UNIVERSITY OF KIEL RADIOCARBON MEASUREMENTS VII

H. ERLENKEUSER and H. WILLKOMM

C^{14} Laboratory of the Institut für Kernphysik, University of Kiel

This list contains data obtained during 1971. Unless otherwise stated, all organic samples or organic fractions are carefully washed with dil. HCl and dil. NaOH to remove all carbonates. Age calculations are based on 95% of NBS oxalic acid standard activity with modern value A.D. 1950. Results are calculated using the Libby half-life and are given in the B.P. scale. Also ages of shells are calculated with the NBS oxalic acid standard. Ages are not corrected for δC^{13} variations. Errors correspond to 1σ variation of sample net counting rate including statistics of modern standard and background. Sample activities, if given in per cent refer to 0.95 NBS oxalic acid standard activity.

I. GEOLOGIC SAMPLES

A. Terrestrial Samples

KI-330. Recent twigs, 1969

156.3 ± 0.8%
$\delta C^{13} = -25.9\%_o$

Twigs (*Malnus domesticus*) grown summer 1969 near Kiel (54° 18.5′ N Lat, 10° 4.3′ E Long), Germany. Coll. Sept. 1969.

Esterweger Dose, peat development

Peat from Esterweger Dose (53° 3.1′ N Lat, 7° 37.1′ E Long), emerged bog near Papenburg, NW Germany. Coll. 1969 and subm. by K. Müller, Bot. Inst., Univ. Kiel. *Comment*: samples complete series in R., 1971, v. 13, p. 335.

KI-337. Light peat, 65 to 67 cm depth

1650 ± 50
A.D. 300
$\delta C^{13} = -25.3\%_o$

Underlies KI-336.

KI-344. Light peat, 10 cm depth

100.2 ± 0.5%
$\delta C^{13} = -24.8\%_o$

Peat (*Sphagnum cuspidatum*) with twigs of Ericaceae and *Scheuchzeria*.

KI-516.01. Leopold oak, tree-ring 90 to 95

3550 ± 55
1600 B.C.
$\delta C^{13} = -25.0\%_o$

Oak with 380 rings, from excavations at center of Kiel (54° 19.4′ N Lat, 10° 8.5′ E Long), Germany. Coll. 1971 and subm. by F. R.

Averdieck, Inst. f. Ur-und Frühgeschichte, Univ. Kiel. *Comment*: tree is for dendrochronologic study of Schleswig-Holstein.

Mammoth tusk, Tettenhausen

Part of mammoth tusk, from gravel pit near Tettenhausen (47° 57.6′ N Lat, 12° 45.7′ E Long), Bavaria, Germany. Coll. 1969 by Johannes Seidel, 8221 Reichersdorf, Post Petting; subm. 1970 by Edith Ebers, 8121 Haunshofen. *Comment* (J.S. and E.E.): tusk was covered by 460 cm gravel ("Laufenschotter") and lay 530 cm underground. Contamination by lime is possible. *Comment*: sample is divided into pieces of different purity (visual criteria), yet age of any fraction is much lower than expected. Organic parts were too small to measure.

3620 ± 70
1670 B.C.

KI-358.031. $\delta C^{13} = -9.9\%_0$

Selected, purely white material, surface mechanically removed.

4030 ± 80
2080 B.C.

KI-358.041. $\delta C^{13} = -10.1\%_0$

Fragments like .031, but with small dark impurities.

4070 ± 60
2120 B.C.

KI-358.051. $\delta C^{13} = -11.1\%_0$

Remains of .031 and .041, darkened surface parts.

910 ± 30
A.D. 1040

KI-457. Boxberg, 1971 $\delta C^{13} = -27.4\%_0$

Soil containing mixture of fossil B_s-, B_h-, and A_h-horizons 80 to 100 cm under ground from slope of Boxberg (54° 4.3′ N Lat, 9° 45.0′ E Long), Schleswig-Holstein, Germany. Coll. 1971 and subm. by G. M. Stanschus, Geog. Inst., Univ. Kiel. *Comments* (G.M.S.): horizons are residues of solifluctions during last interglacial or late glacial. Measured C^{14} content indicates recent contamination. Rootlets were washed away carefully. Carbonates were removed in usual way by diluted HCl.

B. Lakes and Underground Water

Plöner See, recent water and plants

Series is continued from 1970 (cf. R., 1971, v. 13, p. 329).

