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YALE NATURAL RADIOCARBON MEASUREMENTS IX

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The present list represents a major portion of the samples measured since publication of the last date list in 1963. As in previous lists, dates are reported in terms of the 5568 yr half-life. Infinite dates are reported as beyond a limit equal to 2σ above background. Nearly all of the samples were measured in one of three quartz counters with backgrounds of 0.7 to 1.2 cpm per liter of effective counting volume at working pressures of about two atmospheres. The age errors quoted are based only on the standard deviations in counting rates of sample and standards.

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I. C^{14} VARIATIONS IN TREE RINGS

Samples described here have been used for the study of atmospheric C^{14} variations. Samples Y-2100 to Y-2127 came from a Douglas fir that grew in Santa Catalina Mts. near Tucson, Arizona (32° 23′ N Lat, 110° 41′ W Long). Samples Y-2128 to Y-2130 were part of a hemlock tree from a locality in Maine, 18 km N of Seboeis, Maine (45° 22′ N Lat, 68° 42.5′ W Long), Samples Y-2131 to Y-2133 were from a fir in Colorado and Y-2134 from a spruce in College, Alaska (64° 54′ N Lat, 147° 55′ W Long). Tree-ring samples from Arizona, Maine, Colorado, and Alaska were received through the courtesy of, respectively, M. A. Stokes and T. Smiley, Lab. of Tree-Ring Research, Univ. of Arizona; H. E. Young, Univ. of Maine; E. W. Mogren, Colorado State Univ., and the late J. L. Giddings, Brown Univ. For details of this study of atmospheric C^{14} variations, see Stuiver, 1965 and Stuiver and Suess, 1966.

Rings		δC^{14}‰	δC^{13}‰	Δ‰
Y-2100.	1693-1695	+18.1	−25.0	+18.1 ± 2
Y-2101.	1705-1706	+17.2	−26.0	+19.2 ± 5
Y-2102.	1710-1711	+ 9.3	−24.9	+ 9.1 ± 5
Y-2103.	1713-1714	+13.0	−24.6	+12.2 ± 5
Y-2104.	1716-1717	+ 6.1	−25.5	+ 7.1 ± 3
Y-2105.	1718-1720	+22.7	−24.9	+22.5 ± 4
Y-2106.	1721-1722	+18.7	−24.0	+16.7 ± 4
Y-2107.	1725-1726	+17.6	−25.0	+17.6 ± 5
Y-2108.	1727-1729	+12.0	−24.2	+10.4 ± 4
Y-2109.	1739-1742	+ 9.0	−24.9	+ 8.8 ± 4
Y-2110.	1750-1752	+ 6.4	−25.9	+ 8.2 ± 5

Rings		δC^{14}‰	δC^{13}‰	Δ‰
Y-2111.	1756-1758	+ 7.2	−24.2	+ 5.6 ± 5
Y-2112.	1761-1764	+11.5	−24.2	+ 9.9 ± 4
Y-2113.	1765-1767	+ 8.6	−24.0	+ 6.6 ± 5
Y-2114.	1770-1772	− 5.6	−24.7	− 6.2 ± 5
Y-2115.	1773-1776	+ 9.6	−25.0 (est.)	+ 9.6 ± 5
Y-2116.	1778-1782	+ 0.7	−24.3	− 0.7 ± 2.5
Y-2117.	1788-1790	+ 3.3	−23.9	+ 1.1 ± 4
Y-2118.	1791-1793	− 5.5	−25.0 (est.)	− 5.5 ± 5
Y-2119.	1796-1799	+ 2.0	−25.0 (est.)	+ 2.0 ± 5
Y-2120.	1805-1808	+ 3.9	−25.8	+ 5.5 ± 4
Y-2121.	1816-1818	+ 7.7	−25.7	+ 9.1 ± 4
Y-2122.	1819-1822	+ 7.4	−25.0 (est.)	+ 9.1 ± 4
Y-2123.	1829-1832	+ 1.1	−24.3	− 0.3 ± 4
Y-2124.	1838-1842	+ 3.9	−24.7	+ 3.3 ± 5
Y-2125.	1847-1851	+ 4.2	−25.0 (est.)	+ 4.2 ± 4
Y-2126.	1856-1862	+ 6.5	−25.0 (est.)	+ 6.5 ± 4
Y-2127.	1866-1872	+ 2.5	−24.0	+ 0.5 ± 4
Y-2128.	1816-1818	+11.3	−25.9	+13.1 ± 4
Y-2129.	1839-1841	− 0.9	−25.0	− 0.9 ± 5
Y-2130.	1780-1782	− 1.1	−25.6	+ 0.1 ± 5
Y-2131.	1727-1729	+ 7.1	−25.5	+ 8.1 ± 4
Y-2132.	1716-1717	+ 4.8	−25.8	+ 6.4 ± 5
Y-2133.	1721-1722	+ 8.0	−25.0	+ 8.0 ± 4
Y-2134.	1838-1841	+ 5.5	−25.0 (est.)	+ 5.5 ± 3

II. INVESTIGATIONS OF SAMPLES OF MANUFACTURED IRON

In a project carried out by N. J. van der Merwe between 1961 and 1966, a method was developed to measure ages of specimens of manufactured iron (van der Merwe, 1965; van der Merwe and Stuiver, 1968). Carbon, alloyed with iron during smelting and/or forging and therefore dating from time of manufacture, is extracted by direct combustion of milled specimen. Measurements include background calibration (using modern, coke-smelted specimens) and dates for known-age specimens.

Y-1500. Anthracite **0.0 ± 0.3% activity**

Anthracite, analyzed to test possible influence of equipment on background radiation measurements. *Comment*: result shows no spurious radioactivity.

Y-1503. Iron, modern **1.2 ± 0.2% activity**

Modern, coke-smelted cast iron; part of pot-bellied stove. Donated by M. D. Coe, Yale Univ. *Comment*: layer of surface corrosion was not removed, serving as test for possible contamination. Comparison with Y-1502, Y-1501, and Y-1508 indicates that contamination is probably not due to condition of sample, but that modern carbon was introduced at foundry.

Y-1502. Iron, modern **1.3 ± 0.3% activity**

Modern, coke-smelted cast iron; part of same pot-bellied stove as Y-1503. *Comment*: sample was leached with 25% acetic acid to test method of cleaning. No improvement over Y-1503.

Y-1501. Iron, modern **0.7 ± 0.2% activity**

Modern, coke-smelted cast iron; part of same pot-bellied stove as Y-1503. *Comment*: corrosion was removed by dry peening and leaching with 25% acetic acid. Observed activity is inconsistent with Y-1503, Y-1502, and Y-1508 (although statistical considerations allow a small chance that actual values are equal). It is probable that variable contamination was introduced during manufacture.

Y-1508. Iron, modern **1.2 ± 0.3% activity**

Modern, coke-smelted cast iron; part of same pot-bellied stove as Y-1503. *Comment*: corrosion was removed by dry peening and leaching with 25% acetic acid; milled sample was baked out under vacuum for 30 min to remove absorbed CO_2. No improvement over Y-1503.

350 ± 60
Y-1504. Saugus Ironworks **A.D. 1600**

Cast iron; part of adjustable crane hook from Saugus Ironworks (42° 30′ N Lat, 71° 30′ W Long), near Hammersmith, Massachusetts. Subm. by E. N. Hartley, Saugus Ironworks, and C. S. Smith, M.I.T. *Comment*: foundry at Saugus started production in 1648 and closed down in 1678; site has recently been reconstructed.

200 ± 60
Y-1506. Hopewell furnace **A.D. 1750**

Cast-iron fragment from debris around furnace of "iron plantation" at Hopewell, Pennsylvania (40° 10′ N Lat, 78° 15′ W Long). Subm. by P. W. Bishop, Smithsonian Inst. and Leland J. Abel, excavator. *Comment*: Hopewell Furnace operated from 1771 to 1883 (Kurjack, 1956); Sample Y-1506 was estimated to have been manufactured between 1771 and 1845 (P. W. Bishop, pers. commun.). Hopewell Village has been reconstructed as historic site by Natl. Park Service.

180 ± 60
Y-1509. Redding furnace **A.D. 1770**

Cast-iron stove plate, manufactured in Redding furnace (also known as "Wicked Borrower"), in Schuylkill-French Creek region, Pennsylvania. Subm. by Leonard G. Johnson, Bucks County Hist. Soc. *Comment*: stove plate was manufactured in 1761.

1850 ± 80
Y-1510. Roman fort, Scotland **A.D. 100**

Wrought-iron nails from Roman Legionary fortress at Inchtuthil, Perthshire, Scotland (56° 25′ N Lat, 3° 20′ W Long). Subm. H. Cleere, Iron and Steel Inst., London. *Comment*: fort at Inchtuthil formed part of system of Scottish Highland forts designed by Agricola. Built in 83 A.D., fort was dismantled in 87 A.D., following withdrawal of Roman troops from Scotland. Nails, part of 7-ton cache, were buried to prevent their falling into hands of Scots; as a result, they were only lightly oxidized.

