

# Raised beach deposits and new $^{14}\text{C}$ ages from Pricepynten, Prins Karls Forland, western Svalbard



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This note reports the occurrence of two generations of  $^{14}\text{C}$  dated raised beach deposits at Pricepynten, southern Prins Karls Forland, western Svalbard, dated to  $<12$  Kya and  $>30$  Kya. In addition two new  $^{14}\text{C}$  ages of ca. 9.2 and 1.8 Ky are presented from *Mytilus edulis* and a buried peat deposit, respectively.

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Fieldwork on southern Prins Karls Forland in the summer of 1997 focused on geomorphologic investigations in the Pricepynten area (Fig. 1). The study is part of a project on the late Quaternary history of Prins Karls Forland, western Svalbard. Previous results within the project from central and northern Prins Karls Forland are reported in Andersson et al. (1999, in press) and Bergsten et al. (1998).

Previous investigators, e.g. Salvigsen (1977), suggested that the occurrence of multiple generations of raised beach deposits, with well-preserved pre-Late Weichselian beach terraces, at localities on the west coast of Svalbard could indicate the presence of ice-free areas during the Late Weichselian glacial maximum. Based on studies of elevation, degree of morphologic preservation,  $^{14}\text{C}$  ages, molluscan amino acid ratios and soil profile development, up to three generations of raised beaches have been identified on Brøggerhalvøya (Brøgger Peninsula), western Spitsbergen (Forman & Miller 1984). Definitive ages for the raised beach sequence for Brøggerhalvøya are provided by  $^{14}\text{C}$  ages of  $>36$  Ky and 13–9 Ky above and below the Late Weichselian marine limit (LWML), respectively (Forman et al. 1987).

On central and northern Prins Karls Forland, palaeotemperature estimates, derived from amino acid ratios, indicate subaerial polar desert conditions with temperatures of  $-20^{\circ}\text{C}$  during the time interval ca. 70–10 Kya (Andersson et al. 1999, in press). On northern Prins Karls Forland this is further emphasized by a horizon of intense weathering and frost-shattered pebbles and cobbles, stratigraphically sited between ca. 70 Kya deltaic deposits and Holocene emergence deposits (Andersson et al. in press). The results from central and northern Prins Karls Forland conflict with a recent synthesis by Landvik et al. (1998) which concluded that the Late Weichselian Barents Sea



Fig. 1. Svalbard base map with localities mentioned in the text.



Fig. 2. A distinct and well-preserved pre-Late Weichselian raised beach terrace at 50 m asl. The terrace is built against the mountain slope and it can be followed for more than 100 m in the terrain. The person is 1.85 m tall.

ice sheet expanded on a broad front out to the continental shelf edge, 50–100 km off the present west coast, and that only some of the > 1000 m asl mountain peaks on Prins Karls Forland could have remained ice-free. In this context, the main aim of this note is to report the observation of multiple generations of raised beach deposits and associated  $^{14}\text{C}$  ages from Pricepynten, southern Prins Karls Forland, that may indicate that the area remained ice-free during the Late Weichselian.

## Two generations of raised beach deposits

The observation of multiple generations of raised beach deposits on the west coast of Svalbard have been reported by Salvigsen (1977, 1979), Boulton (1979), Salvigsen & Nydal (1981), Forman & Miller (1984) and Forman (1989, 1990). On southern Prins Karls Forland, Salvigsen (1977) reports vague pre-Late Weichselian raised beach deposits up to approximately 50 m asl. Similar features on northern Prins Karls Forland are reported with potential minimum ages of >30 Ky (Salvigsen 1977). On central Prins Karls Forland, pre-Late Weichselian raised beach deposits are constrained by well-developed soil profiles with B<sub>1</sub>-horizons of >80 cm and a minimum limiting AMS  $^{14}\text{C}$  age of >40 Ky (Andersson et al. 1999).

