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UNIVERSITY OF BONN
NATURAL RADIOCARBON MEASUREMENTS VI

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Continuation of radiocarbon measurements, mainly on ground water, soil, and subhydric sediment samples. Sample preparation was described earlier (Scharpenseel and Pietig, 1969).

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SAMPLE DESCRIPTIONS

I. GROUND WATER SAMPLES

A Cologne 07 sand aquifer

After 3 yr repetitions of radiocarbon measurements from 1967 to 1969 (R., 1968, v. 10, p. 8-28; 1969, v. 11, p. 3-14; 1970, v. 12, p. 19-39) a 4th sampling and measurement was done in 1971. Since the 3 sets of dates (1967-1969) did not allow flow speed calculation from movement of bomb-carbon peak, due to geologic ruptures, mixing and unsteady flow-pattern (Tamers and Scharpenseel, 1970), further tests at intervals of several yr are expected to yield new data.

Samples Kölner Bucht	Measured C^{14} age
BONN-1227. Synthern 93730/4 (50° 58′ N Lat, 6° 47′ E Long)	1940 ± 100 A.D. 10
BONN-1228. Glessen 93715/1 (50° 58′ N Lat, 6° 45′ E Long)	2050 ± 60 100 B.C.
BONN-1229. Dansweiler 93732/4 (50° 57′ N Lat, 6° 46′ E Long)	10,270 ± 160 8320 B.C.
BONN-1230. Widdersdorf 83002/2 (50° 58′ N Lat, 6° 50′ E Long)	1470 ± 70 A.D. 480
BONN-1231. Ingendorf 83114/3 (51° 1′ N Lat, 6° 44′ E Long)	7840 ± 220 5890 B.C.

Samples Kölner Bucht	Measured C^{14} age
	22,610 ± 500
BONN-1232. Königsdorf 83131/3 (50° 56′ N Lat, 6° 46′ E Long)	20,660 B.C.
	6220 ± 110
BONN-1233. Bottenbroich 85075/4 (50° 55′ N Lat, 6° 44′ E Long)	4270 B.C.
	8860 ± 120
BONN-1234. Buschbell 85082/2 (50° 56′ N Lat, 6° 48′ E Long)	6910 B.C.
	10,600 ± 140
BONN-1235. Herbertzkaul 85197/3 (50° 54′ N Lat, 6° 48′ E Long)	8650 B.C.

Comment: samples from piezometric tubes Ingendorf and Königsdorf shifted towards considerably older age, Widdersdorf dropped correspondingly. Two further sets of samples in 2 or 3 yr intervals expected to elucidate rather complicated flow and recharge pattern of highly exploited aquifer.

II. SOIL SAMPLES

Methods of pretreating soil samples are compared and reviewed elsewhere (Scharpenseel and Pietig, 1969; Scharpenseel, 1972).

A. Spain

Dates belong to continued natural radiocarbon measurements in Vertisols (see R., 1973, v. 15, p. 23-25, II A to D). Profiles are from Andalusia, S Spain with help of local pedologists.

Vertisol, rich in swelling and cracking clay, La Rimconada (Sevilla), Casas vacas, 20m above NN, 18.5°C ann. t, 559mm ann. rainfall, plain (37° 23′ N Lat, 2° 12′ W Long). Samples from same location.

BONN-1388.	Vertisol La Rimconada, 1.7% C, Ap 20 to 30cm	590 ± 70 A.D. 1360
BONN-1389.	0.8% C, ABv 40 to 50cm	1570 ±80 A.D. 380
BONN-1390.	0.6% C, Bv 75 to 95cm	2840 ± 160 890 B.C.
BONN-1391.	0.4% C, BvCa1 125 to 145cm	3160 ± 160 1210 B.C.
BONN-1392.	0.3% C, BvCa2 160 to 180cm	6470 ± 130 4520 B.C.

Vertisol, Carmona, km 10.5 Carmona-Arahal St., 75m above NN, 19°C ann. t., 540mm ann. rainfall, marl, (37° 25′ N Lat 1° 55′ W Long). Samples from same location.

BONN-1393.	Vertisol, Carmona, 0.7% C, Bv1 10 to 30cm	2410 ± 70 460 B.C.
BONN-1394.	1.0% C, Bv2 30 to 50cm	3150 ± 80 1200 B.C.
BONN-1395.	2.8% C, Bv3 80 to 100cm	4480 ± 90 2530 B.C.
BONN-1396.	1.0% C, Ccal 130 to 140cm	5510 ± 100 3560 B.C.
BONN-1397.	0.5% C, Cca2 >150cm	6650 ± 120 4700 B.C.

Vertisol, Los Palacios, Farm Torbiscal, 18°C ann. t., 600mm ann. rainfall, alluvial soil, (37° 4′ N Lat, 2° 10′ W Long). Samples from same location.

BONN-1398.	Vertisol, Los Palacios, 3.4% C, Ap1 5 to 15cm	1580 ± 70 A.D. 370
BONN-1399.	2.6% C, ApBv1 20 to 35cm	2080 ± 80 130 B.C.
BONN-1400.	2.3% C, Bv21 35 to 50cm	2580 ± 70 630 B.C.
BONN-1401.	2.3% C, Bv21 55 to 70cm	6350 ± 140 4400 B.C.
BONN-1402.	3.2% C, Bv21 80 to 100cm	4940 ± 90 2990 B.C.
BONN-1403.	0.9% C, Bv22 110 to 130cm	8850 ± 130 6900 B.C.
BONN-1405.	0.3% C, Cca1 170 to 200cm	7660 ± 130 5710 B.C.
BONN-1406.	0.4% C, Cca2 >200cm	7510 ± 140 5560 B.C.

Vertisol, El Arahal, Farm l'Estrella, 40km E Sevilla, 60 to 80m above NN, 19.5°C ann. t, 518mm ann. rainfall, plain, alluvial sand cover on top of Vertisol, (37° 15′ N Lat, 1° 53′ W Long). Samples from same location.

BONN-1407.	Vertisol, El Arahal, 1.4% S, Ap1 5 to 15cm	108.4 ± 0.6% Modern

BONN-1408.	1.0% C, Ap2 17 to 30cm	690 ± 70 A.D. 1260
BONN-1409.	0.3% C, Bvl 32 to 42cm	2320 ± 90 370 B.C.
BONN-1410.	1.4% C, Bv2 47 to 59cm	3640 ± 50 1690 B.C.
BONN-1411.	1.4% C, Bv2 61 to 70cm	3480 ± 100 1530 B.C.
BONN-1413.	0.2% C, CcaBv3 90 to 104cm	3520 ± 230 1570 B.C.

Vertisol, Carmona, Far, la motilla chica, 160m above NN, 19°C ϕ ann. t, 540mm ϕ ann. rainfall, plain, pebbles of old Quaternary terrace sediment intermixed, (37° 28′ N Lat, 1° 49′ W Long). Samples from same location.