122.7 ± 0.8%

KI-324. Potamogeton perfoliatus, Plön 1969 $\delta C^{13} = -18.7\%_0$

Aquatic plants ca. 50 to 100 cm under surface of Grosser Plöner See (54° 9.0′ N Lat, 10° 25.1 E Long), NW Germany. Coll. Sept. 1969 and subm. by F. R. Averdieck.

TABLE 1
C¹⁴ dates of Plöner See sediments

Kiel C¹⁴ Lab.		Grosser Plöner See		KI-85 and KI-246		
Lab. no.	Depth within sediment (cm)	Organic fraction Libby age ± 1σ B.P.	δC¹³ ‰	Inorganic fraction Libby age ± 1σ B.P.	δC¹³ ‰	Difference of Libby ages (yr)
85.20	550 to 580	1620 ± 65	−29.7	3160 ± 90	−1.7	1540
85.21	580 to 608	1540 ± 80	−29.2	3260 ± 75	−1.4	1720
85.22	608 to 634	1700 ± 80	−30.6	3800 ± 65	−0.9	2100
85.23	650 to 680	1700 ± 90	−30.6	4230 ± 140	−1.4	2530
85.24	680 to 710	2160 ± 110	−32.2	3860 ± 110	−0.4	1700

KI-487.   Aquatic plants, Plön 1971
$$122.2 \pm 0.7\%$$
$$\delta C^{13} = -14.1\%_0$$

Same position as KI-324, 150 to 180 cm under surface. KI-485, 486, and 487 coll. Sept. 1971 and subm. by G. Enge and H. Erlenkeuser.

KI-486.   Surface water, Plön 1971
$$120.9 \pm 0.8\%$$
$$\delta C^{13} = -3.8\%_0$$

Pumped from 4 m under surface (total depth ca. 28 m) at (54° 9.5′ N Lat, 10° 25.1′ E Long). Well marked thermocline between 16 to 18 m.

KI-485.   Depth water, Plön 1971
$$121.1 \pm 0.7\%$$
$$\delta C^{13} = -7.6\%_0$$

Pumped from 26.5 m under surface at same position as KI-486.

Plöner See series

Lake sediments of the Grosser Plöner See (54° 9.5′ N Lat, 10° 25.1′ E Long), NW Germany. Coll. and subm. 1966 by F. R. Averdieck and W. Ohle, Max-Planck-Inst. f. Limnol., Plön. Continuation of former dates (R., 1971, v. 13, p. 327). Dates are given in Table 1. *Comment*: results confirm large difference between organic and inorganic fraction in 6 to 7 m depth.

Ravensberg series

Lake sediments under small emerged bog near Süderlügum (54° 50.7′ N Lat, 8° 57.5′ E Long), NW Schleswig-Holstein, Germany. Coll. 1970 and subm. 1971 by Hartmut Usinger, Bot. Inst., Univ. Kiel, who also made pollen analysis.

KI-419.   RB 12-14
$$12,080 \pm 110$$
10,130 B.C.
$$\delta C^{13} = -25.8\%_0$$

Gyttja 462 cm under water surface. *Comment* (H.U.): expected age: some centuries before Bölling, ca. 11,400 B.C.

KI-420.   RB 20-22

$$12{,}650 \pm 280$$
10,700 B.C.
$$\delta C^{13} = -23.9\%_0$$

Gyttja 446 cm under water surface. *Comment* (H.U.): middle of Bölling.

KI-421.   RB 28-30

$$10{,}840 \pm 130$$
8890 B.C.
$$\delta C^{13} = -20.5\%_0$$

Gyttja 430 cm under water surface. *Comment* (H.U.): beginning of Alleröd. C^{14} age ca. 1100 yr too young.

Well series, Kiel 1971

Water samples of different wells near Kiel, Germany, coll. Sept. 1971 by G. Enge, Inst. f. Kernphysik, Univ. Kiel. CO_2 of 50 L acidified water was liberated on stirring by bubbling nitrogen and frozen out with liquid air (Enge, 1971).

KI-475.   Brunnen der Universität

$$55.1 \pm 0.4\%$$
$$\delta C^{13} = -14.4\%_0$$

38 to 65 m deep (54° 22.3′ N Lat, 10° 7.3′ E Long).

KI-476.   Brunnen 11, Schulensee

$$52.8 \pm 0.4\%$$
$$\delta C^{13} = -13.3\%_0$$

78 to 138 m deep (54° 17.6′ N Lat, 10° 6.1′ E Long).

