POSTGLACIAL DELEVELLING IN SKELDAL, NORTHEAST GREENLAND

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ABSTRACT. Thirteen radiocarbon dates of shell material were used to establish a rate of emergence in Skeldal, Mesters Vig district, Northeast Greenland, as delevelling occurred. The dates indicate that Skeldal was partially open to the sea by c 8,500 B.P. Early emergence (8,000-7,000 B.P.) was approximately 3m. per century. Emergence is related almost entirely to isostatic adjustment due to glacial unloading.

RÉSUMÉ. *Gauchissement postglaciaire à Skeldal, nord-est du Groënland.* Treize spécimens de matériaux conchologiques, recueillis à Skeldal, district de Mesters Vig, au nord-est du Groënland, ont été datés par la méthode du radiocarbone et ont permis d'établir la vitesse d'émergence tout au cours du gauchissement. Les dates indiquent que Skeldal était partiellement exposé à la mer c 8,500 av. p. Au début (8,000-7,000 av. p.) l'émergence était environ de 3 m. par siècle. L'émergence dépend presque entièrement du règlement isostatique causé par la décharge glaciale.

АБСТРАКТ. ПОСЛЕЛЕДНИКОВОЕ НАРУШЕНИЕ УРОВНЯ В СКЕЛДАЛ, СЕВЕРО-ВОСТОЧНАЯ ГРЕНЛАНДИЯ. Тринадцать радиоуглеродных датировок раковин были использованы для установления скорости подъема во время нарушения уровня земной поверхности в Скелдал, Мастерс Виг район, Северо-Восточная Гренландия. Датировка показывает, что Скелдал был частично открыт морю приблизительно 8.500 лет тому назад. В ранний период (от 8.000-7.000 лет тому назад) скорость подъема равнялась 3 метрам в столетие. Подъем почти полностью относится к изостатичному выравниванию связанному с ледниковым оттаиванием.

SKELDAL (72°15′ N., 24°15′ W.) is a northeast-trending valley situated in the Mesters Vig district, on the southwest shore of Kong Oscars Fjord, about 70 km. from the fjord's entrance, in the northeast corner of Scoresby Land, Northeast Greenland (Fig. 1). As a part of a study of the surficial geology in the area, it was necessary to establish the local history of postglacial delevelling. The present report summarizes some of the results; a detailed report will appear in *Meddelelser om Grønland* (Lasca *in press*). The marine shell material was dated by the radiocarbon laboratory of the University of Michigan, using a radiocarbon half life of 5,568 years. The equipment and counting techniques used by the laboratory have been described by Crane (1961a and *b*).

Several studies have been made of the emerged strandlines in Northeast Greenland (Noe-Nygaard 1932; Bretz 1935; Flint 1948), but until Washburn and Stuiver's paper (1962) information was lacking on absolute dating of emergence. Since then, F. Pessl (1963), and J. P. Schafer (Levin *et al.*, USGS Radiocarbon Lab. Nos. W1378, W1381) have added some shell dates from the Sortebjærg area, Mesters Vig, and Schubert Dal respectively. In Skeldal thirteen radiocarbon dates on shell material have been determined. The localities (Fig. 1), species, altitudes, and dates are summarized in Table 1, and plotted on Fig. 2. The molluscan shell material collected in Skeldal indicates a fauna, ". . . typical of the Quaternary and Recent seas of Greenland. It suggests cold, relatively shallow sea water." (Richards 1965).