BONN-1417.	Vertisol, Carmona, Far, 2.4% C, Ap 5 to 12cm	103.3 ± 0.5% Modern
BONN-1418.	1.5% C, Ap 16 to 25cm	730 ± 70 A.D. 1220
BONN-1419.	1.2% C, AB 36 to 48cm	1710 ± 80 A.D. 240
BONN-1420.	1.0% C, B21 61 to 82cm	2740 ± 70 790 B.C.
BONN-1421.	0.2% C, B22 83 to 94cm	2750 ± 140 800 B.C.
BONN-1423.	0.3% C, II Cca 108 to 128cm	3440 ± 290 1490 B.C.

Samples coll. and subm. 1970 by W. Kerpen and H. Gewehr, Inst. Bodenkunde, Bonn. *Comment*: last 2 profiles, El Arahal and Carmona Far show to the full depth about the same apparent mean residence time (Scharpenseel, 1972), indicating transport of surface material through cracks and self-mulching. La Rimconada and Carmona profiles have an age break at ca. 100cm, Los Palacios at ca. 70cm with steep increase of C-residence times in downward direction, below the crack zone.

B. Portugal

The Portugal series contributes 7 Barros profiles to the natural radiocarbon measurements in Vertisols. Profiles are selected in central and S Portugal with help of local pedologists.

Vertisol, black Barros, Béja, free of $CaCO_3$, 250m above NN (38° 0′ N Lat, 1° 16′ W Long). Samples from same location.

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BONN-1425.	Vertisol, Beja, 0.6% C, Ap 2 to 7cm	101.0 ± 0.4% Modern
BONN-1426.	0.9% C, B11 10 to 18cm	330 ± 100 A.D. 1620
BONN-1427.	1.9% C, B12 24 to 37cm	1550 ± 70 A.D. 400
BONN-1428.	3.0% C, B13 43 to 52cm	1220 ± 70 A.D. 730
BONN-1429.	3.1% C, B14 58 to 72cm	2000 ± 120 50 B.C.
BONN-1432.	0.2% C, Cca 120 to 130cm	3070 ± 140 1120 B.C.

Brown Mediterranean soil till Vertisol, Safara-Camauros Farm, 180m above NN, hilly, (38° 5′ N Lat, 1° 52′ W Long). Samples from same location.

BONN-1433.	Vertisol, Safara-Camauros, 0.4% C, Ap 20 to 32cm	300 ± 80 A.D. 1650
BONN-1434.	0.3% C, BC 45 to 55cm	2430 ± 70 480 B.C.
BONN-1436.	0.3% C, BC 55 to 69cm	1870 ± 90 A.D. 80
BONN-1437.	0.3% C, C1 70 to 90cm	2140 ± 220 190 B.C.

Black Vertisol, not totally free of $CaCO_3$, Safara (field), 197m above NN, hilly, (38° 5′ N Lat, 1° 51′ W Long). Samples from same location.

BONN-1438.	Vertisol, Safara, field, 0.4% C, 1B 23 to 32cm	970 ± 70 A.D. 980
BONN-1439.	0.5% C, IB 33 to 44cm	1490 ± 80 A.D. 460
BONN-1440.	0.8% C, IB 44 to 54cm	2190 ± 80 240 B.C.
BONN-1441.	0.3% C,IIBca 56 to 67cm	2230 ± 190 280 B.C.
BONN-1442.	0.3% C, IICca 72 to 95cm	1860 ± 100 A.D. 90

Red Vertisol, secondarily recalcified, Salvada-Beja, 195m above NN, slightly slopy, (37° 56′ N Lat, 1° 20′ W Long). Samples from same location.

BONN-1443.	Vertisol, Salvada-Beja, 1.0% C, Ap 15 to 32cm	103.3 ± 0.4% Modern
BONN-1444.	1.2% C, B 41 to 51cm	104.4 ± 0.5% Modern
BONN-1445.	0.5% C, B 52 to 65cm	600 ± 70 A.D. 1350
BONN-1446.	0.5% C, BC 71 to 85cm	1380 ± 70 A.D. 570

Roman Cereal silo in Vertisol profile, Beja-Serpa, 150m above NN, street cut, hilly, (37° 54′ N Lat, 1° 27′ W Long).

BONN-1447.	Cereal silo Vertisol, Beja-Serpa, 0.3% C, 0 to 20cm from deepest point of cut	5150 ± 100 3200 B.C.
BONN-1451.	0.8% C, 35 to 50cm	1320 ± 70 A.D. 630

Dark red-brown Vertisol, not completely free of $CaCO_3$, Montes velhos Aljustrel, 104m above NN, slightly slopy (37° 55′ N Lat, 0° 57′ W Long). Samples from same location.

BONN-1452.	Dark red-brown Vertisol, Montes-velhos Aljustrel, 0.8% C, Ap 28 to 43cm	960 ± 100 A.D. 990
BONN-1453.	0.6% C, B 47 to 62cm	1620 ± 70 A.D. 330
BONN-1454.	0.5% C, B 67 to 83cm	2240 ± 80 290 B.C.
BONN-1455.	0.5% C, B 87 to 103cm	1970 ± 150 20 B.C.
BONN-1457.	0.3% C, Cca 140 to 150cm	2000 ± 110 50 B.C.

Red-brown Vertisol almost purely montmorollinitic, Terra Grande de Lisboa, Tapaiao da Ajuda, univ. campus, near Lisboa, 73m above NN, 16.9°C ϕ ann. t., upper slope, (38° 42′ N Lat, 0° 11′ W Long). Samples from same location.

BONN-1458.	Red-brown Vertisol, Tapaiao de Ajuda, 3.8% C, Ap 10 to 21cm	470 ± 70 A.D. 1480
BONN-1459.	1.4% C, Bv 35 to 50cm	1760 ± 80 A.D. 190
BONN-1460.	1.2% C, Bv 56 to 70cm	2530 ± 80 580 B.C.

BONN-1461.	0.9% C, Bv 77 to 91cm	2580 ± 100 630 B.C.
BONN-1462.	0.5% C, BC 98 to 106cm	3170 ± 80 1220 B.C.
BONN-1463.	0.3% C, Cv 115 to 130cm	8900 ± 170 6950 B.C.

Samples coll. and subm. 1970 by W. Kerpen and H. Gewehr. *Comment*: most profiles are rather shallow and wholly within cracking zone, apparent mean residence times are low. Just the last red-brown Vertisol Tapaiao de Ajuda shows jump of age in Cv horizon, which probably lies outside normal depth of cracking.

C. Australia

The Australia series comprises 2 Gilgai sites with 1 mound and 1 depression profile each. Besides the framework of global Vertisol profile studies, comparison of apparent mean residence time vs. depth in profiles, on mounds and in depressions, was expected to reveal Vertisol dynamics, (Blackburn and Coppi, 1970).

Vertisol, Lillimur, Kaniva dist., Victoria, Gilgai mound, (36° 27′ S Lat, 141° 6′ E Long). Samples from same location.

