxalic acid standard, and corrected for isotopic fractionation and decay from the time of collection to 1950.

The average activity of the three samples is 99.95 ± 0.6 % of modern, i.e. they show a C-14 deficiency corresponding to 5 ± 50 yrs. This is in agreement with previous results from Thule, thus a sample of contemporary shells from the area gave an activity of less than ± 1 % of modern wood (Suess 1954), and *Mytilus* shells, collected in 1940, gave an age of 50 ± 60 yrs (GSC-2316; Blake 1987). There is also agreement with results from further south in West Greenland (Krog & Tauber 1973). However, the reservoir effect is somewhat smaller than that measured at nearby Ellesmere Island (Mangerud & Gulliksen 1975, Blake 1987, 1988), and Northeast Greenland (Funder 1982, Tauber & Funder 1975), where the higher reservoir effect has been thought to be caused by the low C-14 activity in polar water, cut off from exchange with the atmosphere (Tauber & Funder 1975).

Thus the reservoir effect appears to be determined by water mass regime, and we suggest that Holocene C-14 dates from the Thule area, like those from other parts of West Greenland, are corrected by subtracting 400 yrs from conventional ages normalised to -25 ‰, while ages normalised to 0 ‰ should not be further corrected.

Reservoir correction is applied only to ages younger than 15000 yrs.

The C-14 dates are listed according to their field number (GC), the last three digits are the same as used as sample numbers elsewhere in this volume.

Samples collected by Svend Funder, Michael Houmark-Nielsen, Christian Kronborg, Ove Klakkegg, Robert Lagerbäck, Arve Misund, Lars Rohde, Lars Erik Skyllvik, Oddmund Soldal, Lennart Sorby and Morten Thoresen

GC68-001:K-4780. Saunders Ø.

8200 \pm 85 B.P. $^{13}\text{C} = -1.1$ ‰

Rcorr. 8200 B.P.

Articulated shells of *Mya truncata* and *Hiatella arctica* in silt in section 21 m above sea-level. Section B, unit S6. Same as sample 010, and amino acid analysed and TL-dated (BAL-1235, R-861006; Tables 9 and 10). Narsarsuaq, 76°36'N, 69°42'W.

GC68-013:AAR-1. Saunders Ø.
9150±200 B.P.

Rcorr. 8750 B.P.

A fragment of *Mya truncata* from beach gravel from top of upper marine terrace 40 m above sea-level. Minimum age for Holocene marine limit. Amino acid analyses suggest that older shells are also present (BAL-1300; Table 10). Previous C-14 dates from this locality have been reported by Suess (1954), and Blake (1987). Narsarsuaq, 76°36'N, 69°42'W.

Sample collected by Jan Lundquist, Jan Mangerud and Joar Sættem

GC68-021:K-4781. Wolstenholme Fjord.
9150±95 B.P. $^{13}\text{C}= 1.7$ 0/00
Rcorr. 9150 B.P.

Fragments of *Hiatella arctica* and *Mya truncata* from silt 1 m above sea-level at base of 6 m high coastal section. Minimum age for local marine limit at 35 m. Fauna contains also *Mytilus edulis* and *Chlamys islandica*. Near Salisbury Gletscher, 76°40'N, 68°38'W.

Samples collected by Nils-Axel Mörner
Coastal cliffs at Narssârssuk, 76°27'N,
69°35'W

GC68-079:St-10721. Section E, unit N4.
41 215 $^{+1480}$ B.P. $^{13}\text{C}= 2.4$ 0/00
-1250

Shells of *Hiatella arctica* from upper part of upper silt at 11.1 m above sea-level.

GC68-080:St-10722. Section E, unit N4.
>48 000 B.P. $^{13}\text{C}=2.2$ 0/00

Articulated shells of *Hiatella arctica* in living position at silt/sand boundary 13.05 m above sea-level.

GC68-081:St-10723. Section E, unit N5.
>48 000 B.P. $^{13}\text{C}= 2.3$ 0/00

Articulated shells of *Hiatella arctica* in living position in sand 13.4 m above sea-level.

GC68-082:St-10724. Section E, unit N5.
>48 000 B.P. $^{13}\text{C}= 2.4$ 0/00

Articulated shells of *Hiatella arctica* and *Mya truncata* in living position in sand 13.67 m above sea-level.

GC68-083:St-10725. Section E, unit N5.
>45 000 B.P. $^{13}\text{C}= 2.3$ 0/00

Articulated shells of *Hiatella arctica* and *Mya truncata* in living position in sand 13.8 m above sea-level.

GC68-084:St-10726. Section E, unit N5.
>47 000 B.P. $^{13}\text{C}=2.1$ 0/00

Articulated shells of *Mya truncata* in living position in sand at 13.7 14.0 above sea-level.

GC68-085:St-10727. Section E, unit N5.

45 160 $^{+4500}$ B.P. $^{13}\text{C}=2.5$ 0/00
-3300

Articulated shells of *Mya truncata* in sand at 14.1 m above sea-level.

GC68-086:St-10730. Section G, unit N5.

44 390 $^{+4500}$ B.P. $^{13}\text{C}=2.5$ 0/00
-4200

Shells in gravel 7.1-7.2 m above sea-level.

GC68-087:St-10731. Section G, unit N5.

