Radiocarbon measurements of Würm-interstadial samples from Jutland

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Zusammenfassung. Der Inhalt von radioaktivem Kohlenstoff in würminterstadialen Proben aus Brörup, Jütland, ist in den Datierungslaboratorien in Kopenhagen und Groningen gemessen worden. Die Proben waren durch verhältnismäßig große Mengen von infiltriertem, jüngeren Material verunreinigt; nach einer Extraktion von Humussäuren zeigte jedoch keine der Proben eine signifikante Aktivität. Dies läßt darauf schließen, daß das Interstadial von Brörup und die vorausgegangene kalte Periode älter als 50 000 Jahre v. Chr. sind. Wenn die Ansicht von Andersen (1957) richtig ist, daß in Brörup wirklich das Göttweiger Interstadial vorliegt, so würde daraus folgen, daß auch Altwürm und wenigstens der tiefere Teil des Göttweiger Interstadials älter als 50 000 Jahre v. Chr. sein müßten.

Summary. The radiocarbon content of Würm-interstadial samples from Brörup, Jutland, has been measured in the dating laboratories in Copenhagen and Groningen. The samples were contaminated with comparatively large amounts of infiltrated younger material, but after an extraction of humic acids none of the samples showed a significant activity. This means that the interstadial at Brörup and the preceding cold period are older than 50.000 B.C. If Andersen (1957) is right in correlating the Brörup interstadial with the „Göttweig Interstadial" this implies that Old Würm and at least the lower part of the Göttweig interstadial also should be older than 50.000 B.C.

In „Eiszeitalter und Gegenwart" Svend Th. Andersen has given a preliminary report on new pollen analytical investigations of interglacial and interstadial fresh water deposits at Brörup in Jutland (Andersen 1957). Samples from these deposits at „Brörup Hotel Bog" have been measured for carbon-14 content in the dating laboratories in Copenhagen and Groningen. According to Andersen (1957), there can be little doubt that the samples submitted represent the Old Würm and the interstadial (Göttweiger interstadial, Gross 1956) which separates Old Würm and Main Würm. A cooling of the climate is indicated at the top of the deposits; but it is not possible to say, whether the whole interstadial is represented at Brörup.

The glacial peat and mud layers, from which the samples originate, are protected by a solifluction deposit of stony sand 2 meters thick and probably formed during a later cold period of the last glaciation. The layers are situated below the ground water level, and penetration of modern rootlets into the layers is therefore improbable. The samples are absolutely non-calcareous, and change of activity due to either older or younger carbonate can be excluded. The samples were dried and stored in closed tins after the boring and thus protected against the attack of microorganisms. For these reasons the samples were considered especially suitable for radiocarbon investigations in this age range, where only a minute admixture of younger material (less than 1 per cent) will produce a drastic change in the measured age.

The stratigraphy at the locality is the following (cp. Andersen 1957):

	0—0.70 m	Made ground		
	0.70—2.65 —	Stony sand		
	2.65—2.80 —	Humous substance ("Dy")	K-512	
Inter-	2.80—3.12 —	Fine sandy mud	K-528	GRO-1264
stadial	3.12—3.74 —	Herbaceous peat	K-510	GRO-1263
	3.74—4.35 —	Sandy mud	K-526	
	4.35—5.89 —	Mud with sand and silt		
Old	5.89—6.00 —	Clay		
Würm	6.00—7.41 —	Mud	K-511	GRO-1256
Inter-	7.41—7.46 —	Herbaceous peat		
glacial	7.46— —	Peat with wood of spruce and alder.		

The place of the measured samples in the stratigraphy is shown. The samples have been taken only from layers, where influx of rebedded interglacial material is either absent or negligible and will have no effect on the dating results.