2060 ± 80
Y-1511. Han Dynasty, Sian, China **110 B.C.**

Cast-iron fragment from grating of stove from Sian, China (34° 20′ N Lat, 109° E Long), Chicago Nat. Hist. Mus., catalogue no. 120988. Subm. by Kenneth Starr, Chicago Nat. Hist. Mus. *Comment*: stove was assumed to have been manufactured during Han Dynasty (221 B.C.—220 A.D.); C^{14} date corroborates this identification.

400 ± 60
Y-1512. Hunan Province, China **A.D. 1550**

Cast-iron from base plate of Chinese statuette from Hunan Province (ca. 28° N Lat, 112° E Long). Anonymous donor. *Comment*: this art object, which was dated from 4th to 10 century A.D., apparently on stylistic grounds, was exhibited in several museums. C^{14} date indicates that it was assigned to wrong stylistic period, or that it was deliberate Ming Dynasty copy of earlier original. Possibility also exists that base plate was added at later date and that C^{14} age does not refer to statue itself.

2380 ± 80
Y-1513. Warring States Period, Honan, China **430 B.C.**

Cast-iron fragment from tomb group near Loyang, Honan Province, China (34° 48′ N Lat, 112° 24′ E Long). Subm. by the late W. Todd, Royal Ontario Mus. and C. S. Smith, M.I.T. *Comment*: iron fragments were curved in cross section and were apparently cast to reinforce round poles. Tomb group contained large number of bronze fittings and was assumed to date from time of feudal state of Han, Warring States Period (480-221 B.C.); C^{14} date corroborates this identification.

2130 ± 100
Y-1515. Han Dynasty, Szechwan, China **180 B.C.**

Cast-iron fragments from group of cist tombs at Chia-shan-Chai, Lifan Hsien, Szechwan Province, China (31° 45′ N Lat, 103° 45′ E Long). Subm. by K. C. Chang, Yale Univ. *Comment*: iron fragments formed part of collection which includes pottery assumed to be of Han Dynasty (221 B.C.—220 A.D.); C^{14} date corroborates this identification.

2130 ± 60
Y-1516. La Tène I, Yugoslavia **180 B.C.**

Fragments of steel sword and scabbard from Magdalenska gora, Yugoslavia (46° 5′ N Lat, 14° 30′ E Long), Tumulus V, Graves 19—20. Subm. by H. M. Hencken, Harvard Univ. *Comment*: sample had been almost completely converted to oxide and consisted of large number of small, friable pieces, encrusted with clayey dirt which had become cemented by iron oxide. Sample was boiled and repeatedly washed in distilled water and then broken into ¼ inch fragments. Upon cleaning, composite rivet (?) of gold and copper was found in debris. C^{14} date corroborates previously assumed cultural age, La Tène I (ca. 400–180 B.C. in W Europe), which had been assigned to specimen.

4.7 ± 0.1% activity
Y-1505. Fort Kiowa?, South Dakota apparent age ca. 25,000 B.P.

Cast-iron stove part from Fort Kiowa (?), Lyman County, South Dakota (44° N Lat, 99° 20′ W Long). Subm. by C. Evans, Smithsonian Inst. *Comment*: identification of this site by excavator is questionable; it is now thought to have been late trading post, operating between 1870 and 1900 A.D., and not Fort Kiowa itself (C. Evans, pers. commun.). Observed C^{14} activity indicates that specimen was manufactured by melting together "coke iron" and "charcoal iron" (by, for example, adding small amount of "charcoal iron" scrap to batch of "coke iron"), or by fueling furnace with coke-charcoal mixture in ratio of ca. 20:1.

43.6 ± 0.5% activity
Y-1507. Fort Berthold, North Dakota apparent age ca. 6700 B.P.

Cast-iron wagon thimble from the second Fort Berthold, McLean County, North Dakota (47° 30′ N Lat, 101° 30′ W Long). Subm. by C. Evans, Smithsonian Institution. *Comment*: the site of the second Fort Berthold was occupied from 1845 to 1885. The observed C^{14} activity leads to the same conclusion as for Y-1505, but with a "coke iron"-"charcoal iron," of coke-charcoal, ratio of ca. 5.4.

General Comment: close agreement between historical and radiocarbon ages for iron specimens demonstrates accuracy of this method for dating iron.

III. LAKE SEDIMENTATION RATE STUDIES, CONNECTICUT, TAIWAN, AND UGANDA

This series is part of a study of atmospheric C^{14} variations during the past as discussed by Stuiver, 1967. Absolute pollen fallout rates for Rogers Lake core have been studied by Margaret B. Davis (1967). Sample ages for all cores have not been corrected by any C^{14} deficiency of lake water. Connecticut core was coll. in center of S basin of Rogers Lake (41° 22′ N Lat, 72° 18′ W Long), Lyme, Connecticut. Coll. 1961 and subm. by M. B. Davis, Univ. of Michigan, and E. S. Deevey, Yale Univ. Present results are continuation of Yale VIII series (Radiocarbon, 1965, v. 5, p. 312-341). Absolute pollen fallout rates for Lake Yueh Tan core are being determined by Matsuo Tsukada; pollen diagram of Yueh Tan is similar to that publ. for Jih Tan (Tsukada, 1966b). Taiwan core was coll. in center of Yueh Tan (23° 51′ N Lat, 120° 54′ E Long), Nan Tou Hsien, Taiwan, by M. Tsukada, Yale Univ. Absolute pollen fallout rates of Lake Victoria core have been studied by R. L. Kendall (1968). Core was coll. from Pilkington Bay, Lake Victoria, near Jinja, Uganda (0°

17′ S Lat, 33° 19′ E Long). Coll. by R. L. Kendall and J. L. Richardson, Duke Univ.

Rogers Lake series, Connecticut

Y-1678.	Rogers	2 to 7 cm	630 ± 60	A.D. 1320
Y-1677.	Rogers	42 to 48 cm	760 ± 60	A.D. 1190
Y-1676.	Rogers	106 to 112 cm	1640 ± 60	A.D. 310
Y-1675.	Rogers	167 to 172 cm	2210 ± 80	260 B.C.
Y-1674.	Rogers	227 to 232 cm	2660 ± 80	710 B.C.
Y-1673.	Rogers	285 to 290 cm	3220 ± 80	1270 B.C.
Y-1672.	Rogers	344 to 349 cm	3570 ± 80	1620 B.C.
Y-1671.	Rogers	404 to 409 cm	4120 ± 80	2170 B.C.
Y-1670.	Rogers	467 to 472 cm	4550 ± 80	2600 B.C.
Y-1669.	Rogers	527 to 532 cm	4990 ± 80	3040 B.C.
Y-1749.	Rogers	542 to 547 cm	5240 ± 90	3290 B.C.
Y-1722.	Rogers	557 to 562 cm	5710 ± 80	3760 B.C.
Y-1748.	Rogers	572 to 577 cm	5330 ± 80	3380 B.C.
Y-1668.	Rogers	586 to 591 cm	5500 ± 100	3550 B.C.
Y-1747.	Rogers	602 to 607 cm	5390 ± 60	3440 B.C.
Y-1721.	Rogers	617 to 622 cm	5680 ± 60	3730 B.C.
Y-1667.	Rogers	649 to 654 cm	5940 ± 120	3990 B.C.
Y-1720.	Rogers	667 to 672 cm	5930 ± 60	3980 B.C.
Y-1666.	Rogers	692 to 698 cm	6260 ± 120	4310 B.C.
Y-1454.	Rogers	704 to 709 cm	7320 ± 120	5370 B.C.
Y-1746.	Rogers	709 to 714 cm	6410 ± 60	4460 B.C.
Y-1745.	Rogers	714 to 719 cm	6820 ± 100	4870 B.C.
Y-1696.	Rogers	719 to 724 cm	6860 ± 60	4910 B.C.
Y-1744.	Rogers	724 to 729 cm	7050 ± 100	5100 B.C.
Y-1679.	Rogers	730 to 735 cm	7290 ± 60	5340 B.C.
Y-1743.	Rogers	739 to 744 cm	7550 ± 80	5600 B.C.
Y-1693.	Rogers	742 to 746 cm	7700 ± 120	5750 B.C.
Y-1695.	Rogers	754 to 759 cm	7980 ± 60	6030 B.C.
Y-1692.	Rogers	758 to 763 cm	7810 ± 80	5860 B.C.
Y-1742.	Rogers	764 to 769 cm	8320 ± 80	6370 B.C.
Y-1741.	Rogers	769 to 774 cm	8370 ± 80	6420 B.C.
Y-1694.	Rogers	774 to 779 cm	8670 ± 60	6720 B.C.
Y-1740.	Rogers	779 to 784 cm	8460 ± 120	6510 B.C.
Y-1453.	Rogers	784 to 789 cm	8460 ± 120	6510 B.C.
Y-1739.	Rogers	789 to 794 cm	8750 ± 140	6800 B.C.
Y-1452.	Rogers	811 to 817 cm	8900 ± 160	6950 B.C.
Y-1728.	Rogers	823 to 828 cm	9190 ± 160	7240 B.C.
Y-1738.	Rogers	833 to 839 cm	9050 ± 100	7100 B.C.
Y-1726.	Rogers	851 to 857 cm	9120 ± 120	7170 B.C.
Y-1451.	Rogers	857 to 863 cm	9010 ± 160	7060 B.C.
Y-1725.	Rogers	863 to 868 cm	9140 ± 80	7190 B.C.
Y-1450.	Rogers	868 to 874 cm	9630 ± 120	7680 B.C.
Y-1724.	Rogers	874 to 880 cm	9520 ± 80	7570 B.C.