BONN-1465.	Vertisol, Lillimur, Gilgai mound, 3.2% C 0 to 10cm	100.0 ± 0.4% Modern
BONN-1466.	4.1% C, 10 to 20cm	1130 ± 70 A.D. 820
BONN-1467.	3.4% C, 20 to 30cm	1240 ± 80 A.D. 710
BONN-1468.	2.4% C, 30 to 40cm	2620 ± 80 670 B.C.
BONN-1469.	1.8% C, 40 to 50cm	2520 ± 80 570 B.C.
BONN-1470.	0.5% C, 50 to 60cm	2600 ± 70 650 B.C.
BONN-1471.	0.5% C, 60 to 70cm	2410 ± 80 460 B.C.
BONN-1472.	0.5% C, 70 to 80cm	2780 ± 80 830 B.C.
BONN-1473.	0.4% C, 80 to 90cm	4120 ± 110 2170 B.C.
BONN-1474.	0.3% C, 90 to 100cm	3800 ± 140 1850 B.C.

BONN-1475.	0.3% C, 100 to 110cm	4680 ± 90 2730 B.C.
BONN-1476.	0.3% C, 110 to 120cm	5160 ± 110 3210 B.C.
BONN-1477.	0.3% C, 120 to 130cm	5880 ± 180 3930 B.C.
BONN-1478.	0.2% C, 130 to 140cm	5100 ± 140 3150 B.C.
BONN-1479.	0.2% C, 140 to 150cm	4190 ± 100 2240 B.C.
BONN-1481.	0.2% C, 150 to 160cm	4460 ± 350 2510 B.C.
BONN-1482.	0.3% C, 160 to 170cm	4960 ± 250 3010 B.C.
BONN-1483.	0.2% C, 170 to 180cm	4930 ± 210 2980 B.C.
BONN-1484.	0.1% C, 180 to 190cm	4480 ± 200 2530 B.C.
BONN-1485.	0.1% C, 190 to 200cm	4950 ± 150 3000 B.C.

Vertisol, Lillimur, Kaniva dist., Victoria, Gilgai depression, (36° 27° S Lat, 141° 6′ E Long). Samples from same location.

BONN-1486.	Vertisol, Lillimur, Gilgai depression 4.5% C, 0 to 5cm	109.4 ± 0.5% Modern
BONN-1487.	1.1% C, 5 to 10cm	102.7 ± 0.6% Modern
BONN-1488.	0.6% C, 10 to 17cm	104.0 ± 0.4% Modern
BONN-1489.	0.6% C, 17 to 20cm	108.8 ± 0.6% Modern
BONN-1490.	0.7% C, 20 to 30cm	112.1 ± 0.5% Modern
BONN-1491.	0.6% C, 30 to 40cm	116.5 ± 0.8% Modern
BONN-1492.	0.5% C, 40 to 50cm	112.8 ± 0.5% Modern
BONN-1493.	0.4% C, 50 to 60cm	1380 ± 110 A.D. 570

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BONN-1494.	0.5% C, 60 to 70cm	103.9 ± 0.4% Modern
BONN-1495.	0.3% C, 70 to 80cm	1530 ± 100 A.D. 420
BONN-1496.	0.3% C, 80 to 90cm	2150 ± 100 200 B.C.
BONN-1497.	0.3% C, 90 to 100cm	700 ± 120 A.D. 1250
BONN-1498.	0.3% C, 100 to 110cm	590 ± 80 A.D. 1360
BONN-1499.	0.3% C, 110 to 120cm	1230 ± 100 A.D. 720
BONN-1501.	0.2% C, 130 to 140cm	1520 ± 250 A.D. 430
BONN-1502.	0.1% C, 140 to 150cm	480 ± 80 A.D. 1470
BONN-1503.	0.2% C, 150 to 160cm	390 ± 250 A.D. 1560
BONN-1504.	0.2% C, 160 to 170cm	690 ± 280 A.D. 1260
BONN-1505.	0.2% C, 170 to 180cm	1110 ± 160 A.D. 840
BONN-1506.	0.2% C, 180 to 190cm	2280 ± 150 330 B.C.
BONN-1507.	0.3% C, 190 to 200cm	1680 ± 150 A.D. 270

Vertisol, Miram, Kaniva dist., Victoria, Gilgai mound, (36° 28′ S Lat, 141° 21′ E Long). Samples from same location.

BONN-1508.	Vertisol, Miram, Gilgai mound, 1.8% C, 0 to 10cm	119.9 ± 0.4% Modern
BONN-1509.	0.9% C, 10 to 20cm	107.9 ± 0.5% Modern
BONN-1510.	0.5% C, 20 to 30cm	104.8 ± 0.6% Modern
BONN-1511.	0.6% C, 30 to 40cm	560 ± 90 A.D. 1390
BONN-1512.	0.3% C, 40 to 50cm	710 ± 70 A.D. 1240

BONN-1513.	0.3% C, 50 to 60cm	750 ± 70 A.D. 1200
BONN-1514.	0.5% C, 60 to 70cm	1610 ± 70 A.D. 340
BONN-1515.	0.3% C, 70 to 80cm	1110 ± 100 A.D. 840
BONN-1516.	0.3% C, 80 to 90cm	2100 ± 80 150 B.C.
BONN-1517.	0.4% C, 90 to 100cm	3110 ± 120 1160 B.C.
BONN-1518.	0.3% C, 100 to 110cm	3470 ± 130 1520 B.C.
BONN-1519.	0.3% C, 110 to 120cm	4060 ± 120 2110 B.C.
BONN-1520.	0.5% C, 120 to 130cm	5170 ± 130 3220 B.C.
BONN-1521.	0.3% C, 130 to 140cm	5410 ± 130 3460 B.C.
BONN-1522.	0.3% C, 140 to 150cm	5940 ± 160 3990 B.C.
BONN-1523.	0.2% C, 150 to 160 cm	5920 ± 160 3970 B.C.
BONN-1524.	0.2% C, 160 to 170cm	8050 ± 160 6110 B.C.
BONN-1525.	0.2% C, 170 to 180cm	8440 ± 110 6490 B.C.
BONN-1526.	0.2% C, 180 to 190cm	8140 ± 180 6190 B.C.
BONN-1527.	0.2% C, 190 to 200cm	8530 ± 250 6580 B.C.

Vertisol, Miram, Kaniva dist., Victoria, Gilgai depression, (36° 28′ S Lat, 141° 21′ E Long). Samples from same location.