KI-477.   Brunnen 5, Kiel-Wik

$$36.39 \pm 0.20\%$$
$$\delta C^{13} = -13.8\%_0$$

149 to 199 m deep (54° 20.7′ N Lat, 10° 7.1′ E Long).

C. Marine Samples

Kiel Bay Sediment

Muddy sediment from NW Kiel Bay (54° 46.3′ N Lat, 10° 11.3′ E Long), W Baltic Sea. Coll. and subm. by F. Werner, Geol. Inst., Univ. Kiel, and H. Erlenkeuser and H. Willkomm, March 1971. Sample is from surface sediment, at −26 m, with Box Corer (cross section 20 × 28 cm). Sediment core was cut into slices 1 cm thick parallel to sediment surface. Samples were boiled with 1% HCl to remove traces of carbonate, filtered, washed to neutrality, and dried. Samples were converted to CO_2 by dry combustion. Results are given in Table 2. *Comment*: sediment core is from area with high sedimentation rate (ca. 3 mm/year) with postglacial mud layers up to 20 m thick (Seibold *et al.*, 1971). Radiographic methods show a layered structure of sediment core between 0 to 90 mm depth, whereas below 160 mm sediment is homogeneous without recognizable structure. Measurements give an apparent age of pre-bomb sediments of ca. 1000 yr. Steep increase of C^{14} activity between at least 68 mm and surface is probably due to bomb-produced C^{14}. Significance of the older layer interposed at 100 to 70 mm is still under discussion.

Kiel Bay Macrobenthic series, 1971

Shells of live mollusks at different positions in W Kiel Bay. Coll. by A. Fritsche, R. S. Newton, F. Werner, Geol. Inst., Univ. Kiel, and H. Willkomm, March 1971; subm. by H. Erlenkeuser and H. Willkomm. Only carbonate fraction was dated. Large specimen (diam. > 5 cm) was used.

129.5 ± 1.2%

KI-407.011.   Aero S.W., 11777 $\delta C^{13} = -0.1\%_0$

Cyprina islandica, (54° 46.3′ N Lat, 10° 11.3′ E Long), from black-gray muddy sediment surface, 26 m water depth.

105.8 ± 0.8%

KI-408.011.   Aero S.W., 11779 $\delta C^{13} = +0.8\%_0$

Cyprina islandica, (54° 47.0′ N Lat, 10° 14.6′ E Long), from black-gray muddy sediment surface, 29 m water depth.

TABLE 2

C^{14} dates of Kiel Bay sediments

Age calculations are made without δC^{13} corrections

	Kiel Bay sediments		
Kiel C^{14} Lab.	Aero S.W., 11777-3		KI-483
Lab. no.	Depth within sediment (mm)	Organic fraction	
		Libby age ± 1σ B.P.	δC^{13} (‰)
483.01	0 to 20	540 ± 45	−23.3
483.02	20 to 32	450 ± 60	−22.5
483.03	32 to 44	680 ± 55	−22.8
483.04	44 to 56	955 ± 55	−22.5
483.05	56 to 68	900 ± 40	−21.9
483.06	68 to 80	1060 ± 85	−21.6
483.07	80 to 92	1625 ± 65	−21.6
483.08	92 to 104	1480 ± 60	−21.1
483.09	104 to 116	1475 ± 70	−21.3
483.10	116 to 128	1065 ± 60	−21.5
483.11	128 to 140	1325 ± 45	−21.1
483.12	140 to 152	1095 ± 80	−22.3
483.13	152 to 164	1120 ± 45	−20.1
483.14	164 to 188	1110 ± 55	−20.1
483.15	188 to 212	1055 ± 55	−20.5
483.16	212 to 236	920 ± 50	−20.3
483.17	236 to 260	810 ± 60	−20.7
483.18	260 to 284	—	—
483.19	284 to 308	750 ± 55	−20.0
483.20	308 to 332	940 ± 60	−21.5

KI-410.011.   Aero S.W., 11818   **103.4 ± 0.5%**
                                        $\delta C^{13} = +0.4\%_o$

Astarte borealis, (54° 50.1′ N Lat, 10° 5.6′ E Long), from fine grained sand bottom, 16 m water depth.