Y-1449.	Rogers	880 to 886 cm	9660 ± 120	7710 B.C.
Y-1723.	Rogers	886 to 892 cm	9500 ± 140	7550 B.C.
Y-1448.	Rogers	898 to 903 cm	9950 ± 200	8000 B.C.
Y- 947.	Rogers	918 to 923 cm	10,510 ± 160	8560 B.C.

Lake Yueh Tan series, Taiwan

Y-2000.	Yueh Tan	6.9 to 17.7 cm	1280 ± 100	A.D. 670
Y-2001.	Yueh Tan	37.7 to 48.4 cm	1750 ± 100	A.D. 200
Y-2002.	Yueh Tan	177.7 to 189.0 cm	2240 ± 100	290 B.C.
Y-2003.	Yueh Tan	248.7 to 259.0 cm	2520 ± 120	570 B.C.
Y-2004.	Yueh Tan	309.5 to 319.0 cm	2890 ± 100	940 B.C.
Y-2005.	Yueh Tan	349.5 to 359.0 cm	2990 ± 100	1040 B.C.
Y-2006.	Yueh Tan	389.5 to 399.0 cm	3270 ± 100	1320 B.C.
Y-2007.	Yueh Tan	446.8 to 458.1 cm	3490 ± 100	1540 B.C.
Y-2008.	Yueh Tan	521.8 to 532.7 cm	3600 ± 80	1650 B.C.
Y-1617.	Yueh Tan	541.1 to 550.6 cm	4130 ± 80	2180 B.C.
Y-2010.	Yueh Tan	587.5 to 598.3 cm	4070 ± 80	2120 B.C.
Y-2011.	Yueh Tan	628.4 to 639.1 cm	4500 ± 50	2550 B.C.
Y-2012.	Yueh Tan	687.4 to 698.0 cm	4480 ± 80	2530 B.C.
Y-2013.	Yueh Tan	725.5 to 736.0 cm	5150 ± 60	3200 B.C.
Y-2014.	Yueh Tan	793.0 to 802.0 cm	5790 ± 100	3840 B.C.
Y-2015.	Yueh Tan	828.0 to 838.0 cm	5950 ± 80	4000 B.C.
Y-2016.	Yueh Tan	868.0 to 878.0 cm	6270 ± 80	4320 B.C.
Y-2017.	Yueh Tan	902.3 to 912.4 cm	6690 ± 120	4740 B.C.
Y-2018.	Yueh Tan	941.1 to 950.8 cm	7080 ± 100	5130 B.C.
Y-2019.	Yueh Tan	979.7 to 988.9 cm	7540 ± 80	5590 B.C.
Y-2020.	Yueh Tan	1002.1 to 1012.9 cm	7890 ± 80	5940 B.C.
Y-2021.	Yueh Tan	1037.6 to 1048.4 cm	8270 ± 80	6320 B.C.
Y-2022.	Yueh Tan	1067.7 to 1078.4 cm	8510 ± 80	6560 B.C.
Y-2023.	Yueh Tan	approx. 1120 cm	8950 ± 100	7000 B.C.
Y-2024.	Yueh Tan	approx. 1155 cm	9220 ± 100	7270 B.C.
Y-1618.	Yueh Tan	approx. 1174 cm	9670 ± 100	7720 B.C.

Lake Victoria series, Uganda

Y-2027.	Victoria	50 to 75 cm	860 ± 120	A.D. 1090
Y-2028.	Victoria	100 to 120 cm	1200 ± 120	A.D. 751
Y-2029.	Victoria	150 to 170 cm	1440 ± 100	A.D. 510
Y-2030.	Victoria	205 to 225 cm	2000 ± 120	50 B.C.
Y-2031.	Victoria	255 to 275 cm	2300 ± 80	350 B.C.
Y-2032.	Victoria	305 to 325 cm	2390 ± 100	440 B.C.
Y-2033.	Victoria	355 to 375 cm	2870 ± 80	920 B.C.
Y-2034.	Victoria	405 to 425 cm	3200 ± 60	1350 B.C.
Y-1572.	Victoria	455 to 475 cm	3240 ± 100	1290 B.C.
Y-2036.	Victoria	505 to 525 cm	3660 ± 60	1710 B.C.
Y-2037.	Victoria	605 to 625 cm	4280 ± 100	2330 B.C.
Y-2038.	Victoria	655 to 675 cm	4630 ± 60	2680 B.C.
Y-2039.	Victoria	705 to 725 cm	5190 ± 80	3240 B.C.

Y-2040.	Victoria	752 to 772 cm	5490 ± 100	3540 B.C.
Y-2041.	Victoria	806 to 826 cm	5820 ± 100	3870 B.C.
Y-2042.	Victoria	855 to 875 cm	6160 ± 100	4210 B.C.
Y-2043.	Victoria	905 to 925 cm	6500 ± 120	4550 B.C.
Y-2044.	Victoria	955 to 975 cm	6990 ± 160	5040 B.C.
Y-2045.	Victoria	1010 to 1030 cm	7340 ± 120	5390 B.C.
Y-2046.	Victoria	1110 to 1130 cm	8130 ± 160	6180 B.C.
Y-2048.	Victoria	1210 to 1230 cm	8950 ± 100	7000 B.C.
Y-1573.	Victoria	1249 to 1270 cm	9550 ± 200	7600 B.C.

IV. GEOLOGIC SAMPLES

A. North America

Tingin Fiord series, Canada

Shells from silt banks at S arm of Tingin Fiord, Canada. Coll. and subm. by J. T. Andrews, Univ. of Colorado.

Y-1830. Tingin Fiord GBL-313-66 **8430 ± 140** **6480 B.C.**

Alt of site (68° 57′ N Lat, 69° 07′ W Long) is +70 m. Shells of *Mya truncata* and *Hiatella arctica* coll. from silt banks that lived in ca. 15 m water; marine limit: +86 m. Age of marine limit est. 9000 ± B.P.

Y-1831. Tingin Fiord GBL-314-66 **3580 ± 120** **1630 B.C.**

Alt of site (68° 58.1′ N Lat, 69° 03′ W Long) is +3 to 5 m. Shells of *Mytilus edulis* and *Macoma balthica* from beach, near surface.

Cape Hooper series, Canada

Shells from Cape Hooper (68° 25.6′ N Lat, 66° 46.4′ W Long), Canada. Coll. and subm. by J. T. Andrews.

Y-1833. Hooper, 16 to 20 m **7960 ± 140** **6010 B.C.**

From continuous, fossiliferous silt/clay bed at +16 to 20 m containing *Mytilus* fragments. Probably shells lived in less than 7 m water. Episode correlative with Cockburn phase.

Y-1832. Hooper, 27 m **9180 ± 180** **7230 B.C.**

In view of local marine limit, shells (*Mya truncata*) lived in ca. 13 m water. Date provides est. of age of marine limit.

Y-1834. Kangok Fiord, Canada **7820 ± 140** **5870 B.C.**

Shells from top layers of silt banks, overlain by deltaic sands, at Kangok fiord (68° 32′ N Lat, 68° 10′ W Long), Canada. Alt: +46 m. Considered to date relative sea level at 54 m. Coll. and subm. by J. T. Andrews.

Y-1835. Loozie Bay, Canada **7290 ± 120**
5340 B.C.

Shells (*Mytilus edulis* and *Astarte montagu* var. *striata*) from beds near surface of delta in "Loozie" Bay (68° 47′ N Lat, 68° 37′ W Long). Shells lived in 5 to 10 m water. Coll. and subm. by J. T. Andrews. For discussion of Tingin Fiord, Cape Hooper, Kangok Fiord, and Loozie Bay results, see Andrews (1967, 1968a, 1968b, and 1969).

Cape Henry Kater series, Canada

Shells from Cape Henry Kater area, Baffin I., Canada (69° 9′ N Lat, 67° 47′ W Long). Coll. by C. A. M. King; subm. by J. T. Andrews.

Y-1985. Henry Kater 1 **40,900 ± 2000**
38,950 B.C.

Shells (*Mya truncata* and *Hiatella arctica*) from surface of moraine in valley close to Cape Henry Kater. Imbedded in fine sand between overlying drift and marine strata. Dates moraine, as there is no unconformity between marine sediments and till cover. Alt: 15.1 m.

Y-1986. Henry Kater 2 **10,210 ± 180**
8260 B.C.

Shells (*Astarte striata*) from surface of till near Cape Henry Kater. Shells confined to uppermost 3 cm and above marine limit. Date is minimum for the moraine. Alt: 26.7 m.

Y-1987. Henry Kater 3 **38,100 ± 1200**
36,150 B.C.

Shells (*Hiatella arctica*) from uppermost 5 to 10 cm of till on distal side of moraine running out to sea at Cape Henry Kater. Material apparently not *in situ*. Date is minimum for moraine. Alt: 23.7 m.