BONN-1528.	Vertisol, Miram, Gilgai depression, 4.9% C, 0 to 5cm	102.3 ± 0.6% Modern
BONN-1529.	2.1% C, 5 to 10cm	101.0 ± 0.5% Modern
BONN-1530.	0.8% C, 10 to 20cm	110.6 ± 0.5% Modern

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BONN-1531.	0.9% C, 20 to 30cm	106.8 ± 0.7% Modern
BONN-1532.	0.8% C, 30 to 40cm	101.1 ± 0.4% Modern
BONN-1533.	0.5% C, 40 to 50cm	108.2 ± 0.5% Modern
BONN-1534.	0.4% C, 50 to 60cm	780 ± 80 A.D. 1170
BONN-1535.	0.4% C, 60 to 70cm	810 ± 70 A.D. 1140
BONN-1536.	0.4% C, 70 to 80cm	1070 ± 110 A.D. 880
BONN-1537.	0.3% C, 80 to 90cm	3380 ± 290 1430 B.C.
BONN-1538.	0.2% C, 90 to 100cm	3660 ± 140 1710 B.C.
BONN-1539.	0.2% C, 100 to 110cm	3790 ± 330 1840 B.C.
BONN-1540.	0.2% C, 110 to 120cm	4750 ± 320 2800 B.C.
BONN-1541.	0.2% C, 120 to 130cm	4990 ± 240 3010 B.C.
BONN-1542.	0.2% C, 130 to 140cm	5300 ± 260 3350 B.C.
BONN-1543.	0.2% C, 140 to 150cm	5720 ± 440 3770 B.C.
BONN-1544.	0.2% C, 150 to 160cm	4880 ± 320 2930 B.C.
BONN-1545.	0.4% C, 160 to 170cm	6730 ± 200 4780 B.C.
BONN-1546.	0.2% C, 170 to 180cm	7540 ± 390 5590 B.C.
BONN-1547.	0.2% C, 180 to 190cm	8330 ± 400 6380 B.C.
BONN-1548.	0.2% C, 190 to 200cm	8450 ± 260 6500 B.C.

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Samples coll. and subm. 1970 by G. Blackburn, CSIRO, Div. Soils, Adelaide. *Comment*: Gilgai Lillimur shows extremely different age vs. depth profiles on mounds and in depressions with lagging apparent mean residence time in the depression due to excessive deposits of surface material in dry-season cracks. Mound profile is also unusual in that 2 zones of almost homogenous apparent mean residence time are differentiated (30 to 80 cm, ca. 2500 yr, 80 to 200cm, ca. 4500 to 5000 yr). In Gilgai Miram, apparent mean residence times are higher in mound and depression as well, up to 8500 yr. Mound and depression profiles both are to a level of ca. 80cm, strongly intermixed with surface material, especially in the depression profile.

D. Germany

Fossil Ah, Eberspoint, 10km W Freising, 100cm under loess-loam (eroded Hapludalf). Time of chernozem formation in Bavaria is questioned (48° 30′ N Lat, 11° 40′ E Long).

BONN-1464. **6160 ± 90**
4210 B.C.

Fossil A-Horizon, Ezerspoint, 2.6% C, 100cm. Sample coll. and subm. 1971 by U. Schwertmann, Inst. Bodenkunde, Techn. Univ. Munich. *Comment*: result agrees well with apparent mean residence time found in AC transition zone of recent chernozem profiles in other parts of Germany (Scharpenseel, 1972).

Fossil A horizon, and charcoal in terrace brown earth, 5km S Siegenburg, Abens valley, N Bacaria, (48° 46′ N Lat, 11° 50′ E Long). Samples from same location.

BONN-1648. **2270 ± 70**
320 B.C.

Fossil A-horizon, terrace Abens valley, Siegenburg, 60 to 80cm.

BONN-1649. **1220 ± 80**
A.D. 730

Charcoal fireplace, 1m ϕ.

BONN-1651. **1460 ± 70**
A.D. 490

Charcoal from different fireplace, 150cm below sand blanket. Samples Coll. and subm. 1971 by U. Schwertmann. *Comment*: dates alluviation of material embedding fossil A-horizon and fireplaces.

Humus horizons in high flood loam, Hapludalf, on nether terrace of Rhine R., gravel pit Horn, Bonn-Hersel, (50° 43′ N Lat, 7° 8′ E Long).

BONN-1652. **5080 ± 110**
3130 B.C.

Hapludalf in high flood loam on nether terrace, 0.5% C, Bt 60 to 100cm.

8230 ± 470
BONN-1653. **6280 B.C.**

fA-horizon below Hapludalf, same location, 0.4% C, fA 160 to 180cm.

Samples coll. and subm. 1972 by Chr. Haupenthal, Inst. Bodenkunde, Bonn Univ. *Comment*: date of Bt horizon is minimum for recent Hapludalf, date of fA horizon indicates 1st soil development on nether terrace, showing good agreement with expectation due to terrace history.

Carbonaceous, bituminous coating of gravel remnant in younger terrace of Isar, Aschölding, Wolfratshausener Becken, (47° 51′ N Lat, 11° 28′ E Long).

28,320 ± 470
BONN-1657. **26,370 B.C.**

Carbonaceous, bituminous coating on gravel relic, 280cm. Sample coll. and subm. 1971 by W. Kerpen, Chr. Haupenthal, and H. W. Scharpenseel. *Comment*: terrace thought to be late Pleistocene, most likely Holocene in origin (Dietz, 1971). Old date difficult to interpret. Secondary quartz crystallization adjacent and partly covering C material. Gravel relic is void of $CaCO_3$ in otherwise calcareous milieu and rounded by water transport. Conflicting views on terrace chronology make date controversial, confirmed by repetition.

Brownearth of unusually high and deep organic matter, meadow on Würm basal moraine of Isar foreland glacier, Unterbuchen, (11° 30′ N Lat, 47° 42′ E Long). Soil suspected of amelioration by plaggen (swards). Existence and time of plaggen management in Bavarian Alps foreland is of interest.

1090 ± 70
BONN-1669. **A.D. 860**

Brownearth, humus to great depth on basal moraine, 4.4% C, Ah1 20 to 30cm. Samples from same location.

1630 ± 70
BONN-1670. **A.D. 320**

2.8% C, Ah2 30 to 40cm

2350 ± 80
BONN-1671. **400 B.C.**

2.5% C, Ah3 40 to 50cm

3800 ± 80
BONN-1672. **1850 B.C.**

2.5% C, Ah4 50 to 60 cm

Samples coll. and subm. 1972 by H. Jertz, Bayr. Geol. Landesamt, Munich. *Comment*: dates are older than corresponding results on plaggen soils in NW Germany and Ireland (Mückenhausen *et al.*, 1968, Scharpenseel, 1972). Micromorphologic studies on thin sections should decide nature of plaggen soil.

Roots and fossil A horizon from gravel pit, Gemeinde Trieb, Oberfranken, Bavaria, (50° 9′ N Lat, 11° 8′ E Long). Samples serve stratigraphic study of terraces in upper Main valley.

BONN-1700. **1810 ± 70**
A.D. 140

Root, gravel pit Maintag, Trieb 170 to 145cm.

BONN-1801. **7980 ± 110**
6030 B.C.

Ah horizon, pit Maintag, 180 to 200cm.

BONN-1802. **4360 ± 90**
2410 B.C.

Root, vertical in sediment, 200 to 270cm. Samples coll. and subm. 1972 by W. Schirmer, Geol. Inst., Univ. Cologne. *Comment*: dates. estimated to be Sub-Atlantic, are older and require new approach.

Fossil loessic A horizon, covered by Pleistocene terrace material, Kärlich, mining pit, (50° 26′ N Lat, 7° 30′ E Long).

BONN-1659. **30,450 ± 1270**
28,500 B.C.