Geomorphologic fieldwork during the summer of 1997 in the Pricepynten area, southern Prins Karls Forland (Fig. 1), verified the existence of

two generations of raised beach deposits. A well-preserved series of raised beaches extend from the present-day coastline to the LWML at 36 m asl. A minimum limiting age of ca. 11.4 Ky is inferred for the formation of the LWML on this part of Prins Karls Forland (Forman 1990). Discontinuous beach deposits rise from the LWML at 36 m asl to approximately 50 m asl. Reworked shell fragments collected from soil pits dug into a distinct and well-preserved beach terrace at 50 m asl. (Fig. 2) and submitted for AMS  $^{14}\text{C}$  dating, yielded ages of  $28\,530 \pm 420$  and  $33\,820 \pm 815$  years BP (Table 1). The carbonate in the shell fragments may have exchanged with moving groundwater, introducing modern carbon, and the reported ages are considered minimum age estimates.

## A sub-recent marine transgression

The issue of a modern transgression in the area has been discussed by Feyling-Hanssen (1955), Blake (1961), Forman et al. (1987) and Forman (1990), among others.  $^{14}\text{C}$  dates on whale bones and terrestrial peat buried by modern storm beach gravels from southern Prins Karls Forland and Hermansenøya, respectively, indicate that sea level rose to its present position ca. 2–1 Kya (Forman 1990).

On southern Prins Karls Forland, 1.5 km south of Pricepynten, a horizon of peat of terrestrial origin is exposed in section at 3.5 m asl. The peat horizon is laterally continuous and traceable along the section for more than 50 m and it is overlain by an up to 50 cm thick deposit of storm beach gravels. A sample of the buried peat yielded an AMS  $^{14}\text{C}$  age of  $1760 \pm 70$  years BP (Table 1) and further supports the notion that sea level rose to its present position ca. 2–1 Kya (Forman 1990).

## A new $^{14}\text{C}$ age on *Mytilus edulis*

Paired and well-preserved shells of *M. edulis* occur in stratigraphic position in sections 1.5 km south of Pricepynten. A sample of paired shells submitted for AMS  $^{14}\text{C}$  dating yielded the corrected age of  $9130 \pm 65$  years BP (Table 1). The reported age is almost identical to a former age determination of  $8955 \pm 90$  years BP of *M. edulis* from Pricepynten (Forman 1990), and is within close range of the first immigration of *M. edulis* to the west coast of Svalbard by ca. 9.5 Kya (Salvigsen et al. 1992).

Table 1. AMS  $^{14}\text{C}$  ages expressed as years BP, Pricepynten, Prins Karls Forland, Svalbard.

Field no.	Lab no. <sup>1)</sup>	$^{14}\text{C}$ age $\pm 1\sigma$ years BP	Corrected $^{14}\text{C}$ age $\pm 1\sigma$ years BP <sup>2)</sup>	$\delta^{13}\text{C}$ ‰ <sup>3)</sup>	Dated material	m asl
TAPKF 007-97	Ua-12911	33 820 $\pm$ 815		+3.21	shell fragment from raised beach terrace <sup>4)</sup>	50.0
TAPKF 007-97	Ua-12454	28 530 $\pm$ 420		+2.59	shell fragment from raised beach terrace <sup>4)</sup>	50.0
TAPKF 012-97	Ua-12455	9600 $\pm$ 65	9130 $\pm$ 65	-0.73	paired valve of <i>Mytilus edulis</i> from littoral sediments <sup>4)</sup>	2.0
TAPKF 014-97	Ua-12456	1760 $\pm$ 70		-27.77	terrestrial peat from stratigraphic section <sup>5)</sup>	3.5

<sup>1)</sup>Ua numbers refer to accelerator mass spectrometry (AMS)  $^{14}\text{C}$  dates performed at the Ångström Laboratory, Uppsala University, Sweden.

<sup>2)</sup>Corrected for a marine reservoir effect of 470 years (Stuvier & Braziunas 1993).

<sup>3)</sup>As per convention all  $^{14}\text{C}$  ages have been normalized to  $-25\text{‰}$   $\delta^{13}\text{C}$ .

<sup>4)</sup>Reported ages are on a single shell fragment analysis. Pre-treatment of shell fragment prior to dating include a twofold leach in 0.5 M HCl. The inner fraction has been dated.

<sup>5)</sup>Pre-treated with 1% hot HCl and 1% hot NaOH. The insoluble part has been dated.

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