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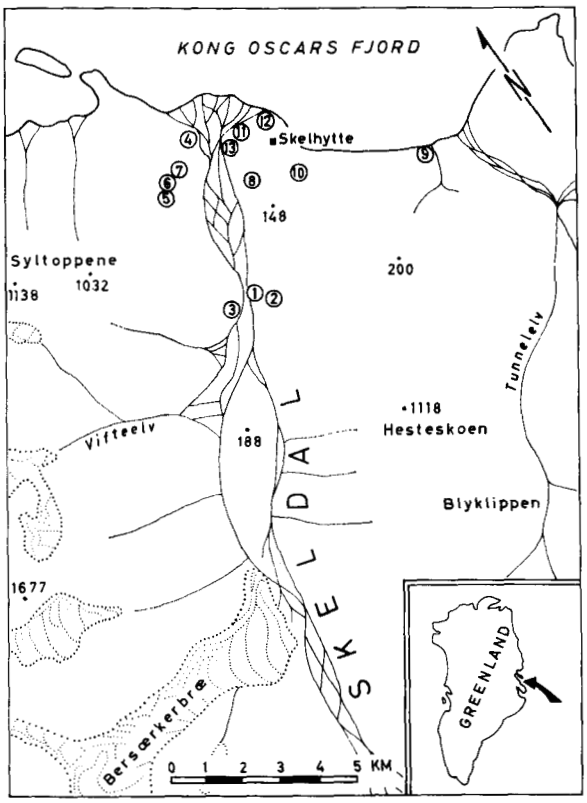

Fig. 1. Map of Skeldal, Mesters Vig district, Northeast Greenland. Circles with numbers indicate shell localities. Note: altitudes are in metres.

All the samples, except two, were collected from emerged delta deposits. Radiocarbon dating was essential to determine a rate of emergence for the area. A related problem, as Washburn and Stuiver (1962) pointed out from another part of the Mesters Vig district, was to determine whether the widespread till-like material was an emerged fjord-bottom deposit, or had been glacially transported.

All the samples were collected from very narrow horizons. Only samples M-1613, M-1616, M-1618, and M-1621 were taken from horizons as great as 1 m. thick; all other samples were taken from horizons less than 30 cm. thick. In only two cases (samples M-1611 and M-1615) were shells collected from solifluction material. The remaining shells were found *in situ*. Shells were considered to be *in situ* when both the following criteria were met: (1) shells were complete shells rather than fragments, and (2) shells with united valves, or delicate shells which were intact, or both were found in the deposit.

Two of the samples were found in shore deposits by shorelines; four were found in topset delta beds, and two samples (M-1618 and M-1622) were from probable topset delta beds; three were found in probable foreset delta beds lying not more than 10 m. below known topset delta beds (samples M-1619, M-1620, and M-1621). The final two samples (M-1611 and M-1615) were from a solifluction fossiliferous till-like material. Eight of the samples therefore seem to be closely related to specific former sea levels, as the shells deposited in the shore deposits and in the topset delta beds were deposited very near sea level. The curve

Table 1. Radiocarbon-dated shells from Skeldal, Mesters Vig district, Northeast Greenland. Note: second date (in parenthesis) has been corrected in each case for an apparent age of 550 years based on modern shells collected in the area and used as standard (Yale Radiocarbon Lab. No. Y-606. Washburn and Stuiver 1962).