Humus containing soil, Kärlich, 2.6% C. Coll. and subm. 1972 by J. Frechen, Inst. Petrol., Bonn Univ. *Comment*: date confirms expectation, contemporaneous with Paudorf interstadial.

Humus containing silty A horizon, sandwiched by loess material, underlying tuffaceous material, probably of Rodderberg volcanism. N slope Bausenberg, Lengsdorf, 140m above NN, (50° 42.5′ N Lat 7° 2′ E Long). Dated to determine age of Rodderberg volcanism, Quaternary profile of Bonn area.

BONN-1699. **22,360 ± 510**
20,410 B.C.

Humus containing horizon, silty, Lengsdorf, 400cm deep. Coll. and subm. 1972 by G. Bartels, Geogr. Inst., Univ. Bonn. *Comment*: date lags behind expected age: >30,000 yr. Thorough study of existence of rejuvenating principles, such as small roots, will follow.

Fossil A horizon in gravelly gley, Gammelsbach valley, N Eberbach, buntsandstone Odenwald, (49° 29′ N Lat, 8° 57′ E Long). Date of fossil A is taken to estimate sedimentation speed of younger accumulations on top.

BONN-1815. **1350 ± 110**
A.D. 600

Gleyey fAh, Gammelsbach valley, Eberbach, Odenwald, 3.0% C. Coll. and subm. 1972 by E. Szabados, Inst. Bodenkunde, Techn. Univ. Berlin. *Comment*: estimates were either Boreal age or pre-medieval deforestation. Results confirm latter.

III. SOIL ORGANIC MATTER FRACTIONS

Soil organic matter fractions were dated after different pretreatments of the soil samples.

A. Particle size

Similar to particle size dating on Inden parabrowncarth (R., 1971, v. 13, p. 207; Scharpenseel, 1970), texture fractions of a fossil A horizon, underlying trachyt tuff of Alleröd volcanism, were dated, compared to charcoal from same horizon. Niedermendig, tephrit quarry Michels, (50° 26′ N Lat, 7° 15′ E Long). Material belongs to same fossil horizon as BONN-413, (R., 1970, v. 12, p. 27).

BONN-1681. **11,550 ± 160** / **9600 B.C.**

Fossil A horizon, Niedermendig, charcoal, 300 to 350cm.

BONN-1682. **7570 ± 190** / **5620 B.C.**

Same location, particle size fraction >0.2mm, 0.86% C.

BONN-1684. **10,950 ± 150** / **9000 B.C.**

Same location, particle size fraction 63 to 2μ, 0.68% C.

Samples coll., fractioned, and synthesized 1972 by Chr. Haupenthal, Inst. Bodenkunde, Bonn Univ. *Comment*: between charcoal and organic C fraction, particle size 63 to 2μ, agreement is rather good. Exclusive use of larger particle fraction leads to drastic decrease of age. Particle size fractions 60 to 1μ seem optimal in loessic soils (Scharpenseel, 1970; 1972).

B. Fractions from continuous extraction

One chernozem and podzol each were continuously extracted by 0.15 M $Na_4P_2O_7$ solution (chernozem required pretreatment with 0.1 N H_2SO_4). Successive fractions of extracted humic acids were separately dated, after acid precipitation and drying of humic acids.

BONN-1809. **1030 ± 100** / **A.D. 920**

Chernozem, Aseler Holz, 22.5% C, AC 40 to 60cm, (52° 10′ N Lat, 10° 1′ E Long), 1. fraction.

BONN-1810. **4130 ± 270** / **2180 B.C.**

Same location, 36.3% C, 2, fraction.

BONN-1811. **4970 ± 80** / **3020 B.C.**

Same location, 1.05% C, whole sample, unfractioned.

Samples coll., extracted, and subm. 1972 by Chr. Haupenthal. *Comment*: preceding 1st extract sample of low C concentration was modern. Alkali extract of hard-to-extract soils is highly susceptible to atmospheric

bomb C contamination, even if work was performed, wherever possible, under N_2 gas. In the BONN lab., this method was rejected.

BONN-1688.	Podzol Scherpenseel, gravel pit Weber, 22.5% C, Bh 120 to 140cm, (50° 56′ N Lat, 6° 0.5′ E Long). Samples are from same location.	1400 ± 140 A.D. 550
BONN-1689.	24.8% C	1160 ± 70 A.D. 790
BONN-1691.	27.0% C	1460 ± 80 A.D. 490
BONN-1692.	25.5% C	1350 ± 110 A.D. 600
BONN-1693.	24.0% C	1510 ± 130 A.D. 440
BONN-1697.	Podzol Scherpenseel, gravel pit Weber, 20.8% C, Ah 80 to 100cm	1290 ± 70 A.D. 660
BONN-1698.	Same location, 16.5% C	1220 ± 70 A.D. 730

Samples coll., extracted, and subm. 1972 by Chr. Haupenthal. *Comment*: extraction of humus-C from podzols proceeds quickly and efficiently, yielding large quantities of organic carbon till gray-white sand remains. Danger of contamination is lower than in case of chernozem due to much shorter exposure time required for phase of alkali extraction. Results do not favor taking one special fraction out of continuous extraction.

IV. SUBHYDRIC SOILS, GYTTJA

A. Schalkenmehren

Gyttja in Schalkenmehren-Maar, Eifel. Continuation of BONN-781 -802, Profile III (R., 1971, v. 12, p. 207). Profiles I to V are part of larger program of subhydric soil studies in Eifel Maaren. The origin of Schalkenmehren Maar, a true gas explosion funnel of ca. 25m depth, was lately palynologically dated to ca. 10,950 B.P., by C^{14} dating of adjacent dry maar layers to 13,900 B.P. (Erlenkäuser *et al.*, 1970). Erlenkäuser and co-workers estimate that, based on stable isotope measurements, mud of Eifel maars might be contaminated by magmatic CO_2, which could account for ca. 2000 yr gap between palynologic and C^{14} dates. Samples are taken with a case lot, (50° 11.5′ N Lat, 6° 50′ E Long).

BONN-994.	Schalkenmehren maar, Profile I, NE of maar, taken by case lot, 20.0% C, 0 to 10cm. Samples from same location.	4690 ± 90 2740 B.C.