Y-1988. Henry Kater 4 **34,900 ± 900**
32,950 B.C.

Shells occurring in pockets of clay in sandy till above cliff top, ca. 30 km N of Cape Henry Kater. Material was incorporated into till and is not *in situ*.

Baffin Island series, Canada

Y-1702. Cape Christian **>50,000**

Shells (*Serripes groenlandicus* [*Brugière*], *Mya truncata* L, and *Hiatella arctica* L) *in situ* at +13.4 m in cliff ca. 12 km NW of Cape Christian, Baffin I. (70° 36.2′ N Lat, 68° 28.1′ W Long). Coll. and subm. by O. H. Löken, Div. Physical Geog., Ottawa. Previously dated at 39,000 yr (I-1813) (Löken, 1966).

Y-1703. Cape Aston **>54,000**

Shells (*Hiatella arctica* L. and *Mya truncata*) *in situ* in sandy part of large delta at alt 61.3 m some 15 km inland from present shore at Cape Aston, Baffin I. (69° 54.6′ N Lat, 67° 34.2′ W Long). Coll. and subm. by O. H. Löken. Previously dated at 32,300 ± 2100 (I-1815).

8190 ± 120
Y-1705. Middle Ingsuin Fiord 6240 B.C.

Shells (*Mytilus edulis*) from fine sand dipping seaward from Middle Ingsuin Fiord (69° 51′ N Lat, 68° 59′ W Long), Baffin I. Coll. 1965 by D. A. Harrison and subm. by O. H. Löken.

1170 ± 80
Y-1704. Alberta, Canada A.D. 780

Organic debris from 1.20 m depth from lacustrine deposit (49° 28′ N Lat, 110° 34′ W Long) Alberta, Canada. Material correlates with ash layer. Coll. 1965 by M. J. Bik and subm. by O. H. Löken.

Y-1683. Ascot River, Quebec >54,000

Wood fragments from lacustrine sandy silt exposed on N bank Ascot R., 2.1 m W of Johnville, Quebec, Canada (45° 20′ N Lat, 71° 48′ W Long). Depth 33.5 m below adjacent land surface and 5 m above level of Ascot R. Overlying plant-bearing sediments are 2 till sheets separated by lacustrine sand. Sample underlies 2nd drift unit exposed from surface. Coll. and subm. 1965 by B. C. McDonald, Geol. Survey, Canada. *Comment* (B.C.M.): plant-bearing unit is considered to correlate with St. Pierre beds of E St. Lawrence Lowland (Gadd, 1960), and with plant-bearing beds (GSC-507: >41,500) on Magog R. (McDonald, 1967).

7430 ± 120
Y-1557. Lake St. John District, Quebec, Canada 5480 B.C.

Brown organic mud from bottom of kettle, in highland S of Lake St. John basin (48° 23′ 24″ N Lat, 72° 7′ W Long), Quebec, Canada. Elev. ca. 236 m. Date is minimum for deglaciation of area. Subm. by P. Lasalle, Dept. of Nat. Resources, Quebec.

9170 ± 160
Y-1558. St. Hilaire Mountains, Canada 7220 B.C.

Barnacles (*Balanus crenatus*) from marine-built terrace N of St. Hilaire Mts., ca. 20 mi E of Montreal (45° 34′ N Lat, 73° 11′ W Long), Canada. Elev. ca. 91 m. Date yields average rate of isostatic readjustment of terrane around Montreal since deglaciation. Subm. 1965 by P. Lasalle. *Comment* (P.L.): date, as recalculated, falls within upper time limit suggested by Terasmae (1960, p. 19) for end of Champlain Sea. Date has been quoted by Lasalle (1966) as 10,560 ± 160 B.P. Rectification of calculation error in lab. has given new figure.

8680 ± 80
Y-1700. Chicoutimi, Quebec, Canada 6730 B.C.

Marine shells (mostly *Hiatella arctica*) from ridge 150 to 180 cm high in Chicoutimi, Quebec, Canada (48° 26′ 50″ N Lat, 71° W Long). Elev. ca. 6.1 m. *Comment* (P.L.): because date is virtually contemporaneous with material of Y-1701, which is 120 m higher, it seems likely that material of Y-1700 has slid by debris flow to its present position (Lasalle, 1965). Coll. and subm. 1965 by P. Lasalle.

Y-1701. Kenogami, Quebec, Canada **8630 ± 80**
6680 B.C.

Marine shells (mostly *Macoma baltica*) from Kenogami, Quebec (48° 28′ 30″ N Lat, 71° 24′ W Long), Canada. Elev. ca. 120 m. Date agrees well with others from material from Lake St. John dist. concerning marine invasion in area (Lasalle, 1965). Coll. and subm. 1965 by P. Lasalle.

Y-1717. Deception Bay, Canada **330 ± 100**
A.D. 1620

Charcoal from archaeologic site on hilly outcrop 2 mi S of head of Deception Bay, and 1 mi N of outlet of Lac Duquet, N Quebec, Canada (62° 6′ N Lat, 74° 33′ W Long). Sample depth 9.2 to 30.5 cm. Site appears to be composed of one group of structures occurring on crest of hill, apparently of Eskimo origin as they are circular dwelling foundations with collapsed tunnels, caches, and pillars probably for supporting kyaks; and another group of foundations of pentagonal shape in depression which ran down side of outcrop. Sample obtained from one of these pentagonal foundations at 3 m above Jac Duquet and 4.50 m above high tide level. No artifacts assoc. but cracked bones occurred between foundation stones. Coll. 1965 and subm. by B. Matthews, McGill Univ. *Comment* (B.M.): results indicate that relatively large Eskimo community (Thule culture) lived near S end of Deception Bay at time of 1st European colonization of Canada, compared with only a few scattered families seen in area by R. Bell and A. P. Low at turn of this century. In addition, since Thule settlements were usually built near extreme high tide level, and as site is at present 2 mi inland at side of Lac Duquet and surface of Lac Duquet is between 2.4 to 3.1 m above high tide level, land emergence of at least 61 to 91 cm per 100 yr must have occurred in last 300 to 400 yr. Such a rate is compatible with that suggested by Matthews (1966).

Y-691. Hamilton City Hall, Ontario **11,570 ± 260**
9620 B.C.

Wood fragments (id. as dicotyledonous, possibly *Populus*, by W. L. Stern) (43° 15′ 22″ N Lat, 79° 52′ 27″ W Long), 11.3 m below surface of bar of Lake Iroquois, 24.4 m above modern Lake Ontario; alt ca. +103.1 m, found in excavation for new City Hall, Hamilton, Ontario, Canada.

For further description, see Stuiver, Deevey, and Gralenski (1960, p. 50). In that date list Yale lab. no. was mistakenly given as Y-391.

Devon Island series, Canada

Shells from raised beaches on Devon I., Northwest Territories, Canada. Samples coll. 1962 and 1965 by F. Muller and W. Barr; subm. 1963 and 1966, respectively, by S. Apollonio and W. Barr, McGill Univ. Beach elev. determined by aneroid. Lat and Long of Y-1732, Y-1733 are (76° 40′ N Lat, 84° 30′ W Long), of Y-1734 is (76° 44′ N Lat, 84° 10′ W Long), of Y-1735 is (76° 47′ N Lat, 83° 90′ W Long), and of Y-

1736, Y-1737 (76° 49′ 30″, N Lat, 83° 90′ N Long). Additional details in Muller and Barr (1966).

7480 ± 120
Y-1294. Devon Island 1 **5530 B.C.**
From "meat cache" site; +3 to 4 m.

8250 ± 160
Y-1295. Devon Island 2 **6300 B.C.**
From "whale bone" site; +8 m.

8740 ± 120
Y-1296. Devon Island 3 **6790 B.C.**
From "base camp" site; +16 m.

16,000 ± 240
Y-1297. Devon Island 4 **14,050 B.C.**
From "Nic's Lake" site; +66 m.

13,620 ± 200
Y-1298. Devon Island 5 **11,670 B.C.**
From "Musk-ox Lake" site; +11.5 m.

9360 ± 160
Y-1299. Devon Island 6 **7410 B.C.**
From "Valley" site; +50 m.

9670 ± 240
Y-1731. Devon Island 10 **7720 B.C.**
From Base-camp lowland; +6.7 m.

10,860 ± 140
Y-1732. Devon Island 13 **8910 B.C.**
From Base-camp lowland; +20.1 m.

30,100 ± 1500
Y-1733. Devon Island 17 **28,150 B.C.**
From Base-camp lowland; +35.9 m.

31,200 ± 1800
Y-1734. Devon Island 21 **29,250 B.C.**
From Skogn lowland; +26.7 m.

8980 ± 200
Y-1735. Devon Island 35 **7030 B.C.**
From Sparbo-Hardy lowland; +46.5 m.

9720 ± 160
Y-1736. Devon Island 37 **7770 B.C.**
From Sparbo-Hardy lowland; +4.4 m.

8800 ± 160
Y-1737. Devon Island 39 **6850 B.C.**
From Sparbo-Hardy lowland; +10.3 m.

