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UNIVERSITY OF KIEL RADIOCARBON MEASUREMENTS IV

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The following dates are samples measured since publication of Kiel III (Radiocarbon, v. 10, p. 328-332). Age calculations are based on 95% of the activity of NBS oxalic-acid standard as modern value of A.D. 1950. Results are calculated with Libby half-life and reported in yr before 1950. Error corresponds to 1σ variation of sample net counting rate as well as modern standard and background, but does not include the uncertainty in C^{14} half-life and in secular C^{14} variations. Dates are not corrected for isotopic fractionation.

Most of the measurements have been obtained with a 4.5-L CO_2 counter; smaller samples were measured in a 3-L counter, and about 20% of the samples were measured with both counters.

In 1968, we constructed two additional CO_2 counters. One is a proportional counter with a separate ring counter for shielding cosmic radiation. The other is an Oeschger-type counter (Hänsel, 1968). Both counters are made of commercially available copper. Insulating parts are built of teflon heated in vacuum for several days at 180°C. Nevertheless, the Oeschger counter still degasses, but it is possible to measure a sample up to one week in this counter. For working values, see Table 1.

TABLE 1
CO_2 counters of the C^{14} Laboratory, Kiel

Counter	a	b	c	d
Type	Prop. counter with 36 separate GM-counters for screening	28	Prop. counter with a ring counter for screening	Oeschger counter
Internal shielding	Quartz tube as cathode	—	—	75 μ Hostaphan foil with vaporized Aluminum on both sides to separate inner and outer part
Effective volume	4.5 L	3.0 L	3.0 L	4.2 L (total 12.6 L)
Pressure	500 torr	600 torr	1000 torr	500 torr
Recent value (95% of oxalic acid, calculated for A.D. 1950)	21.28	13.94	22.54	16.51 cpm
Background	12.69	13.35	9.46	3.99 cpm

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Counting rates of the last dating equipment (guard counter, central counter, coincidences of inner and outer part, and central pulses, which do not coincide with a guard pulse) are punched in a tape every 100th minute. When measurement is finished the tape can be given to computer without any corrections and can be evaluated by an ALGOL program. We intend to give the counting rates of all 4 dating equipments on a single tape perforator (for details, see Hänsel, 1968).

I. GEOLOGIC SAMPLES

Sehestedt series

Peat samples from bog (53° 26′ N Lat, 8° 18′ E Long) at Jadebusen (German shore of North Sea). Coll. for investigation of settlement in NW Germany by R. Wiermann, who also made pollen analysis, Bot. Inst., Univ. Münster. Subm. 1965 by F. Overbeck, Bot. Inst., Univ. Kiel. *Comment* (R.W.): samples KI-162 and KI-161 show beginning, KI-160 shows end of interruption in settlement. Pollen of KI-159 to KI-155 represent intensive medieval agriculture, which stops in KI-155. Youngest interruption is represented by KI-154 and KI-153.

General Comment: substituting Libby-age by real astronomical age (for calculation, see Willkomm, 1968), ages of samples correspond within statistical error with growth rate of 150 cm per millennium.

KI-153.	**Seh-I,1**	**4 to 9 cm depth**	**350 ± 50** **A.D. 1600**
KI-154.	**Seh-I,2**	**9 to 14 cm depth**	**475 ± 55** **A.D. 1475**
KI-155.	**Seh-I,3**	**50 to 55 cm depth**	**1060 ± 85** **A.D. 890**
KI-156.	**Seh-I,4**	**55 to 60 cm depth**	**840 ± 45** **A.D. 1110**
KI-157.	**Seh-I,5**	**60 to 65 cm depth**	**920 ± 35** **A.D. 1030**
KI-158.	**Seh-I,6**	**65 to 70 cm depth**	**900 ± 55** **A.D. 1050**
KI-159.	**Seh-I,7**	**70 to 75 cm depth**	**950 ± 30** **A.D. 1000**
KI-160.	**Seh-I,8**	**145 to 150 cm depth**	**1305 ± 45** **A.D. 595**
KI-161.	**Seh-I,9**	**190 to 195 cm depth**	**1830 ± 50** **A.D. 120**
KI-162.	**Seh-I,10**	**195 to 200 cm depth**	**1750 ± 60** **A.D. 200**
KI-163.	**Seh-I,11**	**220 to 225 cm depth**	**1930 ± 50** **A.D. 20**

Large amounts of *Carpinus* pollen.