BONN-995.	24.0% C, 10 to 20cm	4790 ± 70 2840 B.C.
BONN-996.	18.4% C, 20 to 30cm	5240 ± 80 3290 B.C.
BONN-997.	23.5% C, 30 to 40cm	5340 ± 90 3390 B.C.
BONN-998.	30.6% C, 40 to 50cm	7260 ± 130 5310 B.C.
BONN-999.	31.9% C, 50 to 60cm	7170 ± 110 5220 B.C.
BONN-1000.	17.5% C, 60 to 70cm	9220 ± 130 7270 B.C.
BONN-1001.	26.9% C, 70 to 80cm	8480 ± 140 6530 B.C.
BONN-1002.	27.0% C, 80 to 90cm	9740 ± 110 7790 B.C.
BONN-1003.	27.5% C, 90 to 100cm	9910 ± 100 7960 B.C.
BONN-1004.	26.6% C, 100 to 110cm	9800 ± 90 7850 B.C.
BONN-1005.	20.0% C, 110 to 120cm	12,130 ± 140 10,180 B.C.
BONN-1662.	25.5% C, 120 to 150cm	12,190 ± 170 10,240 B.C.
BONN-1007.	Schalkenmehren maar, Profile II, E of maar, taken by case lot, 6.8% C, 0 to 20cm. Samples from same location.	3470 ± 70 1520 B.C.
BONN-1008.	4.9% C, 20 to 30cm	3300 ± 100 1350 B.C.
BONN-1009.	4.6% C, 30 to 40cm	3580 ± 90 1630 B.C.
BONN-1010.	4.2% C, 40 to 50cm	2660 ± 90 710 B.C.
BONN-1011.	5.7% C, 50 to 60cm	3220 ± 80 1270 B.C.
BONN-1012.	6.0% C, 60 to 70cm	4020 ± 80 2070 B.C.

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BONN-1013.	5.0% C, 70 to 80cm	4750 ± 80 2800 B.C.
BONN-1014.	4.3% C, 80 to 90cm	3200 ± 80 1250 B.C.
BONN-1015.	3.4% C, 90 to 100cm	3120 ± 80 1170 B.C.
BONN-1016.	5.3% C, 100 to 110cm	3290 ± 80 1340 B.C.
BONN-1017.	6.9% C, 110 to 120cm	3570 ± 80 1620 B.C.
BONN-1018.	8.5% C, 120 to 130cm	3740 ± 70 1790 B.C.
BONN-1019.	14.4% C, 130 to 140cm	3340 ± 80 1390 B.C.
BONN-1020.	14.3% C, 140 to 150cm	4930 ± 90 2980 B.C.
BONN-1021.	6.0% C, 150 to 160cm	4770 ± 90 2820 B.C.
BONN-1022.	13.5% C, 160 to 167cm	5200 ± 80 3250 B.C.
BONN-1023.	8.3% C, 167 to 170cm	8930 ± 100 6980 B.C.
BONN-1024.	15.3% C, 170 to 185cm	11,060 ± 150 9110 B.C.
BONN-1025.	20.6% C, 185 to 200cm	12,160 ± 130 10,210 B.C.
BONN-1026.	Schalkenmehren maar, Profile IV, N of maar, taken by case lot, 6.6% C, 0 to 10cm. Samples from same location.	3160 ± 70 1210 B.C.
BONN-1027.	4.8% C, 10 to 20cm	2940 ± 70 990 B.C.
BONN-1028.	4.6% C, 20 to 30cm	2790 ± 70 840 B.C.
BONN-1029.	6.5% C, 30 to 40cm	2470 ± 80 520 B.C.
BONN-1030.	6.0% C, 40 to 50cm	3960 ± 60 2010 B.C.

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BONN-1031.	7.6% C, 50 to 60cm	3580 ± 60 1630 B.C.
BONN-1032.	5.7% C, 60 to 70cm	3520 ± 70 1570 B.C.
BONN-1033.	9.8% C, 70 to 80cm	3390 ± 60 1440 B.C.
BONN-1034.	3.8% C, 80 to 90cm	3060 ± 60 1110 B.C.
BONN-1036.	5.8% C, 100 to 110cm	2630 ± 60 680 B.C.
BONN-1037.	6.3% C, 110 to 120cm	3000 ± 70 1050 B.C.
BONN-1038.	6.7% C, 120 to 130cm	2930 ± 70 980 B.C.
BONN-1039.	13.1% C, 130 to 140cm	2930 ± 60 980 B.C.
BONN-1040.	13.5% C, 140 to 150cm	3020 ± 60 1070 B.C.
BONN-1041.	18.3% C, 150 to 160cm	3220 ± 60 1270 B.C.
BONN-1043.	19.5% C, 170 to 180cm	3110 ± 70 1160 B.C.
BONN-1044.	17.7% C, 180 to 190cm	3270 ± 70 1320 B.C.
BONN-1045.	12.8% C, 190 to 200cm	9290 ± 130 7340 B.C.
BONN-1046.	Schalkenmehren maar, Profile V, SW of maar, taken by case lot, 8.3% C, 0 to 10cm. Samples from same location.	3450 ± 80 1500 B.C.
BONN-1047.	2.8% C, 10 to 20cm	2800 ± 80 850 B.C.
BONN-1048.	4.3% C, 20 to 30cm	2770 ± 90 820 B.C.
BONN-1049.	4.5% C, 30 to 40cm	3680 ± 80 1730 B.C.
BONN-1050.	4.9% C, 40 to 50cm	3840 ± 80 1890 B.C.

BONN-1051.	4.4% C, 50 to 60cm	3580 ± 80 1630 B.C.
BONN-1052.	3.6% C, 60 to 70cm	2710 ± 80 760 B.C.
BONN-1053.	2.3% C, 70 to 80cm	3000 ± 80 1050 B.C.
BONN-1054.	8.1% C, 80 to 90cm	2980 ± 80 1030 B.C.
BONN-1055.	2.8% C, 90 to 100cm	3090 ± 70 1140 B.C.
BONN-1056.	3.0% C, 100 to 110cm	2920 ± 80 979 B.C.
BONN-1057.	5.0% C, 110 to 120cm	2950 ± 80 1000 B.C.
BONN-1058.	4.0% C, 120 to 130cm	2920 ± 100 970 B.C.
BONN-1059.	12.0% C, 130 to 140cm	3340 ± 80 1390 B.C.
BONN-1060.	14.5% C, 140 to 150cm	2850 ± 80 900 B.C.
BONN-1061.	19.2% C, 150 to 160cm	2510 ± 80 560 B.C.
BONN-1062.	19.9% C, 160 to 170cm	2350 ± 70 400 B.C.
BONN-1063.	30.0% C, 170 to 180cm	2800 ± 80 850 B.C.
BONN-1064.	20.8% C, 180 to 190cm	2630 ± 80 680 B.C.
BONN-1065.	20.8% C, 190 to 200cm	2670 ± 80 720 B.C.

Samples coll. and subm. 1969 by H. W. Scharpenseel, W. Kerpen, and H. Gewehr, Inst. Bodenkunde, Bonn Univ. *Comment*: dependent on location of sampling, age vs. depth progression is very different, sometimes even to the point of trend reversal. Also, the mixing effect with rejuvenation to considerable depth, e.g. by inflowing sewage or methane bubbles, is assoc. with site of sampling spot, distance as well as windward direction from lake shore village. C concentrations of gyttja vary greatly with location and depth. Highest dates in Profile I and II, which were

ending on top of tuffaceous sand, blocking further penetration of the case lot, reach ca. 12,000 yr. Profile IV is intermediate, dates of Profiles III and IV, near inhabited S lake shore are much lower. Apparently, Erlenkäuser *et al.* (1970), besides using dry maar samples, disposed of cores, penetrating also through the sandy tuff layers, which could account for 1600 yr more, compared with our deepest samples. Results show danger of lake sediment dating, relying on too few sampling spots.

