

Apparent Radiocarbon Ages of Recent Marine Shells from Norway, Spitsbergen, and Arctic Canada

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The mean apparent radiocarbon ages of marine shells, collected alive before the initiation of atomic bomb testing, and also before the main input of dead carbon derived from fossil fuels, are found to be 440 yr for the coast of Norway, 510 yr for Spitsbergen, and 750 yr for Ellesmere Island, Arctic Canada. The relationship between these apparent ages and the oceanic circulation pattern, is discussed. Also possible variations of the apparent ages back in time are discussed.

INTRODUCTION

As is well known, present day seawater and living marine organisms assume an apparent radiocarbon age due to the circulation of carbon in nature. The processes involved were recently discussed by Mangerud (1972), and will not be repeated here. An important point is that apparent ages measured today can vary from 200 to 300 yr to more than 2500 yr, depending on the history of the relevant water masses. Therefore, for the correction of radiocarbon dates of marine specimens, the apparent age of the water masses in which the dated organism lived must be estimated.

Since 1962 atomic bomb testing has completely disturbed the natural ¹⁴C activity; the use of fossil fuel in this century has also influenced the activity, but in the opposite direction. We have therefore employed museum specimens of shells, collected before 1926, the majority being collected much earlier. In compilation of published results we have used only dates from marine shells collected before 1940.

In the present study recent marine shells from the North Sea, the coast of Norway, Bear Island, Spitsbergen, and

Ellesmere Island (Arctic Canada) are dated.

All samples were from the collections in the Zoological Museum, University of Bergen. Shells from Ellesmere Island were collected by the second Norwegian Fram-expedition, the others by various Norwegian scientists. Their ¹⁴C activity was measured by the Radiological Dating Laboratory in Trondheim, and the ¹³C/¹²C ratio by R. Ryhage, Karolinska Institutet, Stockholm.

Methods

All the molluscs had been collected alive, some of them possibly being stored in alcohol for a short time after collection. Later they were kept in dry storage in boxes in a closed drawer. Contamination during storage (Olsson *et al.*, 1968) is negligible for carbonate shells of such young samples.

Pretreatment of samples in the ¹⁴C-laboratory involves washing and scrubbing of shell surfaces followed by a thorough rinse in distilled water. On average 12% by weight of the samples was removed by hydrochloric acid leaching.

¹⁴C activity was measured in not less

TABLE 1
Measurements on Recent Shells from Norway, Spitsbergen, and Arctic Canada.^a

Lab. no.	Species	Locality	Lat. N	Long. E	Sample depth (m)	Year of collection	$\delta^{13}\text{C}$ per mil	$\delta^{14}\text{C}$ per mil	Δ per mil	Apparent age (yr)
T-951	<i>Buccinum undatum</i>	Leikanger, Sognefjord	61° 11'	6° 48'	20-40	1912	+0.8	+4	-47 ± 9	390 ± 75
T-952	<i>Linia excavata</i>	Vangsnes, Sognefjord	61° 10'	6° 39'	300	1920	+2.1	-1	-55 ± 9	460 ± 75
T-953	<i>Chlamys septemradiatus</i>	Færølandsfjorden, Sogn	61° 13'	6° 34'	180-200	1909	+2.7	-3	-59 ± 10	490 ± 80
T-954	<i>Cyprina islandica</i>	Ideosen, Herdla, Hordaland	61° 22' 60° 34'	6° 85' 5° 00'	ca. 10	1923	+2.1	+5	-49 ± 8	400 ± 60
T-954A	Outer 50%	Ideosen, Herdla, Hordaland	60° 34'	5° 00'	ca. 10	1923	+1.9	+8		
T-954B	Inner 50%	Ideosen, Herdla, Hordaland	60° 34'	5° 00'	ca. 10	1923	+2.2	+3		
T-955	<i>Cyprina islandica</i>	Sollesnes, Jondal, Hardanger	60° 18'	6° 17'	20-50	1908	+2.6	-3	-58 ± 9	480 ± 75
T-956	<i>Tapes pullastra</i>	Mosterhavn, Hordaland	59° 42'	5° 24'	15	1918	-0.2	+7	-43 ± 11	350 ± 90
T-957	<i>Modiolus modiolus</i>	Vikingbank, North Sea	60° 38'	2° 35'	110-115	1906	+1.9	0	-54 ± 9	440 ± 75
T-959	<i>Chlamys septemradiatus</i>	Brevikfjord, Telemark	59° 03'	9° 42'	100-120	1898	+0.8	-14	-65 ± 10	540 ± 80
T-960	<i>Modiolus modiolus</i>	Grønholmsund, Risør, Aust-Agder	58° 44'	9° 18'	10	1905	+1.4	+12	-41 ± 9	340 ± 75
T-1532	<i>Neptunaea antiqua</i>	Skagerak	57° 44'	9° 53'	100	1906	-3.9	-8	-50 ± 6	410 ± 50
T-1533	<i>Modiolus modiolus</i>	Vikingbank, North Sea	60° 38'	2° 35'	110-115	1906	+1.1	+1	-51 ± 6	420 ± 50
Mean value, southern Norway							+1.0	0	-52 ± 3	430 ± 20
T-958	<i>Mytilus edulis</i>	Komagfjord, Finnmark	70° 16'	23° 24'	0-10	1922	0	-11	-60 ± 9	500 ± 75