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KI-164. Seh-I,12 235 to 240 cm depth **2015 ± 40 / 65 B.C.**

Large amounts of *Fagus* pollen.

Meerhusener Moor series

Peat samples from "Meerhusener Moor", bog (53° 32′ N Lat, 7° 30′ E Long, r 2597 740, h 5935 130) near Aurich, NW Germany. Coll. 1967 and subm. 1968 by H. Usinger, Bot. Inst., Univ. Kiel. *Comment* (H.U.): KI-252 lay directly below artificial sandy way across bog, which later was abandoned and overgrown by bog. KI-251 comes from layer directly above way.

KI-251. 84 cm depth **1830 ± 65 / A.D. 120**

KI-252. 151 cm depth **2440 ± 40 / 490 B.C.**

Keitum series

Peat from Tinnum, Keitum, and Archsum on Sylt I. (54° 54′ N Lat, 8° 23′ E Long), NW Germany. Coll. and subm. 1967 by D. Hoffman, Germany by R. Wiermann, who also made pollen analysis, Bot. Inst., Geol. Inst., Univ. Kiel. *Comment* (D.H.): a few thousand yr ago, lower part of E Sylt I. was covered by bogs, which now yield peat layer up to 180 cm thickness. Due to following transgression by North Sea, this layer was covered by clay (marshy soil). Peat samples were taken from boundary of peat to clay at different locations to date time of transgression.

For each sample, location, coordinates of Topographische Karte 1116 Morsum and depth are given.

KI-99. Tinnum, r 3456 300, h 6085 620, 50 cm **2000 ± 85 / 50 B.C.**

KI-202. Tinnum, r 3456 340, h 6085 070, 140 cm **3070 ± 60 / 1120 B.C.**

KI-96. Teidishoog, r 3456 220, h 6084 370, 40 cm **430 ± 45 / A.D. 1520**

KI-97. Tinnum, r 3456 500, h 6084 090, 450 cm **3300 ± 50 / 1350 B.C.**

KI-204. Tinnum, r 3456 300, h 6085 620, 30 cm **1710 ± 60 / A.D. 240**

KI-95. Keitum, r 3460 480, h 6084 460, 500 cm **4620 ± 50 / 2670 B.C.**

KI-200. Keitum, r 3460 510, h 6084 430, 385 cm **3690 ± 50 / 1740 B.C.**

KI-100. Keitum, r 3459 100, h 6083 570, 240 cm **3820 ± 60 / 1870 B.C.**

KI-201.	**Keitum, r 3459 550, h 6082 840, 240 cm**	**3510 ± 55** **1560 B.C.**
KI-98.	**Archsum, r 3462 050, h 6081 250, 220 cm**	**3255 ± 40** **1305 B.C.**
KI-203.	**Archsum, r 3461 790, h 6080 330, 250 cm**	**3650 ± 40** **1700 B.C.**

Föhr Island

Wood and peat beneath surface of mud near shore of Föhr I. (54° 41′ N Lat, 8° 27′ E Long), Germany. Coll. and subm. 1967 by F. Rüth for dating transgression of region by North Sea.

KI-231.	**Wood of trunk, 2 to 5 cm under surface of mud**	**4100 ± 60** **2150 B.C.**
KI-232.	**Root of tree, 2 to 5 cm depth**	**4240 ± 60** **2290 B.C.**
KI-233.	**Peat, 10 to 15 cm depth**	**4230 ± 75** **2280 B.C.**
KI-234.	**Root of tree, 10 to 15 cm depth**	**4150 ± 60** **2200 B.C.**

Kieler Bucht series

Peat and wood of borings from bottom of Baltic Sea. Samples coll. for dating transgression of Kieler Bucht. KI-207 to KI-215 coll. 1962 to 1966 and subm. 1967 by F. Werner; KI-216 and KI-217 coll. 1966 and subm. 1967 by F. C. Kögler, both Geol. Inst., Univ. Kiel.