B. Selent

Gyttja in lake of Selent, E Holsteen. Continuation of BONN-882 -908, Profile II (R., 1971, v. 13, p. 209). In this second biggest glacier lake of E Holsteen, with max. depth ca. 45m, thickness of mud sediment varies with echo sounder between <1m and 5 to 10m. Thickest sediment corresponds with shallow water in E part of lake. Profile cores were taken by means of case lot (Profiles I, III, IV), as well as with Livingstone borer (Profiles II, V, VI) (54° 41′ N Lat, 10° 35′ E Long).

BONN-869.	Selent lake, Profile I, in front of Giekau, taken by case lot, 11.8% C, 0 to 25cm. Samples from same location.	380 ± 70 A.D. 1570
BONN-871.	12.3% C, 25 to 35cm	500 ± 70 A.D. 1450
BONN-873.	12.7% C, 45 to 55cm	450 ± 70 A.D. 1500
BONN-874.	15.9% C, 55 to 65cm	1670 ± 100 A.D. 280
BONN-875.	22.3% C, 65 to 75cm	700 ± 70 A.D. 1250
BONN-876.	17.5% C, 75 to 85cm	790 ± 80 A.D. 1160
BONN-877.	19.5% C, 85 to 100cm	970 ± 70 A.D. 980
BONN-878.	19.9% C, 100 to 115cm	930 ± 70 A.D. 1020
BONN-879.	14.6% C, 115 to 125cm	1190 ± 70 A.D. 760
BONN-880.	Tube sample, 2m below end of case lot, underneath sand, 3.7% C.	10,170 ± 140 8220 B.C.
BONN-1122.	Soil profile on shore, opposite Profile I in front of Giekau, 6% C, Ah1 10 to 25cm. Samples from same location.	140 ± 60 A.D. 1810

BONN-1123.	1.2% C, Ah2 25 to 40cm	390 ± 60 A.D. 1560
BONN-1124.	0.9% C, GoAh3, 40 to 60cm	620 ± 60 A.D. 1330
BONN-1125.	0.4% C, GorCl 60 to 80cm	1400 ± 70 A.D. 550
BONN-961.	Selent lake, Profile III, between Selent and Bellin, taken by case lot, 7.5% C, 0 to 15cm. Samples from same location.	1290 ± 70 A.D. 660
BONN-962.	18.5% C, 10 to 15cm	1300 ± 70 A.D. 650
BONN-911.	4.9% C, 15 to 20cm	1910 ± 100 A.D. 40
BONN-912.	5.3% C, 20 to 30cm	1430 ± 100 A.D. 520
BONN-913.	6.4% C, 30 to 40cm	2360 ± 80 410 B.C.
BONN-914.	6.4% C, 40 to 50cm	3830 ± 80 1880 B.C.
BONN-915.	7.1% C, 50 to 55cm	6380 ± 100 4430 B.C.
BONN-916.	2.8% C, 55 to 60cm	6660 ± 100 4710 B.C.
BONN-917.	2.3% C, 60 to 70cm	9760 ± 130 7810 B.C.
BONN-918.	2.1% C, 70 to 80cm	11,350 ± 150 9400 B.C.
BONN-919.	0.9% C, 80 to 90cm	11,520 ± 130 9570 B.C.
BONN-920.	1.0% C, 90 to 100cm	9930 ± 120 7980 B.C.
BONN-921.	0.5% C, 100 to 110cm	13,050 ± 420 11,100 B.C.
BONN-922.	0.4% C, 110 to 120cm	12,570 ± 440 10,620 B.C.
BONN-924.	0.9% C, 130 to 140cm	15,200 ± 260 13,250 B.C.

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BONN-925.	0.5% C, 140 to 150cm	11,020 ± 160 9070 B.C.
BONN-926.	0.5% C, 150 to 160cm	21,640 ± 550 19,690 B.C.
BONN-927.	0.8% C, 160 to 170cm	21,200 ± 550 19,250 B.C.
BONN-930.	0.8% C, 190 to 200cm	20,510 ± 460 18,560 B.C.
BONN-931.	0.5% C, 200 to 210cm	23,890 ±700 21,940 B.C.
BONN-932.	0.8% C, 210 to 220cm	24,410 ± 630 22,460 B.C.
BONN-963.	0.5% C, 220 to 240cm	24,790 ± 800 22,840 B.C.
BONN-964.	1.4% C, 240 to 250cm	24,830 ± 970 22,880 B.C.
BONN-933.	Selent lake, Profile IV, in front of beach of Selent village, taken by case lot, 14.6% C, 0 to 5cm. Samples from same location.	1630 ± 70 A.D. 320
BONN-934.	12.5% C, 5 to 10cm	920 ± 80 A.D. 1030
BONN-935.	9.5% C, 10 to 20cm	1550 ± 70 A.D. 400
BONN-936.	10.3% C, 20 to 30cm	1220 ± 70 A.D. 730
BONN-937.	10.1% C, 30 to 40cm	1050 ± 70 A.D. 900
BONN-938.	14.3% C, 40 to 50cm	1150 ± 70 A.D. 800
BONN-939.	10.9% C, 50 to 60cm	1090 ± 70 A.D. 860
BONN-940.	11.3% C, 60 to 70cm	1040 ± 80 A.D. 950
BONN-941.	11.1% C, 50 to 70cm (rep)	1080 ± 70 A.D. 870
BONN-942.	11.0% C, 70 to 80cm	1160 ± 70 A.D. 790

BONN-943.	10.5% C, 80 to 90cm	1770 ± 70 A.D. 180
BONN-944.	11.4% C, 80 to 100cm (rep)	1670 ± 220 A.D. 280
BONN-945.	9.0% C, 90 to 100cm	1780 ± 70 A.D. 170
BONN-946.	8.5% C, 100 to 110cm	2060 ± 70 110 B.C.
BONN-948.	8.6% C, 110 to 120cm	2570 ± 80 620 B.C.
BONN-949.	10.5% C, 120 to 130cm	3350 ± 80 1400 B.C.
BONN-951.	10.5% C, 130 to 144cm	2920 ± 70 970 B.C.
BONN-952.	5.4% C, 144 to 154cm	2690 ± 80 740 B.C.
BONN-953.	8.0% C, 154 to 157cm	8500 ± 120 6550 B.C.
BONN-954.	4.4% C, 157 to 160cm	10,390 ± 190 8440 B.C.
BONN-955.	0.8% C, 160 to 170cm	9810 ± 180 7860 B.C.
BONN-956.	1.8% C, 170 to 180cm	11,470 ± 160 9520 B.C.
BONN-957.	0.5% C, 180 to 190cm	12,330 ± 220 10,380 B.C.
BONN-959.	0.3% C, 190 to 215cm	17,390 ± 460 15,440 B.C.
BONN-1127.	Soil profile on shore, opposite Profile IV, in front of beach, Selent village, peaty, 36.4% C, T1 10 to 30cm. Samples from same location.	1750 ± 50 A.D. 200
BONN-1128.	41.3% C, T2 30 to 50cm	2460 ± 60 510 B.C.
BONN-1129.	35.6% C, T3 40 to 60cm	2210 ± 70 260 B.C.
BONN-1130.	34.1% C, T4 60 to 80cm	2580 ± 70 630 B.C.