450 ± 100
Y-1354. Kaskawulsh Glacier, Yukon, Canada **A.D. 1500**
Fragments from one of several large trees incorporated in terminal moraine of most recent advance of Kaskawulsh glacier (60° 46′ N Lat,

138° 31′ W Long), Yukon, Canada. This moraine marks furthest advance of this glacier during Neoglaciation. Field evidence indicates that trees were overrun within ½ mi of their present position. Coll. and subm. by H. W. Borns, Univ. of Maine. For details, see Borns and Goldthwait (1966).

Y-1387. Yukon Territory, Canada **3330 ± 100**
1380 B.C.

Woody material from base of peat bog at peat lacustrine silt interface at junction of Kaskawulsh and Slims R. Valleys (60° 48′ N Lat, 138° 35′ W Long), St. Elias Mts. Yukon, Canada. Date is minimum for retreat for last major Pleistocene advance, at that point, prior to advance of Neoglaciation. Coll. and subm. by H. W. Borns. For details, see Borns and Goldthwait (1966).

Bog series, Yukon Territory, Canada

Peat samples from bog near top of rock knob located at junction of Kaskawulsh and Slims R. Valleys in SW sec. of Yukon, Canada (60° 46′ N Lat, 138° 35′ W Long). Coll. and subm. by H. W. Borns. Age of ash is discussed by Stuiver, Borns, and Denton (1964).

Y-1363. Yukon 1A **1460 ± 70**
A.D. 490

First 1.3 cm of peat above 2.5 cm thick layer of volcanic ash.

Y-1364. Yukon 1B **1390 ± 70**
A.D. 560

First 1.3 cm of peat below same ash.

Yukon Territory series

All samples were coll. from NE and N flank of St. Elias Mts., Yukon Territory, Canada.

Y-1355. Silver Creek, Yukon **>46,400**

Thin organic layer *in situ* in Shakwak outwash body overlain by drift of Icefield and Kluane glaciations. Sample site is in exposure on W bank of Silver Creek in Shakwak Trough on NE border of St. Elias Mts., Yukon, Canada (61° 00′ N Lat, 138° 19′ W Long). Coll. 1964 by G. H. Denton. For exact location and significance of sample, see Denton and Stuiver (1967).

Y-1356. Silver Creek, Yukon **37,700 $^{+1500}_{-1300}$**
35,750 B.C.

Thin organic layer *in situ* in Icefield outwash body underlain by Icefield till and deposits of Shakwak glaciation, and overlain by deposits of Kluane glaciation. Sample site is in exposure on W bank of Silver Creek in Shakwak Trough on NE border of St. Elias Mts., Yukon, Canada (61° 00′ N Lat, 138° 19′ W Long). Coll. 1964 by G. H. Denton. For exact location and significance of sample, see Denton and Stuiver (1967).

Y-1357. Silver Creek, Yukon **7340 ± 140**
5390 B.C.

Thin organic layer *in situ* in Kluane outwash body underlain by Kluane till as well as drift of Icefield and Shakwak glaciations. Sample site is in exposure on W bank of Silver Creek in Shakwak Trough on NE border of St. Elias Mts., Yukon, Canada (61° 00′ N Lat, 138° 19′ W Long). Coll. 1964 by G. H. Denton. For exact location and significance of sample, see Denton and Stuiver (1967).

Y-1365. Kluane Lake, Yukon **870 ± 100**
A.D. 1080

Wood from outer rings of spruce stump buried in growth position in Neo-glacial loess immediately above white volcanic ash. Sample site is on SE shore of Kluane Lake in Shakwak Trough on NE border of St. Elias Mts., Yukon, Canada (61° 03′ N Lat, 138° 22′ W Long). Coll. 1963 by G. H. Denton. For exact location and significance of sample, see Stuiver *et al.* (1964); Denton and Stuiver (1966, 1967).

Y-1385. Silver Creek, Yukon **30,100 ± 600**
28,150 B.C.

Thin organic layer *in situ* in Icefield outwash body overlain by Kluane till and underlain by Icefield till and deposits of Shakwak glaciation. Sample site is in exposure on W bank of Silver Creek in Shakwak Trough on NE border of St. Elias Mts., Yukon, Canada (61° 00′ N Lat, 138° 19′ W Long). Coll. 1964 by G. H. Denton. For exact location and significance of sample, see Denton and Stuiver (1967).

Y-1386. Kluane Lake, Yukon **12,500 ± 200**
10,550 B.C.

Basal material from body of organic sediment 3.7 m thick, which fills kettle hole in Kluane ice-contact stratified drift. Sample site is located close to SE shore of Kluane Lake in Shakwak Trough on NE border of St. Elias Mts., Yukon, Canada (61° 03′ N Lat, 138° 21′ W Long). Coll. 1964 by G. H. Denton. For exact location and significance of sample, see Denton and Stuiver (1966, 1967).

Y-1435. Kaskawulsh Glacier, Yukon **2640 ± 80**
690 B.C.

Grass buried *in situ* 8 cm above base of sec. of Neoglacial loess which totals 3.0 m in thickness. Loess exposure is near terminus of Kashkawulsh Glacier on NE flank of St. Elias Mts., Yukon, Canada (60° 49′ N Lat, 138° 37′ W Lat). Coll. 1964 by G. H. Denton. For exact location and significance of sample, see Denton and Stuiver (1966).

Y-1480. Kaskawulsh Glacier, Yukon **270 ± 60**
A.D. 1680

Wood from outer rings of spruce stump on outer fringe of Neoglacial moraines fronting Kaskawulsh Glacier on NE flank of St. Elias Mts., Yukon, Canada (60° 49′ N Lat, 138° 35′ W Lat). Stump, in growth position in Neoglacial loess and Slims Soil and is partly buried by Neoglacial morainal debris, was sheared off and killed by Kaskawulsh Glacier when it occupied its Neoglacial maximum position. Coll. 1964 by G. H. Denton. For exact location and significance of sample, see Denton and Stuiver (1966).

Y-1481. Outpost Creek, Yukon **>49,000**

Thin organic layer *in situ* in Icefield ice-contact stratified drift body overlain by Kluane till. Sample site is in exposure on W bank of Outpost Creek in Shakwak Trough on NE border of St. Elias Mts., Yukon, Canada (61° 00′ N Lat, 138° 21′ W Long). Coll. 1964 by G. H. Denton. For exact location and significance of sample, see Denton and Stuiver (1967).

Y-1482. Donjek Glacier, Yukon **>100**

Wood from outer rings of spruce log buried in highest beach ridge of lake dammed by Donjek Glacier when it occupied its maximum Neo-
lake dammed by Donjek Glacier when it iccupied its maximum Neoglacial position. Sample site is near terminus of Donjek Glacier on N flank of St. Elias Mts., Yukon, Canada (61° 8′ N Lat, 139° 29′ W Long). Coll. 1964 by G. H. Denton. For exact location and significance of sample, see Denton and Stuiver (1966).

9780 ± 80
Y-1483. Kaskawulsh Glacier, Yukon **7830 B.C.**

Grass buried *in situ* at base of sec. of Kluane loess 1.5 m in thickness. Sample site is same as Y-1435. Coll. 1964 by G. H. Denton. For exact location and significance of sample, see Denton and Stuiver (1966).

290 ± 80
Y-1484. Donjek Glacier, Yukon **A.D. 1660**

Wood from outer rings of spruce log buried in outermost Neoglacial moraine fronting Donjek Glacier on NE flank of St. Elias Mts., Yukon, Canada (61° 13′ N Lat, 139° 40′ W Long). Coll. 1964 by G. H. Denton. For exact location and significance of sample, see Denton and Stuiver (1966).

230 ± 80
Y-1485. Donjek Glacier, Yukon **A.D. 1720**

Wood from outer rings of spruce log buried in outermost Neoglacial moraine fronting Donjek Glacier. Spruce log is from same site as Sample Y-1484. Coll. 1964 by G. H. Denton. For exact location and significance of sample, see Denton and Stuiver (1966).

Y-1486. Silver Creek, Yukon **>49,000**

Sinuous stringer of peat in base of Icefield till body which overlies drift of Shakwak glaciation and underlies drift of Kluane glaciation. Sample site is in exposure in W bank of Silver Creek in Shakwak Trough on NE border of St. Elias Mts., Yukon, Canada (61° 00′ N Lat, 138° 19′ W Long). Coll. 1964 by G. H. Denton. For exact location and significance of sample, see Denton and Stuiver (1967).

Y-1488. Silver Creek, Yukon **33,400 ± 800**
31,450 B.C.

Thin organic layer *in situ* in Icefield outwash body underlain by Icefield till and overlain by Kluane drift. Sample site is in exposure on W bank of Silver Creek in Shakwak Trough on NE flank of St. Elias Mts., Yukon, Canada (61° 00′ N Lat, 138° 19′ W Long). Coll. 1964 by G. H. Denton. For exact location and significance of sample, see Denton and Stuiver (1967).

Y-1489. Kaskawulsh Glacier, Yukon **110 ± 80**
A.D. 1840

Wood from outer rings of spruce log buried in outermost Neoglacial moraine fronting Kaskawulsh Glacier on NE flank of St. Elias Mts., Yukon, Canada (60° 49′ N Lat, 138° 34′ W Long). Coll. 1964 by G. H. Denton. For exact location and significance of sample, see Denton and Stuiver (1966).