KI-207. **9430 ± 85**
7480 B.C

Peat, 34 to 43 cm depth, 31 m below sea level (−31 m) (54° 41.8′ N Lat, 10° 9.5′ E Long).

KI-208. **9780 ± 100**
7830 B.C.

Peat, like KI-207, 43 to 52 cm depth.

KI-209. **8150 ± 80**
6200 B.C.

Peat, 70 to 80 cm depth, −19 m (54° 30.2′ N Lat, 10° 2′ E Long).

KI-210. **8250 ± 130**
6300 B.C.

Peat, like KI-209, 91 to 102 cm depth.

KI-211. **7819 ± 120**
5860 B.C.

Wood, 20 cm depth, −19 m (54° 35.9′ N Lat, 10° 20.6′ E Long).

KI-214. **7550 ± 140**
5600 B.C.

Peat, 17 to 24 cm depth, −12.5 m (54° 25.4′ N Lat, 10° 55.9′ E Long).

7300 ± 100
KI-215. **5350 B.C.**
Wood, like KI-214, 25 cm depth.

4840 ± 110
KI-216. **2890 B.C.**
Peat, 92 to 95 cm depth, −2.5 m (54° 21′ N Lat, 11° 4′ E Long).

5940 ± 75
KI-217. **3990 B.C.**
Peat, like KI-216, 115 to 119 cm depth.

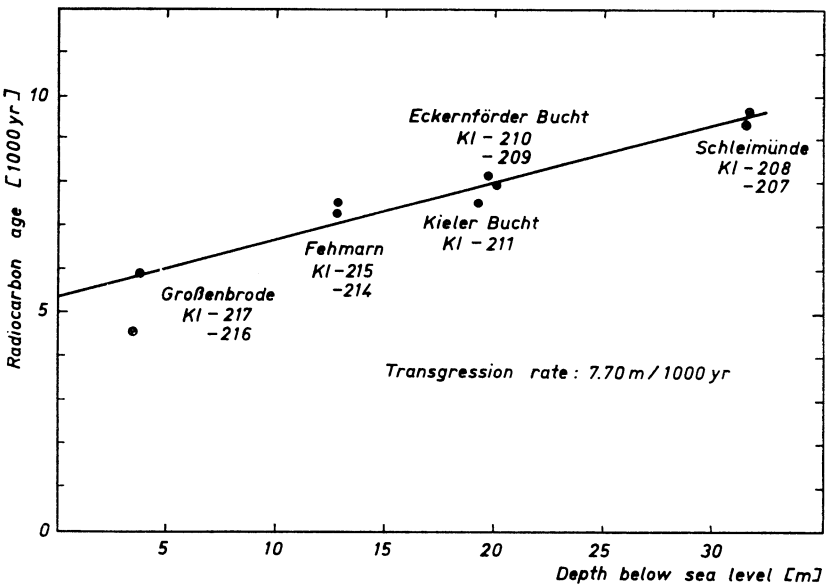

Fig. 1. Transgression of Baltic Sea (Western Part).

Lake Valencia

Calcareous sediments of Lake Valencia (10° 15′ N Lat, 67° 41′ W Long), Venezuela. Coll. and subm. 1967 and 1968 by F. Gessner, Inst. f. Meereskunde, Univ. Kiel.

General Comment: because modern activity of these samples is unknown, we give only δC^{14} values without age calculation.

KI-93. $\delta C^{14} = -3.4 \pm 0.5‰$
Snail shells, 5 cm depth at 4 m water depth.

KI-247. $\delta C^{14} = -31.8 \pm 0.6‰$
Sediment of partly inorganic origin, now several m above lake level.

KI-248. $\delta C^{14} = -38.8 \pm 0.4‰$
Like 247, but from a lower level.

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II. ARCHAEOLOGIC SAMPLES

4210 ± 60

KI-89. Varna **2260 B.C.**

Wood from lake dwellings, now under sea level, at Varna (43° 12′ N Lat, 27° 55′ E Long), Bulgaria. Coll. 1965 by Mrs. Tonceva, subm. by F. R. Averdieck and R. Kenk, Inst. f. Ur- und Frühgeschichte, Univ. Kiel.