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BONN-1131.	35.6% C, T5 80 to 100cm		2670 ± 70 720 B.C.
		Carbonate C	Organic C
BONN-967.	Selent lake, Profile V, in lake center ahead of narrowing NE branch towards Giekau, taken by Livingstone borer, 0.7% C, 0 to 20 cm.	24,590 ± 690 22,640 B.C.	106.3 ± 0.2 Modern
BONN-968.	0.4% C, 20 to 40cm	28,500 ± 1100 26,550 B.C.	470 ± 110 A.D. 1480
BONN-969.	0.7% C, 40 to 60cm	27,810 ± 820 25,860 B.C.	3160 ± 330 1210 B.C.
BONN-970.	0.5% C, 60 to 80cm	30,280 ± 1200 28,330 B.C.	6660 ± 510 4710 B.C.
BONN-971.	0.4% C, 80 to 100cm	29,170 ± 1190 27,220 B.C.	9070 ± 420 7120 B.C.
BONN-972.	0.6% C, 100 to 120cm	37,810 ± 3190 35,860 B.C.	8640 ± 420 6690 B.C.
BONN-973.	0.3% C, 120 to 140cm	32,940 ± 1870 30,990 B.C.	11,650 ± 590 9700 B.C.
BONN-974.	0.4% C, 140 to 160cm	37,600 ± 3310 35,650 B.C.	10,620 ± 390 8670 B.C.
BONN-975.	0.5% C, 160 to 180cm	37,890 ± 2980 35,940 B.C.	10,930 ± 460 8980 B.C.
BONN-976.	0.4% C, 180 to 200cm	36,250 ± 2660 34,300 B.C.	14,180 ± 670 12,230 B.C.
BONN-977.	Selent lake, Profile VI, bay near Seekrug, taken by Livingstone borer, 11.7% C, 0 to 20cm. Samples from same location.		780 ± 70 A.D. 1170
BONN-978.	10.1% C, 20 to 40cm		980 ± 90 A.D. 970
BONN-979.	7.1% C, 40 to 60cm		1580 ± 80 A.D. 370
BONN-980.	5.1% C, 60 to 80cm		2290 ± 80 340 B.C.
BONN-981.	6.6% C, 80 to 96cm		2970 ± 110 1020 B.C.

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BONN-982.	9.5% C, 100 to 120cm	3120 ± 80 1170 B.C.
BONN-983.	9.8% C, 120 to 140cm	2350 ± 90 400 B.C.
BONN-984.	10.2% C, 140 to 160cm	3430 ± 80 1480 B.C.
BONN-985.	6.3% C, 160 to 180cm	4260 ± 110 2310 B.C.
BONN-986.	9.2% C, 180 to 200cm	4850 ± 90 2900 B.C.
BONN-987.	12.6% C, 200 to 220cm	4670 ± 120 2720 B.C.
BONN-988.	7.6% C, 220 to 240cm	4850 ± 100 2900 B.C.
BONN-989.	5.7% C, 240 to 260cm	5870 ± 230 3920 B.C.
BONN-990.	1.0% C, 260 to 280cm	5340 ± 180 3390 B.C.
BONN-991.	1.5% C, 280 to 300cm	5590 ± 360 3640 B.C.
BONN-992.	0.6% C, 300 to 320cm	10,080 ± 520 8130 B.C.
BONN-993.	0.2% C, 320 to 340cm	30,930 ± 1150 28,980 B.C.

Samples coll. and subm. 1969 by H. W. Scharpenseel, W. Kerpen, and H. Gewehr. *Comment*: as in Schalkenmehren series, the extent of anthropogenic influence, exerted on sampling sites, correlates with age vs. depth pattern of profiles. Selent I and II sites are close to present day village Giekau and a presumed submerged prehistoric settlement. Profile I is young, it has maximum dates of 7000 yr. Selent III to VI date to 25,000 yr, 17,000 yr, 14,200 yr, and 10,000 yr (with a doubtful jump to 31,000 yr in deepest sample, which should be verified). The lake sediment was possibly influenced by partly available free carbonates (Münnich, 1957; Münnich and Vogel, 1959). Selent V was tested on the basis of carbonate C as well as on remaining organic C. Results show no strict relationship, except for general trend of age vs. depth increase. Results suggest, that formation of Selent lake sediment began at least since Boelling, or even Paudorf interval. Measurement of apparent mean residence time in 2 soil profiles on shore, opposite Profile I and IV, reveals young lake alluvium, just as in Profile I, or at Selent lake beach

(opposite Profile IV) peat layers up to 2700 yr, indicating filling of certain parts of lake fringes by low moor formation since Sub-Boreal.

V. ARCHAEOLOGIC SAMPLES

Iran series

Age of old mine, S fringe of Great Kavir, Central Iran, Chah Nukluk or Nakhlak, dated through work on 3 buildings from Sasanitic origin (4 to 7th century), (33° 12′ N Lat, 53° 46′ E Long).

1790 ± 100

BONN-1666. **A.D. 160**

Relic of decaying supporting pole, assoc. archeol. materials, mining tools, wedges, earthen ware.

1190 ± 80

BONN-1667. **A.D. 760**

Parts of 2 wooden containers, assoc. archeol. materials, mining tools, wedges, earthen ware.

1820 ± 80

BONN-1668. **A.D. 130**

Truncated wooden pole, in gate of antique fort, beside 2 Sasanidic fire temples. Samples coll. and subm. 1971 by U. W. Hallier, Inst. Bot., Düsseldorf Univ. *Comment*: dates agree with expectations.

Netherrhine series

Dates different buildings or parts of buildings of Burg Meer, Meerbusch-Büderich, Kreis Grevenbroich as part of regional study by Dr. Janssen, Rheinisches Landesmus. Bonn, (51° 16′ N Lat, 6° 41′ E Long).

1130 ± 70

BONN-1673. **A.D. 820**

Burning relics of wooden Building VI, 120cm below surface.

1130 ± 70

BONN-1674. **A.D. 820**

Roof cover, oak wood, Building III.

910 ± 70

BONN-1675. **A.D. 1040**

Palisade pole, layer younger Period B.

1100 ± 70

BONN-1676. **A.D. 850**

Slice of oak tree, layer younger Period B.

1090 ± 70

BONN-1677. **A.D. 860**

Roof cover, oak wood, Building III.

1140 ± 80

BONN-1678. **A.D. 180**

Burning relics, wooden Building V.

BONN-1679. **840 ± 80**
A.D. 1110

Wooden swimmer from fishing net.

BONN-1680. **1180 ± 70**
A.D. 770

Parts of oak wooden Boat III. Samples coll. and subm. 1971 by Dr. Janssen. *Comment*: estimated age of samples, 11 to 12th century, exceeded by measured dates, except for BONN-1675 and BONN-1679.

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