Y-1490. Kaskawulsh Glacier, Yukon **390 ± 80**
A.D. 1560

Wood from outer rings of 2nd spruce log buried in outermost Neoglacial moraine of Kaskawulsh Glacier at same locality at Y-1489. Coll. 1964 by G. H. Denton. For exact location and significance of sample, see Denton and Stuiver (1967).

Y-2309. Fox-Hazard Glacier, Yukon **470 ± 100**
A.D. 1480

Basal organic material from peat bed, 3.6 m thick, which overlies Kluane (classical Wisconsin) till and underlies Neoglacial till deposited by Fox, Hazard, and assoc. minor glaciers when they coalesced to form glacier system during Neoglaciation. Sec. is at outer edge of Neoglacial moraine system fronting Fox-Hazard glacier system on N flank of St. Elias Mts., Yukon, Canada (61° 15′ N Lat, 140° 16′ W Long). Coll. 1967 by G. H. Denton. *Comment* (G.H.D.): date is minimum for underlying Kluane till and maximum for deposition of outermost Neoglacial moraines of Fox-Hazard system.

Y-2310. Fox-Hazard Glacier, Yukon **7890 ± 120**
5940 B.C.

Basal organic material from peat bed, 1.5 m thick, which overlies Kluane (classical Wisconsin) till and underlies Neoglacial till deposited by Fox-Hazard Glacier system. Although nearby, this peat bed is distinct from one described under Y-2309. Sec. is at outer edge of Neoglacial moraine system fronting Fox-Hazard Glacier system (61° 15′ N Lat, 140° 16′ W Long). Coll. 1967 by G. H. Denton. *Comment* (G.H.D.): date is minimum for underlying Kluane till and maximum for deposition of outermost Neoglacial moraines of Fox-Hazard Glacier system.

Y-2311. Fox-Hazard Glacier, Yukon **6860 ± 120**
4910 B.C.

Uppermost organic matter from peat bed described under Y-2310. Coll. 1967 by G. H. Denton. *Comment* (G.H.D.): date is minimum for underlying Kluane till and maximum for deposition of overlying outermost Neoglacial moraines of Fox-Hazard Glacier system.

Y-2312. Fox-Hazard Glacier, Yukon **8200 ± 140** **6250 B.C.**

Basal organic material from peat sec., 2.4 m thick, which directly overlies Kluane (late Wisconsin) till. Sample site is 2000 ft downvalley from outermost Neoglacial moraines, Canada (61° 15′ N Lat, 140° 15′ W Long). Coll. 1967 by G. H. Denton. *Comment* (G.H.D.): date is minimum for last deglaciation of sample site.

Y-700. Mesters Vig, Greenland **3970 ± 80** **2020 B.C.**

Peat, Sample 58-7-20a from depth 83 to 84 cm, excavation in joined circles 12 m SE of TC string 3A, Mesters Vig, NE Greenland (72° 14′ N Lat, 23° 50′ W Long). Coll. 1958 by A. L. Washburn, Yale Univ., now Univ. of Washington.

Y-1267. Mesters Vig, Greenland **200 ± 60** **A.D. 1750**

Mya truncata (*Linné*), alive in 1961. Coll. by John Scully, and subm. by A. L. Washburn. C^{14} deficiency of this sample is smaller than found for shells in same area coll. a few yr earlier (Y-606: 550 ± 70, Radiocarbon 1962, v. 4, p. 251). This reduction in C^{14} deficiency may have been caused by uptake of bomb carbon in shallow water environment as shells were coll. from water depth of 0 to 1 m where they had been thrown up by storm waves.

Y-1992. Mesters Vig, Greenland **9370 ± 120** **7420 B.C.**

Hiatella arctica (*Linné*). Shells from stony loam on W side of emerged delta complex E of Tunnelelv, Mesters Vig at alt. ca. 80 m. Subm. by A. L. Washburn. This measurement agrees with uplift curve for Mesters Vig area (Washburn and Stuiver, 1962).

White River Valley series

All samples were coll. from White R. valley on N flank of Wrangell and St. Elias Mts., Alaska.

Y-2301. White River, Alaska **10,900 ± 160** **8950 B.C.**

Organic material from base of peat sec. 14.6 m thick, which directly overlies till of Kluane (late Wisconsin) age. Muskeg is exposed in N bank of White R. on N flank of Wrangell and St. Elias Mts., Alaska (61° 45′ N Lat, 141° 36′ W Long) ca. 8 mi downstream from terminus of Russell Glacier. This exposure was 1st described by S. R. Capps (1916, p. 70-75). Coll. 1967 by G. H. Denton. *Comment* (G.H.D.): date is minimum for last deglaciation of sample site.

Y-2302. White River, Alaska **8020 ± 120** **6070 B.C.**

Lowest spruce stump in peat sec. described under Y-2301. Stump 60 cm above base of deposit. Coll. 1967 by G. H. Denton. *Comment* (G.H.D.): date is minimum for invasion of spruce into White R. valley following last deglaciation.

Y-2303. White River, Alaska **1990 ± 80** **40 B.C.**

Spaghnum moss from immediately below 60 cm layer of white volcanic ash which, in turn, is 2.1 m below top of muskeg sec. described under Y-2301. Most likely, spaghnum moss was killed by ash fall. Coll. 1967 by G. H. Denton. *Comment* (G.H.D.): sample dates deposition of volcanic ash.

Y-2304. White River, Alaska **1850 ± 80** **A.D. 100**

Identical to Y-2303, except for location of sample site 9.1 m W of Y-2303. Coll. 1967 by G. H. Denton. *Comment* (G.H.D.): dates deposition of volcanic ash.

Y-2305. White River, Alaska **>47,000**

Organic material *in situ* within gravel unit exposed along N Fork Creek in White R. Valley on N flank of Wrangell and St. Elias Mts., Alaska (61° 52′ N Lat, 141° 39′ W Long). Gravel unit is underlain by till and overlain by lacustrine sediments containing drop stones. Coll. 1967 by G. H. Denton. *Comment* (G.H.D.): date is minimum for last deglaciation of sample site.

Y-2306. White River, Alaska **11,270 ± 200** **9320 B.C.**

Organic matter from base of peat sec., 7.9 m thick, which directly overlies till of Kluane (classical Wisconsin) age. Sec. is exposed in SE bank of White R. on N flank of Wrangell and St. Elias Mts., Alaska (61° 43′ N Lat, 141° 45′ W Long) ca 2.7 mi downstream from snout of Russell Glacier. Coll. 1967 by G. H. Denton. *Comment* (G.H.D.): date is minimum for last deglaciation of site.

Y-2307. White River, Alaska **8280 ± 120** **6330 B.C.**

Organic matter from base of peat sec., 3.0 m thick, which directly overlies till of Kluane (classical Wisconsin) age. Sec. is exposed in SE bank of White R. N flank of Wrangell and St. Elias Mts., Alaska (61° 42′ N Lat, 141° 46′ W Long) ca. 0.2 mi downstream from terminus of Russell Glacier. Coll. 1967 by G. H. Denton. *Comment* (G.H.D.): date is minimum for last deglaciation of sample site.

Y-2308. White River, Alaska **>47,000**

Organic matter *in situ* within gravel unit underlain by 2 tills and overlain by 1 till. These deposits are exposed along Solo Creek in White R. Valley on N flank of Wrangell and St. Elias Mts., Alaska (61° 47′ N Lat, 141° 44′ W Long). Coll. 1967 by G. H. Denton. *Comment* (G.H.D.): date is minimum for 2 lower tills.

Lake Hill series, St. Paul Island, Bering Sea, Alaska

Gyttja from 14 m deep core at Lake Hill, St. Paul I., Pribilof Is., Bering Sea (57° 12′ N Lat, 170° 15′ W Long). Lake is in crater of small extinct volcano, Lake Hill. Coll. and subm. by P. A. Colinvaux, Ohio State Univ.

Y-1388. Lake Hill 141 to 149 cm — **2620 ± 160** / **670 B.C.**

Highly organic gyttja.

Y-1389. Lake Hill 322 to 330 cm — **3520 ± 100** / **1570 B.C.**

Highly organic gyttja.

Y-1390. Lake Hill 541 to 555 cm — **9570 ± 160** / **7620 B.C.**

Organic gyttja, transitional to underlying sandy layers.

Y-1391. Lake Hill 1072 to 1088 cm — **17,800 ± 700** / **15,850 B.C.**

Silty gyttja, possibly containing volcanic ash. *Comment*: Y-1388 to Y-1390 date pollen diagram dominated by *Umbelliferae* and *Artemisia*. Spectrum from surface of lake bottom conforms to spectra deeper in core, showing that pollen sequence can be explained in terms of modern vegetation of island (Colinvaux, 1967). Pollen record of bottom 8 m shows that only tundra was present on St. Paul I. during period recorded.

Y-1392. St. George Island, Bering Sea, Alaska — **5630 ± 150** / **3680 B.C.**

Peat 8 cm from bottom of bog on Garden Cove Trail, St. George I., Pribilof Is., Bering Sea (56° 35′ N Lat, 169° 30′ W Long). Coll. and subm. by P. A. Colinvaux.