KI-411.011.   Aero S.W., 11849   **113.5 ± 0.4%**
                                        $\delta C^{13} = -0.1\%_o$

Cyprina islandica, (54° 46.9′ N Lat, 10° 5.4′ E Long) from fine grained sand bottom, 19 m water depth.

KI-412.011.   Aero S.W., 11851   **103.0 ± 0.8%**
                                        $\delta C^{13} = +2.0\%_o$

Cyprina islandica (54° 46.9′ N Lat, 10° 5.8′ E Long), from brown muddy sand bottom, 23 m water depth.

KI-413.011.   Aero S.W., 11857   **104.0 ± 0.5%**
                                        $\delta C^{13} = +1.0\%_o$

Big *Cyprina islandica* (8 cm diam.), (54° 43.0′ N Lat, 10° 4.2′ E Long) from gray muddy sand bottom, 13.5 m water depth.

KI-415.011.   Aero S.W., 11859   **106.7 ± 0.6%**
                                        $\delta C^{13} = +1.6\%_o$

Cyprina islandica, (54° 43.3′ N Lat, 10° 5.7′ E Long) from coarse grained sand bottom, 13 m water depth. *Comment*: shells show considerably low C^{14} activity compared with recent macrobenthic samples KI-414, -524, -528 and -529, even in view of life-span of mollusks, *i.e.*, ca. 10 yr (Kühlmorgen-Hille, 1963).

KI-414.   Aero S.W., 11858   **133.2 ± 0.9%**
                                        $\delta C^{13} = -23.0\%_o$

Laminaria digitata, (54° 47.5′ N Lat, 10° 4.0′ E Long) growing on lag sediment, 10 m water depth. Coll. and subm. by R. S. Newton and F. Werner, Geol. Inst., Univ. Kiel, and H. Erlenkeuser and H. Willkomm, March 1971.

Stoller Grund

Samples from 'Stoller Grund', (54° 31.8′ N Lat, 10° 10.7′ E Long) SW Kiel Bay. Grown on lag sediment. Coll. and subm. by H. Erlenkeuser, Nov. 1971.

KI-524.   Stoller Grund, 1   **132.4 ± 0.8%**
                                        $\delta C^{13} = -24.7\%_o$

Red algae assoc.

KI-525.   Stoller Grund, 2   **126.6 ± 2.6%**
                                        $\delta C^{13} = -28.8\%_o$

Red and brown algae assoc.

Stoller Rinne

Varied macrobenthic samples from 'Stoller Rinne' (54° 29.5′ N Lat, 10° 11.5′ E Long) SW Kiel Bay. Surface sediment is lag on till and

sand. Water depth ca. 10 m. Coll. and subm. by H. Erlenkeuser, Nov. 1971.

KI-528.01. Stoller Rinne, 1

$134.9 \pm 1.2\%$
$\delta C^{13} = -19.1\%c$

Small specimen (*Astropecten irregularis*) diam. <1 cm.

KI-528.02. Stoller Rinne, 2

$132.5 \pm 0.7\%$
$\delta C^{13} = -27.3\%c$

Bread-crumb sponges (*Halichondria panicea* Pall.)

KI-528.03. Stoller Rinne, 3

$130.8 \pm 0.9\%$
$\delta C^{13} = -31.8\%o$

Red algae.

KI-528.04. Stoller Rinne, 4

$133.6 \pm 0.7\%$
$\delta C^{13} = -25.3\%o$

Brown algae.

General Comment: if corrected for isotopic fractionation, sample activities do not show significant differences and are higher than water activity (KI-531).

Schilksee Bay

Varied macrobenthic samples from 'Grashügel' (54° 25.3′ N Lat, 10° 11.7′ E Long), submarine hillock in Schilksee Bay in outer Kiel Fjord, W Baltic Sea. Lag and sand sediment surface, 5 to 12 m water depth. Coll. and subm. by H. Erlenkeuser, Nov. 1971.

KI-529.01. Schilksee, 1

$129.1 \pm 1.4\%$
$\delta C^{13} = -24.9\%o$

Bread-crumb sponge (*Halichondria panicea* Pall.)

KI-529.02. Schilksee, 2

$124.3 \pm 2.0\%$
$\delta C^{13} = -18.9\%o$

Small specimen (*Astropecten irregularis*) diam. <1 cm.

KI-529.03. Schilksee, 3

$128.4 \pm 1.1\%$
$\delta C^{13} = -27.5\%o$

Red algae.