3140 ± 65

KI-91. Hüsby **1190 B.C.**

Wood of coffin of Bronze age, found at Hüsby (54° 30′ N Lat, 9° 29′ E Long), Germany. Coll. 1966 and subm. 1967 by K. Kersten, Schleswig-Holsteinisches Landesmus., Schleswig, Germany. Tree coffin lay in center of tumulus 200 cm deep.

3160 ± 75

KI-221. Hüsby **1210 B.C.**

Moss and twigs covering coffin KI-91. Coll. 1966 and subm. 1967 by F. R. Averdieck.

Westerkappeln series

Charcoal from 2 different layers within dune near Westerkappeln (r 3419 760, h 5803 580), Germany. Coll. 1966 and subm. 1967 by K. Günther, Landesmus. f. Vor- und Frühgeschichte Münster, Germany. Samples were supposed to represent 2 different cultures of late Palaeolithic or Mesolithic age (Winkelmann, 1959).

3610 ± 45

KI-205. Westerkappeln 1966/2 **1660 B.C.**

Lower cultural layer, 30 cm under KI-206.

3550 ± 65

KI-206. Westerkappeln 1966/1 **1600 B.C.**

Comment (K.G.): possibly C^{14} dates, which are much too young, can be explained by wind blowing, which brought essentially younger charcoal into deeper layers.

Möllenknob series

Excavations near Archsum (54° 52.7′ N Lat, 8° 22.5′ E Long) on Sylt I., Germany (Radiocarbon, 1968, v. 10, p. 331). Coll. 1967 by R. Kenk; subm. 1968 by G. Kossack and F. R. Averdieck.

3060 ± 65

KI-244. Möllenknob 245 (2) **1110 B.C.**

Cereals, weeds, and small pieces of charcoal from small ditches. Younger Bronze age or older pre-Roman Iron age.

2055 ± 60

KI-245. Möllenknob 288 (17) **105 B.C.**

Cereals from storage vessel of a burnt house. Archaeol. estimate ca. A.D. 0.

KI-261. K.S.B. 107 **1560 ± 40** **A.D. 390**

Coll. 1967 and subm. 1968 by K. W. Struve, Landesmus. f. Vor- und Frühgeschichte Schleswig, Germany. *Comment* (K.W.S.): part of disc-wheel, which lay together with 2 other disc-wheels of Neolithic or Bronze-age type near Alt-Bennebek (54° 23′ N Lat, 9° 24′ E Long), Germany.

KI-262. Grammdorf 1960/WS **1420 ± 40** **A.D. 530**

Coll. 1960 and subm. 1968 by K. W. Struve. *Comment* (K.W.S.): charcoal from cross section of rampart near Grammdorf (54° 16′ N Lat, 10° 49′ E Long), Germany. Intended to date early Slavonian ceramics (Struve, 1961, 1969).

KI-263. Scharstorf/Ws 2, 1959 **1515 ± 65** **A.D. 435**

Coll. 1959, subm. 1968 by K. W. Struve. *Comment* (K.W.S.): part of lowest layer of wooden base of rampart, found near Scharstorf (54° 14′ N Lat, 10° 19′ E Long), Schleswig-Holstein, Germany. Intended to date Slavonian castles (Struve, 1961).

KI-264. Warder 1959-Rost **1130 ± 55** **A.D. 820**

Coll. 1959, subm. 1968 by K. W. Struve. *Comment* (K.W.S.): charcoal beneath duck-boards of Slavonian settlement near Warder (53° 59′ N Lat, 10° 23′ E Long), Schleswig-Holstein, Germany (Struve, 1961).

KI-87. **2810 ± 80** **860 B.C.**

KI-272. **2400 ± 40** **450 B.C.**

Charcoal from fireplace (r 3539 250, h 6026 250) near Fockbek/Rendsburg, Schleswig-Holstein, Germany. Coll. and subm. 1966 (KI-87) and 1968 (KI-272) by W. Heinrich, Kiel. Fireplace was thought to be from Mesolithic period because of presence of many fragments of flint. C^{14} dates KI-87 and 2nd sample, KI-272, coll. 1½ yr later did not confirm expectation.

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