Y-1417. Imuruk Lake, Alaska — **29,300 ± 1000** / **27,350 B.C.**

Peat from 7.3 to 7.5 m depth of 8 m deep core at Imuruk Lake, Seward Peninsula, Alaska (65° 15′ N Lat, 165° 45′ W Long). Pollen record of lake is fully discussed in Colinvaux (1964). Date incompatible with pollen-stratigraphic and radiometric data available from core and suggests possible contamination. Coll. and subm. by P. A. Colinvaux.

Elephant Point series, Alaska

Wood and peat from permafrost sea-cliff at Elephant point, Kotzebue Sound, Alaska (66° 15′ N Lat, 161° 18′ W Long). Coll. 1963 and subm. by J. H. Ostrom, Dept. of Geol., Yale Univ.

Y-1351. Elephant Point 1 — **9480 ± 160** / **7530 B.C.**

Wood from ca. 6.7 m below surface of cliff.

Y-1352. Elephant Point 2 — **>44,000**

Peat from ca. 8.5 m below surface of cliff.

Cherryfield Bog series, Maine

Peat-bottom interface samples from kettle bog in Cherryfield, Maine (44° 40′ N Lat, 67° 55′ W Long). All samples are 5 cm secs. and, except Y-1972, were obtained on SW-NE line across deepest spot. Coll. 1967 and subm. by D. Mickelson and H. W. Borns. Deposition of organic material evidently took place simultaneously over large area in kettle. Depths indicated below give peat-sand interfaces for 1st 3 samples, and peat-silt interfaces for remaining ones. A more detailed discussion is given by Michelson (1968).

5310 ± 100
Y-1963. Cherryfield 221 cm **3360 B.C.**

8920 ± 160
Y-1965. Cherryfield 290 cm **6970 B.C.**

9130 ± 120
Y-1964. Cherryfield 323 cm **7180 B.C.**

9040 ± 140
Y-1966. Cherryfield 366 cm **7090 B.C.**

9360 ± 120
Y-1972. Cherryfield 519 cm **7410 B.C.**

9710 ± 160
Y-1967. Cherryfield 529 cm **7760 B.C.**

9380 ± 160
Y-1971. Cherryfield 534 cm **7430 B.C.**

9640 ± 150
Y-1968. Cherryfield 544 cm **7690 B.C.**

9670 ± 150
Y-1970. Cherryfield 549 cm **7720 B.C.**

9630 ± 160
Y-1969. Cherryfield 554 cm **7680 B.C.**

Barnstable Marsh series, Massachusetts

Peat, fibrous and silty, from spit that shelters Barnstable Harbor (Hyannis quadrangle, USGS topographic maps), N shore of Cape Cod, Massachusetts (Radiocarbon, 1963, v. 5, p. 315-316). Coll. and subm. by A. C. Redfield, Woods Hole Oceanog. Inst.

480 ± 80
Y-1305. Bass Creek **A.D. 1470**

Fibrous peat from 1.3 ± .08 m depth, Bass Creek (41° 43′ 34″ N Lat, 70° 18′ 10″ W Long).

1060 ± 80
Y-1306. Bass Creek **A.D. 890**

Silty peat from 2.0 ± .08 m depth.

Y-1307. Braileys **1060 ± 80**
A.D. 1750

Fibrous peat from 0.9 ± .08 m depth, Braileys (41° 43′ 50″ N Lat, 70° 19′ 15″ W Long).

Y-1308. Keith's **510 ± 80**
A.D. 1440

Silty peat from 1.5 ± .08 m depth, Keith's (41° 43′ 50″ N Lat, 70° 20′ 52″ W Long).

Y-1309. Keith's **1070 ± 80**
A.D. 880

Silty peat from 2.2 ± .08 m depth.

Y-1310. Keith's **1680 ± 80**
A.D. 270

Silty peat from 2.9 ± .08 m depth.

Y-1311. Keith's **2010 ± 80**
60 B.C.

Organic sand from 3.8 ± .08 m depth.

General Comment (A.C.R.): samples supplement those reported (Radiocarbon, 1963, v. 5, p. 315-316), which showed minimal age of intertidal salt marsh which formed in protection of Sandy Neck as this spit increased in length (Redfield, 1965). Age of samples is 500 to 700 yr less than samples of high marsh peat from same depths in Barnstable Marsh and using Barnstable marsh sea levels, these samples lay 0.5 to 2 m below est. MHW level at time they were deposited (Redfield and Rubin, 1962). These discrepancies may have arisen from initial development of marsh at intertidal levels or from subsequent compaction. Samples do not meet criteria for peat samples to be used in examining changes in relative sea level (Bloom, 1967a).

Buzzards Bay series, Massachusetts

Core from Buzzards Bay, Massachusetts (41° 30′ N Lat, 70° 31′ W Long). Sample taken between 32 to 45 cm from top of core with gravity corer on silt-clay bottom at 20 m depth. Coll 1967 and subm. by D. C. Rhoads, Yale Univ.

Y-2369a. Carbonate **630 ± 140**
A.D. 1320

Y-2369b. Organic matter **1470 ± 80**
A.D. 480

Oyster Pond series, Massachusetts

Wood and peat from Oyster Pond, Falmouth Co., Massachusetts (41° 42′ N Lat, 70° 38′ W Long). Sample coll. for checking pollen zones in relation to sea level rise. Pollen diagram given by Deevey (1948).

Y-1663. Oyster Pond OP-1 **3420 ± 120**
1470 B.C.

Wood and peat from bottom of Core OP-1, coll. by E. S. Deevey and subm. by K. O. Emery. Originally assigned to C-3 zone according to pollen, C^{14} date places material in upper Zone C-2.

2180 ± 100
Y-1458. Oyster Pond OP 2-19 **230 B.C.**

Core OP-2, gyttja, 5.80 m below mud surface, 10.4 m below water level, at level indicating marine influence. Boring OP-2, Oyster Pond. Coll. 1945 and subm. by E. S. Deevey.

11,750 ± 300
Y-1459. Oyster Pond OP2-43 **9800 B.C.**

Core OP-2, clay-gyttja, 13.12 m below mud surface, 17.69 m below water level, at base of sec. overlying outwash. Coll. 1945 and subm. by E. S. Deevey.

2730 ± 80
Y-1765. Kettle near Oyster Pond **780 B.C.**

Bottom-most peat from 2.6 m depth at small kettle ca. 300 m NE of head of Oyster Pond. Peat overlies sand, silt, cobbles, and boulders. Coll. and subm. by K. O. Emery, Woods Hole Ocean Inst. *Comment* (K.O.E.): dated to determine suitability for post-glacial studies, but date indicates pond supported no peat until water table rose high enough to permit pond floor to be damp ca. 3000 yr ago. Above data are included in general study of Oyster Pond, perhaps titled "Natural History of a Coastal Pond in Massachusetts" American Elsevier Publ. Co.

14,420 ± 300
Y-2420. West Lynn, Massachussetts **12,470 B.C.**

Plates of barnacle *Balanus hameri* (Ascanius) from Blakely clay pit, W Lynn, Massachusetts (42° 28′ N Lat, 70° 59′ W Long). Embedded in blue-gray clay (Kaye and Barghoorn, 1964). Coll. and subm. by C. A. Kaye, U.S.G.S., Boston, Massachusetts. Other dates for barnacles of same horizon at this locality are 14,250 ± 250 (W-735), 13,800 ± 300 (L-598A) and 13,230 ± 320 (GX-17). Yale date agrees with oldest date of this series.

Charlestown Pond series, Rhode Island

Peat from core at Charlestown Pond, Rhode Island (41° 21.2′ N Lat, 71° 41.3′ W Long). Dating was related to study of geol. of one of lagoons in S coast of Rhode Island (Dillon, 1964). Coll. and subm. by W. Dillon, Univ. of Rhode Island.

3960 ± 80
Y-1423. Charlestown Pond 91.3 to 93.3 cm **2010 B.C.**

6220 ± 80
Y-1642. Charlestown Pond 98.0 to 103.0 cm **4270 B.C.**

7300 ± 80
Y-1424. Charlestown Pond 103.0 to 106.1 cm **5350 B.C.**

Prospect Beach series, Connecticut

Shells (*Pecten irradians*) wood and calcitic cement of limestone concretions from Prospect Beach, West Haven, Connecticut (41° 14′ 46″ N

Lat, 72° 58′ W Long). Source of samples appears to be borrow pit from which beach fill was dredged in 1957. Pit lies 450 m offshore, as measured from mean high water level, off Prospect Beach under 4.30 m water. Fauna and flora are of living species but certain invertebrates common in concretions are no longer common in area. Coll. and subm. by Karl M. Waage, Dept. of Geol., Yale Univ.

4600 ± 90
Y-1129. Prospect Beach 1 **2650 B.C.**

Scallop shells.

4530 ± 100
Y-1596. Prospect Beach 2 **2580 B.C.**

Wood fragments.

5330 ± 100
Y-1783. Prospect Beach 3 **3580 B.C.**

Calcitic cement.