General Comment: activity of KI-529 samples is significantly lower than open sea sample activity (KI-524, -525, and -528).

KI-531. Schönberger Strand

$126.9 \pm 0.7\%$
$\delta C^{13} = -0.5\%o$

Surface water (54° 25.0′ N Lat, 10° 25.0′ E Long), S Kiel Bay, CO_2 liberated from inorganic carbonates. Coll. and subm. by H. Erlenkeuser, Dec. 1971. Water was taken at head of groin built into the open sea, 50 m apart from strand. Water depth 5 m, sand sediment surface. *Comment*: activity corrected for isotopic fractionation seems too low compared to benthonic samples KI-414, -524, -525, -528, and -529.

Landsort Basin

Muddy sediments from Landsort Basin (58° 40′ N Lat, 18° 20′ E Long), middle Baltic Sea. Coll. and subm. 1971 by E. Suess, Geol. Inst., Univ. Kiel. Sediment surface, −459 m. Samples are from box core 9 m long. Depths refer to sediment surface.

KI-405.020.   150 to 190 cm depth

$$1700 \pm 110$$
A.D. **250**
$\delta C^{13} = -26.8\%o$

Sample is treated with hot 1% HCl, filtered, washed, and dried before combustion. Final content of C_{org} is 1.4%.

KI-405.022.   180 to 190 cm depth

$$2560 \pm 160$$
610 B.C.
$\delta C^{13} = -29.0\%o$

Same material as KI-405.020. Treated with hot 1% HCl, filtered and washed. Additionally boiled with 1% NaOH, washed to neutrality by centrifuging and decanting. Final C_{org} content is 0.8%. *Comment*: as indicated by low δC^{13} value, KI-405.022 mainly consists of organic complexes that have become highly resistant to chemical attack during their history of diagenesis (Degens, 1969; Williams *et al.*, 1970).

KI-405.030.   340 to 348 cm depth

$$1770 \pm 85$$
A.D. **180**
$\delta C^{13} = -26.2\%o$

Sample treated with 1% HCl only. Final C_{org} content 1.6%.

KI-405.040.   366 to 376 cm depth

$$11,030 \pm 170$$
9080 B.C.
$\delta C^{13} = -21.1\%o$

Sample dried only. C_{org} content is 4.5%. *Comment*: sample might be contaminated with inorganic carbonate as guessed from underlaying samples (undated). Correction for inorganic carbonate aided by δC^{13} value reduces C^{14} age to ca. 8300 yr B.P.; still too old in view of deeper samples.

KI-405.05.   436 to 450 cm depth

No chemical pretreatment. C_{org} content 2.0%. Carbonates ca. 0.10 mMol/g.

KI-405.05-20323.

$$3410 \pm 95$$
1460 B.C.
$\delta C^{13} = -27.9\%o$

First measurement of sample.

KI-405.05-20340.

$$3520 \pm 160$$
1570 B.C.
$\delta C^{13} = -21.1\%o$

Second measurement. *Comment*: same counting gas as KI-405.05-

20323, but purified a 2nd time. Gas was purified because 1st sample mass spectrum showed unusual mass lines due to unknown contaminants. Weighted mean C^{14} age: 3440 ± 85 B.P.

KI-405.06.   633 to 640 cm depth

4430 ± 190
2480 B.C.
$\delta C^{13} = -27.2\%_0$

No chemical pretreatment. C_{org} content 1.5%. Carbonates ca. 0.12 mMol/g. *Comment*: mass spectrum contaminated. δC^{13} might be too low (see KI-405.05).

KI-405.07.   880 to 890 cm depth

4810 ± 95
2860 B.C.
$\delta C^{13} = -29.2\%_0$

No chemical pretreatment. C_{org} content 1.2%. Carbonates ca. 0.02 mMol/g. *Comment*: mass spectrum contaminated. δC^{13} value might be too low (see KI-405.05).

General Comment: samples dated for chemical and microbiological studies on development of middle Baltic Sea (Suess, 1971).

Canary Islands

Mollusk shells from littoral terraces of different heights above sea level for dating ancient landlift of Canaries. Coll. 1965 and subm. 1970 by Heinz Klug, Geog. Inst., Univ. Kiel (Klug, 1968).