LOC. NO.	MICH. LAB. NO.	LOCALITY	SPECIES	FIELD ALTITUDE IN METRES	C-14 AGE YEARS B.P.
1	M-1611	E. cut bank emerged delta in solifluction material, fjord-bot. E. side Skelelv, c. 2.5 km. downvalley fr. waterfalls, and 4 km. S. of Skelhytte.	*Mya truncata* Linné *Macoma calcarea* (Gmelin)	31 ± 2	7,740 ± 250 (7,190 ± 250)
2	M-1612	NW. bank emerged delta, E. side Skelelv, c. 0.4 km. E. of shell loc. 1.	*Hiatella arctica* (Linné) *Mya truncata* Linné	59-60 ± 2	8,490 ± 300 (7,940 ± 300)
3	M-1613	SE. cut bank emerged delta 1 km. west shell loc. 2, W. side Skelelv.	*Macoma calcarea* (Gmelin) *Hiatella arctica* (Linné) *Mya truncata* Linné	59-60 ± 2	8,840 ± 300 (8,290 ± 300)
4	M-1614	SE. cut bank emerged delta W. side Skelelv at Kong Oscars Fjord.	*Macoma* sp. *Hiatella arctica* (Linné) *Mya truncata* Linné	14 ± 1	7,010 ± 250 (6,460 ± 250)
5	M-1615	N. face bank cut by trib. drainage, solifluction material, fjord-bot. and delta, W. side Skelelv. c. 1.5 km. upvalley fr. shell loc. 4.	*Mya truncata* Linné *Hiatella arctica* (Linné)	59 ± 2	9,140 ± 300 (8,590 ± 300)
6	M-1616	N. face strandline, in shore deposit, W. side Skelelv, c. 1.2 km. upvalley fr. shell loc. 4.	*Mya truncata* Linné	36 ± 2	7,770 ± 250 (7,220 ± 250)
7	M-1617	Shore deposit at strandline, W. side Skelelv c. 1 km. upvalley fr. shell loc. 4.	*Hiatella arctica* (Linné) *Mya truncata* Linné *Macoma calcarea* (Gmelin) *Mytilus edulis* Linné	21 ± 1	6,960 ± 220 (6,410 ± 220)
8	M-1618	NW. cut bank emerged delta E. side Skelelv, c. 1 km. SW. of Skelhytte.	*Hiatella arctica* (Linné) *Mya truncata* Linné *Astarte* sp.	20-21 ± 1	7,270 ± 250 (6,720 ± 250)
9	M-1619	NW. cut bank emerged delta c. 4.5 km. SE. of Skelhytte on SW. side Kong Oscars Fjord.	*Macoma calcarea* (Gmelin) *Mya truncata* Linné *Mya arenaria* Linné *Hiatella arctica* (Linné)	4 ± 0.5	5,980 ± 200 (5,430 ± 200)
10	M-1620	NW. cut bank emerged delta c. 1.5 km. SE. of Skelhytte on SW. side Kong Oscars Fjord.	*Mya truncata* Linné *Macoma calcarea* (Gmelin)	17 ± 1	6,830 ± 200 (6,280 ± 200)
11	M-1621	NW. cut bank emerged delta SE. side Skelelv at entrance to Kong Oscars Fjord.	*Astarte* sp. *Macoma* sp. *Serripes grønlandicus* (Bruguiere) *Mya truncata* Linné *Mya arenaria* Linné *Mytilus edulis* Linné	3-4 ± 0.5	5,680 ± 200 (5,130 ± 200)
12	M-1622	NE. cut bank emerged delta c. 0.7 km. E. of Skelelv on SW. side Kong Oscars Fjord.	*Hiatella arctica* (Linné) *Mya truncata* Linné	11 ± 1	7,160 ± 250 (6,610 ± 250)
13	M-1623	NW. cut bank emerged delta SE. side Skelelv at entrance to Kong Oscars Fjord.	*Hiatella arctica* (Linné) *Mya truncata* Linné	9 ± 1	6,790 ± 220 (6,240 ± 220)