40 680 $^{+1450}$ B.P. $^{13}\text{C}=2.4$ 0/00
-1200

Shells just above gravel at 7.5 m above sea-level.

GC68-088:St-10734. Section H, unit N6.

9295±100 B.P. $^{13}\text{C}=1.9$ 0/00

Rcorr. 8895 B.P.

Shells of *Mya truncata* and *Balanus crenatus* in sand at 7.1-7.2 m above sea-level.

GC68-089:St-10732. Section "NAM-2".

42 940 $^{+2870}$ B.P. $^{13}\text{C}=-22.2$ 0/00
-2100

Organic detritus (lower layer) in sand, at 8.3 m above sea level.

GC68-090:St-10733. Section "NAM-2".

>45 000 B.P. $^{13}\text{C}=-23.6$ 0/00

Organic detritus (upper layer) in sand 8.4 m above sea-level.

GC68-091:St-10728. Section "NAM-3".

>33 000 B.P. $^{13}\text{C}=2.3$ 0/00

Organic detritus and shell fragments in lower beach gravel 3.9 m above sea-level.

GC68-092:St-10729. Section "NAM-3".

35 105 + 510
- 1270 B.P. $^{13}\text{C}=2.3$ 0/00

Shells above beach gravel at 7.5 m above sea-level.

GC68-093:St-10720. Section "NAM-6".

>45 000 B.P. $^{13}\text{C}=2.2$ 0/00

Shells from upper part of upper silt at 12.15 m above sea-level.

Coastal cliff at Ivnaq tugdleq, SW of Thule
Air Base 76°32'N 68°55'W

GC68-094:St-10739.

9405±85 B.P. $^{13}\text{C}=3.4$ 0/00

Rcorr. 9005 B.P.

Shells of *Mya truncata* in upper part of upper silt at 4.9 m above sea-level.

GC68-095:St-10736.

9365±85 B.P. $^{13}\text{C}=3.2$ 0/00

Rcorr. 8965 B.P.

Shells of *Mya truncata* in upper silt at 5.25-5.35 m above sea-level.

GC68-096:St-10737.

8760±180 B.P. $^{13}\text{C}=2.4$ 0/00

Rcorr. 8360 B.P.

Shells of *Mya truncata* in Holocene sand at 7.4 m above sea-level.

GC68-097:St-10738.

8570±95 B.P. $^{13}\text{C}=2.8$ 0/00

Rcorr. 8170 B.P.

Shells of *Mya truncata* in upper part of Holocene sand at 8.4 m above sea-level.

GC68-098:St-10735. Store Landgletscher

>48 000 B.P. $^{13}\text{C}=-25.4$ 0/00

Wood (piece of branch) lying on surface of end moraine
c. 400 m above sea-level. 76°30'N, 68°35'W.

Samples collected by Roar Austad, Michael
Kelly, Lars König Königsson, and Kaj
Strand Petersen

GC68-117:K-4782. Narssârssuk.

>40 500 B.P. $^{13}\text{C}=1.4$ 0/00

Articulated shells of *Mya truncata* and *Hiatella arctica*.
Section E, unit N4. 76°27'N, 69°20'W.

GC68-130:K-4783. Narssârssuk.

>37 800 B.P.

Articulated shells of *Mya truncata* and *Hiatella arctica*
from coastal section G, unit N5. 76°27'N, 69°20'W.

Sample collected by Michael Houmark-
Nielsen and Kaj Strand Petersen

GC68-161:K-4784. Inner Wolstenholme Fjord.

9040±95 B.P. $^{13}\text{C}=1.1$ 0/00

Rcorr. 9040 B.P.

Fragments of *Mya truncata* and *Hiatella arctica* in coastal section immediately in front of Harald Moltke Bræ at Nunatarssûp nua, 76°39'N, 68°00'W. Previous C-14 dates from same locality reported by Crane & Griffin (1959) and Goldthwait (1960)

Sample collected by a group of Norwegians
and Robert Lagerbäck

GC68-172:K-4785. Harald Moltke Bræ.

6980±85 B.P. $^{13}\text{C}=1.0$ 0/00

Rcorr. 6980 B.P.

Fragments of *Mya truncata* and *Hiatella arctica* found on the glacier surface, and transported from glacier bed along shear planes. 76°39'N, 68°00'W.

C-14 dating of contemporary shells

GGU-223397:K-381. Prøven harbour.

100.12±0.55 % $^{13}\text{C}=-0.1$ 0/00

Shells from nine individuals of *Mytilus edulis*, collected by F. Johansen on July 10th, 1936. Preserved in alcohol at The Zoological Museum, Copenhagen. 72°22'N, 55°44'W.

GGU-223399:K-382. Upernavik.

99.87±0.55 % $^{13}\text{C}=-0.2$ 0/00

Shells from eight individuals of *Mytilus edulis*, collected on July 2nd, 1936. Preserved in alcohol at The Zoological Museum, Copenhagen. 72°47'N, 56°10'W.

GGU-223400:K-383. Thule.

99.86±0.70 % $^{13}\text{C}=-0.3$ 0/00

Shells from eight individuals of *Mytilus edulis*, collected on Sept. 2nd 1940. Preserved in alcohol at The Zoological Museum, Copenhagen. 76°34'N, 68°48'W.