KI-359.   Gran Canaria, Bañaderos, 65 m

>37,900
(<0.89%)
$\delta C^{13} = -1.2\%_0$

Shells from Gran Canaria (28° 38.5′ N Lat, 15° 32′ W Long) at +65 m, 5 to 90 cm below surface. Statistical certainty of age estimate is 90%.

KI-360.   Gran Canaria, Arucas, 25 m

>38,800
(<0.80%)
$\delta C^{13} = +0.7\%_0$

Shells from Gran Canaria (28° 37.3′ N Lat, 15° 31′ W Long) from terrace at + 25 m, 5 to 25 cm below surface. Statistical certainty of age estimate is 90%.

KI-361.   Fuerteventura, Jandia, 55 m

Different shells belonging to a terrace, +55 m, at Fuerteventura (28° 3′ N Lat, 14° 22′ W Long). The 3 largest shells were treated separately, and their carbonate gave following ages (activity in % of modern in brackets).

		−4000
(0.58 ± 0.22%)		**41,300**
		−2600
KI-361.011.	$\delta C^{13} = -0.5\%_0$	**39,300 B.C.**

		+1700
	(2.49 ± 0.46%)	**29,700**
		−1400
KI-361.021.	$\delta C^{13} = -3.1\%_0$	**27,700 B.C.**
	(4.61 ± 0.24%)	**24,720 ± 420**
KI-361.031.	$\delta C^{13} = -0.9\%_0$	**22,770 B.C.**

Comment: according to different activity, at least the 2 older shells must have been redeposited.

22,730 ± 550

KI-362.   Lanzarote, Montaña Roja, 6 m   **20,780 B.C.**

(5.91 ± 0.40%) $\delta C^{13} = +3.5\%_0$

Purpura haemastoma L. from Lanzarote (28° 51.5′ N Lat, 13° 51′ W Long), at +6 m.

+4000

37,300

−2700

KI-363.   Lanzarote, Los Ajaches, 55 m   **35,300 B.C.**

(0.21 ± 0.08%) $\delta C^{13} = -2.6\%_0$

Vermetus Lumbicatis L., from Lanzarote (28° 51.5′ N Lat, 13° 46.3′ W Long) from terrace at +55 m.

>46,700

KI-364.   Gran Canaria, Agaete Nord   **(<0.30%)**

$\delta C^{13} = +1.5\%_0$

Shells from Gran Canaria (28° 36′ N Lat, 15° 41′ W Long) from terrace at +85 to +91 m.

+4000

38,000

−2700

KI-365.   Fuerteventura, Los Malinos, 6 m   **36,000 B.C.**

(0.88 ± 0.35%) $\delta C^{13} = +2.9\%_0$

Shells (*Cassis* sp.) from W Fuerteventura (28° 31′ N Lat, 14° 4′ W Long).

>27,900

KI-501.   Lanzarote, Montaña Roja, 6 m   **(<3.1%)**

Patella intermedia, from same position as KI-362. Statistical certainty of age estimate is 90%.

Probstei coastline series

Peat and wood from Baltic sea coast of Probstei, Schleswig-Holstein, indicating geomorphologic development of coastline.

1170 ± 100

KI-80.   Schön 1   **A.D. 780**

$\delta C^{13} = -28.5\%_0$

Root of tree from peat covered with ca. 80 cm sand and gravel at Schönberg beach (54° 24.8′ N Lat, 10° 25.3′ E Long). Coll. 1966 and subm. by H. Willkomm.

KI-220.   Schön 2

830 ± 40
A.D. 1120
$\delta C^{13} = -27.9\%_0$

Root of tree 30 m behind Schönberg beach (54° 25.7′ N Lat, 10° 22.7′ E Long). Sample lay 80 to 90 cm underground in peat covered by 50 cm sea sand indicating later transgression. Coll. 1967 and subm. by H. Willkomm.

KI-366.   Köhler 2

3060 ± 100
1110 B.C.
$\delta C^{13} = -25.3\%_0$

Peat from surface of sea floor, ca. 30 m from shore (54° 25.7′ N Lat, 10° 23.3′ E Long). Coll. 1969 and subm. 1970 by Jürgen Köhler, Geog. Inst., Univ. Kiel.

KI-367.   Köhler 1

3080 ± 65
1130 B.C.
$\delta C^{13} = -28.4\%_0$

Wood from peat covered with sand at sea floor near Stakendorf beach (54° 24.5′ N Lat, 10° 26.3′ E Long). Coll. 1969 and subm. 1970 by J. Köhler.