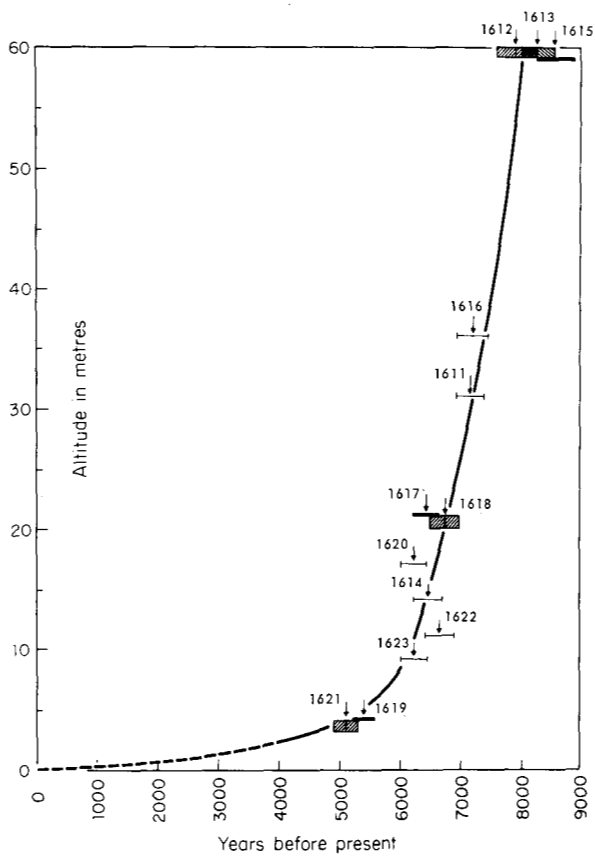

Fig. 2. Radiocarbon ages of shells from Skeldal, Mesters Vig district, Northeast Greenland, relative to altitude. All dates have been corrected for an apparent age of 550 years based on modern shells (Yale Radiocarbon Lab. No. Y-606) collected in the area and used as standard.

(Fig. 2) therefore seems to establish an accurate rate of emergence in Skeldal as delevelling occurred.

The following points should be noted: (1) the plotted altitudes in Fig. 2 are field altitudes taken with Paulin aneroid and corrected for temperature and pressure. As the tidal range is only 1 m., no corrections were made in computing altitudes to compensate for differences in high-tide and mean-tide levels. Accuracy for altitudes of less than 5 m. is estimated to be ± 0.5 m.; between 5 and 25 m., ± 1 m.; and above 25 m., ± 2 m. (cf. Washburn and Stuiver 1962, p. 67). (2) The shell dates in Fig. 2 have been corrected for an apparent age of 550 years based on modern shells collected in the area and used as standard (Yale Radiocarbon Lab. No. Y-606). (3) There may be an error of several metres when correlating a shell date with a former sea level, as the exact depth at which the mollusc died is unknown. (4) In Fig. 2, each arrow points to a radiocarbon date; the horizontal extent of the line shows the statistical error of the date; the vertical extent of the line (or box) indicates the range in altitude from which the sample was collected.

The following conclusions can be drawn from Fig. 2 and Table 1: (1) the marine character of the fossils indicates that the Skeldal was at least partially open to the sea by about 8,500 B.P. (2) The closeness of ages of emerged delta deposits and fossiliferous till-like material found in Skeldal indicates that the

latter is a fjord-bottom (glacial-marine) deposit. (3) Based on the curve (Fig. 2) the early emergence (8,000-7,000 B.P.) was of the order of 3 m. per 100 years, and slowed to about 1 m. per 100 years between 6,500-6,000 B.P. The early emergence rate of 3 m. per 100 years agrees closely with curves from other regions (Feyling-Hanssen and Olsson 1960; Olsson and Blake 1961). The emergence rate may be greater prior to 8,500 B.P. as Washburn and Stuiver's (1962) data from another part of the Mesters Vig district suggest. (4) The uninterrupted nature of the curve (Fig. 2) indicates that emergence was continuous from at least 8,500 B.P. By implication, Skeldal has been relatively ice-free since 8,500 B.P., and deglaciation of Skeldal is related to postglacial time. (5) Because a major valley glacier, the Bersærkerbræ (Fig. 1), with large moraines at its snout is only 7 km. from an emerged delta with shells dated at 8,290 ± 300 B.P. (M-1613, corrected for 550 years based on modern shells; Y-606: Washburn and Stuiver 1962), it seems likely that the climate since about 8,500 B.P. has not been significantly better for glaciation than the present climate. (6) At least 60 m. of emergence has occurred since 8,500 B.P. It is probable that emergence began prior to 8,500 B.P. for two reasons: higher sea levels are suggested by delta and beach deposits of probable marine origin to altitudes of 120 m. in Skeldal; some adjustment would be expected as the ice thinned prior to encroachment of the sea. Therefore, it seems probable that emergence is related almost entirely to isostatic adjustment owing to glacial unloading. (7) These conclusions confirm those of Washburn and Stuiver (1962).

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