The samples K-512, 510, and 511 were measured in Copenhagen in a 2-liter CO_2-gas counter operated at 2 atms. (net count for modern carbon 24.8 counts per minute, background 4.8 cpm, and barometric effect 0.12 cpm per cm of mercury). Since the amount of material was limited, and the samples were considered free of infiltrations, the material was combusted directly without any chemical pretreatment. Each sample was measured two or three times, alternating with background measurements. The following net activities (activity above background) were obtained:

K-512	peat	(2.70—2.80 m)	0.66 ± 0.06 cpm
K-510	peat	(3.61—3.67 m)	0.43 ± 0.08 cpm
K-511	mud	(7.07—7.18 m)	0.12 ± 0.04 cpm

These activities correspond to ages of 27.000—40.000 years B. C.

The samples GRO-1264, 1263, and 1256 were measured in Groningen with a 2-liter CO_2-gas counter operated at 3 atms. (net count for modern carbon 36.9 cpm, background 2.4 cpm, and barometric effect 0.05 cpm per cm of mercury). Before combustion the samples were pretreated with dilute hydrochloric acid and dilute sodium hydroxide in order to extract humic acids (cp. DE VRIES 1958). With this pretreatment the following net activities were found:

GRO-1264	mud	(2.85—2.90 m)	0.00 ± 0.03 cpm
GRO-1263	peat	(3.37—3.48 m)	—0.02 ± 0.05 cpm
GRO-1256	mud	(6.81—6.91 m)	0.02 ± 0.03 cpm

These measurements show that no significant activities were left. The samples thus are older than the range of the Groningen laboratory, i. e. older than 50.000 B.C. An age of 50.000 B.C. corresponds to an activity of 0.06 cpm in this counter.

In order to investigate the discrepancies between the measurements in Copenhagen and in Groningen, sample GRO-1264 was sent as CO_2-gas in a steel container to Copenhagen, where it was measured as sample K-528. Further, a sample K-526 from 3.96—4.08 m was given the same pretreatment in Copenhagen and then combusted and measured. The results were the following:

K-528	mud	(2.85—2.90 m)	0.04 ± 0.04 cpm
K-526	mud	(3.96—4.08 m)	—0.01 ± 0.07 cpm

These activities correspond to ages older than the range of the Copenhagen laboratory, i. e. older than 40.000 years B.C. (the difference in range between the Copenhagen and the Groningen stations is due mainly to the different pressures, and therefore the different amounts of sample used at the two stations).

The activities initially measured for samples K-512, 510, and 511 thus were due to younger material (perhaps humic acids), which may be extracted from the samples by a pretreatment with hydrochloric acid and sodium hydroxide. The amount of infiltrated material is surprisingly high. For sample K-512 it is 2.7 per cent or more, depending upon the age of the material, and even down to 7 meters below ground level the effect of this infiltration is noticeable. This was considered highly improbable when the measurements were undertaken. It should be mentioned that the „Brörup Hotel Bog" is a small basin (diameter about 60 m), so there is a possibility that part of the infiltrations comes not from above but from the sides. Further investigations as to the nature of the infiltrations are planned. Moreover, if it turns out that the infiltrated material can be removed completely, it will be tried to date the upper peat layer with an improved procedure, which extends the range to 70.000 years (see also DE VRIES 1958). The large difference in age

before and after the extraction of the infiltrated material demonstrates the influence of an admixture of more recent material into glacial samples. The difficulties encountered in securing uncontaminated samples older than 25—30.000 years in many cases makes it necessary to consider radiocarbon results for these samples as minimum ages rather than true datings (cp. DE VRIES ET AL. 1958, and DE VRIES 1958).

The measurements thus performed in Copenhagen and in Groningen prove that the interstadial at Brörup and the preceding cold period are older than 50.000 B.C. Hence, if the correlations by ANDERSEN (1957) are right, Old Würm and at least the lower part of the interstadial which separates Old Würm and Main Würm should also be older than 50.000 B.C. A further discussion of dates for Würm-interstadial samples and the correlation of the Göttweig fossile soil with these dates has been given by DE VRIES (1958).

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