KI-381.   10056, 200 to 220 cm under sea floor

11,880 ± 100
9930 B.C.
$\delta C^{13} = -28.1\%_0$

Peat from bottom of Baltic Sea (54° 34.24′ N Lat, 10° 6.21′ E Long), water depth 29 m. Coll. 1969 and subm. 1970 by F. Werner, Geol. Inst., Univ. Kiel. *Comment*: continues Kieler Bucht series (R., 1971, v. 13, p. 334).

II. ARCHAEOLOGIC SAMPLES

KI-82.   Burg Ahr

490 ± 40
A.D. 1460
$\delta C^{13} = -24.1\%_0$

Cut of ceiling rafter of Kemenate (ladies bower) of Ahr castle near Altenahr/Eifel (50° 30′ N Lat, 6° 59′ E Long), W Germany. Coll. 1966 and subm. by H. Erlenkeuser. *Comment*: it is really as old as the guide tells.

Alt-Lübeck

Plant residues under wooden foundation of mound of Slovanic castle Alt-Lübeck (53° 55′ N Lat, 10° 43′ E Long), ca. 5 km N of present Lübeck, Germany. Coll. 1968 and subm. 1969 by F. R. Averdieck.

KI-278.   Sambucus twigs

1030 ± 40
A.D. 920
$\delta C^{13} = -26.4\%_0$

KI-289.   Peat

1100 ± 45
A.D. 850
$\delta C^{13} = -28.3‰$

Comment (F.R.A.): very local character of mixture of swamp and ruderal flora makes palynologic zonation difficult. Expected age of wood and peat is 11th century or later.

Haithabu

Wood from Haithabu (54° 30′ N Lat, 9° 33′ E Long), ancient Viking town near Schleswig, NW Germany. Coll. by Josef Bauch and Dieter Eckstein, Ordinariat f. Holzbiol., Hamburg 80; subm. 1967 by F. R. Averdieck. *Comment* (J.B. and D.E.): samples are connected to dendrochronology of Haithabu, which is not yet connected to present. Tree rings indicate KI-242 is 280 yr older than KI-241. Measured C^{14} ages are ca. 100 yr older than expected.

KI-241.   Haithabu, Probe 4

1250 ± 40
A.D. 700
$\delta C^{13} = -25.7‰$

KI-242.   Haithabu, Probe 5

1630 ± 40
A.D. 320
$\delta C^{13} = -25.9‰$

Saelborg skull

Wood and peat overlying skull from Saelborg shore near Esbjerg (55° 30′ N Lat, 8° 27′ E Long), Denmark. Coll. 1968 by Walter Wetzel, Geol.-Paläont. Inst., Univ. Kiel; subm. 1969 by Hermann Helmuth, now Univ. Peterborough/Toronto, Canada (cf. Wetzel and Helmuth, 1970). *Comment*: Libby age indicates wood must have been redeposited.

KI-297.   Saelborg, peat

2750 ± 65
800 B.C.
$\delta C^{13} = -29.9‰$

Sandy peat, overlying skull, dated by pollen analysis (F. R. Averdieck, Inst. f. Ur- und Frühgeschichte, Univ. Kiel) in Zone IXa (according to Overbeck, 1950). *Comment* (W.W.): Libby age is too young.

KI-298.   Saelborg, wood

14,890 ± 160
12,940 B.C.
$\delta C^{13} = -25.0‰$

Budrinna series

Organic remains of burials from Budrinna, Libya (26° 42′ N Lat, 13° 48′ E Long). Coll. and subm. 1970 by Helmut Ziegert, Seminar f. Vor- u. Frühgeschichte, Univ. Hamburg. *Comment* (H.Z.): samples are from different vaults of pre-Islamite burial place. Dates will help set chronology of pre-Islamite colonization of the Fezzan. Samples, except for KI-397, lay ca. 110 to 180 cm under surface (Ziegert, 1969; 1970).

KI-392. Budr. A/6/Pr. 7

$$1360 \pm 60$$
A.D. 590
$$\delta C^{13} = -22.8\%o$$

Carbonized remains of burial.

KI-393. Budr. A/5/Pr. 7

$$1270 \pm 60$$
A.D. 680
$$\delta C^{13} = -24.2\%o$$

Carbonized remains of brain.

KI-394. Budr. A/9/Pr. 5

$$1470 \pm 110$$
A.D. 480

Carbonized remains of brain.