T-1534	<i>Chlamys islandicus</i>	Tromsø, Troms	69°39'	18°58'	1857	+0, 2	- 6	-56 ± 6	460 ± 50
T-1535	<i>Astarte crenata</i>	Tanaafjord, Finnmark	70°30'-71°	ca. 28°30'	1876	+1, 1	-10	-61 ± 9	510 ± 70
T-1536	<i>Astarte crenata</i>	Vadsø, Finnmark	70°04'	29°45'	1857	-0, 5	- 6	-55 ± 6	450 ± 50
Mean value, northern Norway									
T-1537	<i>Chlamys islandicus</i>	Near Bear Island	74°07'	19°04'	1900	+0, 2	- 7	-57 ± 4	470 ± 30
T-1538	<i>Chlamys islandicus</i>	Bellsund, Spitsbergen	ca. 77°40'	14-16°	1926	-0, 5	- 8	-57 ± 6	470 ± 50
T-1539	<i>Chlamys islandicus</i>	Isfjorden, Spitsbergen	78°07'	14°08'	1925	+0, 5	- 7	-57 ± 6	470 ± 50
T-1540	<i>Astarte borealis</i>	Adventbukta, Spitsbergen	78°15'	15°36'	1878	-0, 1	-17	-66 ± 9	550 ± 70
T-1541	<i>Astarte borealis</i>	Magdalenafj., Spitsbergen	79°34'	10°40'	1878	-0, 1	-18	-67 ± 9	560 ± 70
Mean value, Spitsbergen									
T-1542	<i>Astarte borealis</i>	Havnefjorden, Jones Sound, Ellesmere Island	76°30'	84°30'	1899	+0, 3	-11	-61 ± 4	510 ± 30
T-1543	<i>Astarte borealis</i>	Goose Bay, Jones Sound, Ellesmere Island	ca. 76°45'	89°00'	1900	-0, 8	-39	-85 ± 9	720 ± 70
T-1544	<i>Astarte borealis</i>	Rice Strait, Smith Sound, Ellesmere Island	78°45'	74°55'	1898	-1, 1	-36	-82 ± 9	690 ± 70
Mean value, Arctic Canada									
						-1, 0	-43	-89 ± 6	750 ± 50

^aDated shells. Latitude and longitude can be ea. 2' in error. The parameters are calculated according to formulas given in Mangerud 1972. $\delta^{14}\text{C}$, Δ and apparent age refers to year of collection and are also corrected for the industrial effect (Fig. 1). The latter correction causes the small differences for the samples T-951 to T-960, compared with the results given by Mangerud (1972, Table 4) and Nydal *et al.* (1972, pp. 448-450).

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ADDENDUM

After this manuscript was submitted, further measurements of the ^{14}C -activity of recent marine shells from Denmark, Iceland, and Western Greenland were published in: Krog, H. and Tauber, H. (1974). C-14 chronology of Late- and Post-glacial marine deposits in North Jutland. *Danmarks geologiske Undersøgelse*, Årbog 1973, pp. 93-105. Copenhagen.

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