KI-395. Budr. A/8/Pr. 12

$$1450 \pm 55$$
A.D. 500
$$\delta C^{13} = -23.0\%o$$

Carbonized remains of brain.

KI-396. Budr. A/7/Pr. 22

$$1330 \pm 40$$
A.D. 620
$$\delta C^{13} = -21.2\%o$$

Carbonized remains of brain.

KI-397. Budr. A/11/Pr. 2 + 3

$$1530 \pm 160$$
A.D. 420
$$\delta C^{13} = -25.6\%o$$

Charcoal from fireplace above tomb, 45 cm under surface.

KI-398. Budr. A/11A/Pr. 11

$$1290 \pm 45$$
A.D. 660
$$\delta C^{13} = -22.5\%o$$

Carbonized remains of brain.

KI-399. Budr. A/10D/Pr. 1

$$1780 \pm 80$$
A.D. 170
$$\delta C^{13} = -23.9\%o$$

Twigs of tamarisc covering corpse in a vault.

KI-400. Budr. A/10B/Pr. 10

$$1840 \pm 150$$
A.D. 110
$$\delta C^{13} = -23.2\%o$$

Carbonized remains of brain.

KI-401. Budr. A/10C/Pr. 7

$$1350 \pm 50$$
A.D. 600
$$\delta C^{13} = -21.3\%o$$

Carbonized remains of brain.

1690 ± 110
KI-402.   Budr. B/3/Pr. 2
A.D. 260
$\delta C^{13} = -26.4\%_0$

Stalks of a mat underlying corpse in a vault tomb.

1780 ± 65
KI-403.   Budr. D/2/Pr. 7
A.D. 170
$\delta C^{13} = -27.8\%_0$

Carbonized remains of brain.

1050 ± 90
KI-438.   Las Tortolas
A.D. 900
$\delta C^{13} = -22.1\%_0$

Sample of a wood pile on top of Las Tortolas, 6330 m, Chile (29° 51.0′ S Lat, 69° 53.5′ W Long). Coll. 1971 and subm. by Klaus Krisch, Inst. f. Physiol. Chem., Univ. Kiel. *Comment* (K.K.): wood could have been piled during realm of Incas, for use in fire signals (summit of empire ca. A.D. 1400 to 1500).

References

Degens, E. T., 1969, Biochemistry of stable isotopes, *in*: Eglinton, G., Murphy, M. T. J. (eds.), Organic Geochemistry, Berlin, Springer Verlag, chap. 12, p. 304-329.

Enge, Günter, 1971, C^{13}- und C^{14}-Untersuchungen an rezenten Wasserproben: Staatsexamensarbeit, Kiel.

Klug, Heinz, 1968, Morphol. Studien auf den Kanarischen Inseln: Geog. Inst. Kiel Schr., v. 24, p. 3.

Kühlmorgen-Hille, G., 1963, Quantitative Untersuchungen der Bodenfauna in der Kieler Bucht und ihre jahreszeitlichen Veränderungen: Kieler Meeresforschungen, v. 19, p. 42-66.

Overbeck, Fritz, 1950, Die Moore Niedersachsens: Bremen-Horn, Niedersächsisches Amt für Landesplanung und Statistik, p. 65-68.

Seibold, E. *et al.*, 1971, Marine geology of Kiel Bay: 8th internatl. sedimentological cong., Heidelberg, Germany, 1971; Sedimentology of parts of Central Europe, Guidebook, p. 209-235.

Suess, Erwin, 1971, Diagenesis of organic matter in Baltic Sea sediments: 8th internatl. sedimentological cong., Heidelberg, Germany, 1971, abs., p. 99.

Wetzel, Walter and Helmuth, Hermann, 1970, Ein fossiles trepaniertes menschliches Stirnbein: Naturw. Ver. Schlesw.-Holst. Schr., v. 40, p. 97-100.

Williams, P. M., Gordon, L. I., 1970, Carbon-13: Carbon-12 ratios in dissolved and particulate organic matter in the sea: Deep-Sea Research, v. 17, p. 19-27.

Ziegert, Helmut, 1969, Überblick zur jüngeren Besiedlungsgeschichte des Fezzan: Berliner Geog. Abh., no. 8, 1969, p. 49-58.

———— 1970, Human cultural development and climatic conditions in the Sahara during Pleistocene times: Internatl. conf. on African geol., Ibadan, Dec. 1970.