5620 ± 80
Y-1400. Hammock River, Connecticut **3670 B.C.**

Peat from layer underlying estuarine mud in Hammock R. tidal marsh, Clinton, Connecticut (41° 15.7′ N Lat, 72° 30.7′ W Long). Depth, 770 ± 20 cm. Coll. 1963 and subm. by A. Bloom, Cornell Univ. *Comment* (A.B.): further verifies submergence curve in Bloom and Stuiver (1963).

280 ± 60
Y-1402. Chittenden Beach, Connecticut **A.D. 1670**

Axe-cut pole from "corduroy" log road that formerly crossed tidal marsh from Guilford point to wharf on West R. (41° 16′ N Lat, 72° 40.2′ W Long), Guilford, Connecticut. Beach ridge has now migrated landward past old road, and logs were exposed in intertidal wave-cut bank. Sample was overlain by 53 cm of salt-marsh peat and underlain by 20 cm of compact gray mud and undetermined thickness of sand and gravel. Coll. 1965 and subm. by A. Bloom. *Comment* (A.B.): accelerated submergence during recent centuries or decades is implied.

Lake Quassapaug series, Connecticut

A 3.4 m core taken in ca. 18 m water near W basin of Lake Quassapaug, alt: 212 m (41° 32′ N Lat, 73° 11′ W Long). Coll. and subm. by M. Tsukada, Yale Univ., now Univ. of Wash.

1020 ± 80
Y-1860. Lake Quassapaug 0 to 10 cm **A.D. 930**

2050 ± 100
Y-1861. Lake Quassapaug 40 to 50 cm **100 B.C.**

3300 ± 100
Y-1862. Lake Quassapaug 90 to 100 cm **1350 B.C.**

4780 ± 120
Y-1863. Lake Quassapaug 120 to 130 cm **2830 B.C.**

Y-1864. Lake Quassapaug 190 to 200 cm **8750 ± 160**
6800 B.C.

Y-1865. Lake Quassapaug 211 to 219 cm **9410 ± 160**
7460 B.C.

Y-1866. Lake Quassapaug 246 to 254 cm **12,330 ± 250**
10,380 B.C.

Comment (M.T.): preliminary unpubl. pollen diagram shows that A/B boundary is at ca. 2.4 m level and pine peak in B zone can be seen at ca. 2.1 m level. B/C zonal boundary is probably placed at 195 cm level, date of which is ca. 8000 B.P.; *Carya* pollen begins to increase at ca. 1.5 m level; *Castanea* pollen at ca. 0.6 m level. General trend of vegetational succession for last 14,000 yr accords with S New England scheme established by Deevey (1939, 1943), but sedimentation rate is remarkably low in this lake as compared to other Connecticut lakes.

Stony Creek series, Connecticut

Wood found assoc. with red bricks of colonial age immediately above bedrock and underneath salt marsh at Stony Creek, Connecticut (41° 15′ 40″ N Lat 72° 44′ 33″ W Long). Thickness of overlying marsh deposits is 105 cm. Coll. and subm. by A. L. Washburn.

Y-1433. Stony Creek 1 **180 ± 80**
A.D. 1770

Y-1434. Stony Creek 2 **100 ± 80**
A.D. 1850

Young age indicates rapid marsh accumulation not assoc. with sea level changes.

Morgan Point series, Connecticut

Core A 6197 taken from 14.9 water 2½ mi. due S of Morgan Point, East Haven, Connecticut (41° 12′ N Lat, 72° 53′ W Long). Coll. by D. C. Rhoads and subm. by D. Kharkar, Yale Univ.

Y-1846. Morgan Point 5 to 12 cm **2680 ± 160**
730 B.C.

Y-1847. Morgan Point 40 to 65 cm **1550 ± 120**
A.D. 400

Morris Cove series, Connecticut

Core A 6198 taken from 3.30 m water at Morris Cove, due W of Farbes Bluff, Connecticut (41° 15′ 50″ N Lat, 72° 54′ 10″ W Long). Coll. by D. C. Rhoads, and subm. by D. Kharkar.

Y-1848. Morris Cove 10 to 20 cm **2020 ± 80**
70 B.C.

Y-1849. Morris Cove 40 to 53.5 cm **1350 ± 100**
A.D. 600

360 ± 100
A.D. 1590

Carbonate. *Comment*: four dates for organic fraction in 2 cores show that dredging operations in Long Island Sound have redeposited older sediments on top of younger sediments.

Y-1715. Tahawus, New York **>56,000**

Organic material, peat, and wood close to top of ca. 1 m thick layer of brown laminated silt between till sheets and underneath Wisconsin till. Coll. 1965 by M. Stuiver and E. Muller at Nat. Lead Co. Mining Pit, Tahawus, New York (44° 3′ N Lat, 74° 3′ W Long). For details of site, see Muller (1965).

41,900 ± 900
Y-1401. Sixmile Creek, New York **39,950 B.C.**

Picea cf. *mariana* driftwood knot from lacustrine gray sand, exposed in gully tributary to Sixmile Creek (42° 24.6′ N Lat, 76° 27.8′ W Long) Ithaca, New York. Sand is at ca. 240 m alt. in upper part of sec. of lacustrine sand, silt, and clay over 21 m in thickness, overlain by till. Lake beds at this alt. require glacier margin ca. 30 mi N, damming N end of Cayuga Lake trough. Sample predates at least one glacial advance to S of Ithaca, N.Y. Wood from this gully, but not necessarily from same stratum, dated >35,000 B.P. (W-504). Coll. 1965 and subm. by A. Bloom.

Cayuga Lake series, New York

Driftwood logs (*Abies*) from lacustrine silt and sand exposed on W shore of Cayuga Lake, 910 m NW of NW base of Taughannock Point (42° 33′ N Lat, 76° 36.9′ W Long), Covert, New York. Coll. 1966 and subm by A. Bloom.

Y-1403. "Clam bed" **>54,000**

Pieces of single flattened log, from clam beds ca. 8.5 m above present lake level.

Y-1404. "Low wood" **>52,000**

Flattened logs from sand ca. 14.3 m above present level. *Comment* (A.B.): wave-cut bank 23 m high exposes deltaic lacustrine beds. Between 7.5 and 10.5 m above present lake level is dense, peaty, gray silt, packed with freshwater clam shells. From 10.5 to 18 m above lake level is well-sorted gray medium sand, containing abundant driftwood logs. From 18 m to 23 m above lake level is flat-pebble gravel in compact, clay-rich matrix. Wood and shells are flattened in horizontal plane and all sediments are notably over-consolidated, apparently by glacier-ice load. Beds are believed to be those described by Maury (1908) as interglacial and correlative with Don Valley beds of Toronto, Canada (Sangamon age?). See Bloom (1967b).

Brigantine National Wildlife Reserve series, New Jersey

Peat from base of swamp and brackish marsh layer bedded between intertidal peat or mudflat deposit at top sands and gravels at bottom.

Sands and gravel form basement of lagoon at Brigantine Natl. Wildlife Reserve (39° 28′ N Lat, 74° 25′ W Long), between Brigantine City and mainland. Coll. and subm. 1962 by J. Daddario with objective of establishing rate of New Jersey coastal submergence (Daddario, 1961; Stuiver and Daddario, 1963). Depths established below present level of mean high tide.

Y-1331. Brigantine 2.5 to 2.7 m — **1890 ± 40** / **A.D. 60**

From 180 m SE of mainland above steep basement slope.

Y-1281. Brigantine 4.6 to 4.8 m — **3000 ± 90** / **1050 B.C.**

From 275 m SE of mainland above steep basement slope.

Y-1282. Brigantine 7.3 to 7.5 m — **3830 ± 100** / **1880 B.C.**

From 990 m SE of mainland above gentle basement slope.

Y-1283. Brigantine 10.2 to 10.4 m — **4760 ± 80** / **2810 B.C.**

From 3570 m SE of mainland above very gentle basement slope.

Y-1284. Brigantine City, New Jersey — **5890 ± 100** / **3940 B.C.**

Organic material from 10 cm thick organic layer 13.1 m below tidal marsh surface at Brigantine City (39° 25′ N Lat, 74° 23′ W Long), New Jersey. Surface of marsh is approx. at mean high water. Sample is 12.95 to 13.05 m below present level of mean high tide. *Comment*: area shows rapid submergence until 2000 to 3000 yr ago, and much reduced submergence rate from that time to present (Stuiver and Daddario, 1963).

Y-1886. Virginia Beach, Virginia — **>47,000**

Driftwood from Layer 3 at Bonneys' Corner Pit in Virginia Beach, Virginia (36° 47′ 30″ N Lat, 76° 10′ 49″ W Long). Pit is ca. 15 mi from ocean and 12 m deep. Layer 1, Upper Member of Sand Bridge formation, is 1.2 m thick and consists of Pleistocene clays and soils and contains no known fossils. Layer 2, Kempsville formation, beach and dune sand layer, is ca. 3.5 m thick and composed of white and yellow sand. Layer 3, Kempsville formation, marine gravel layer, is of variable thickness, 15 cm to 3.6 m, and consists of gravel with fauna indicating cooler climate than present. Coll. 1967 and subm. by Paul Drez, Old Dominion College. For details, see Oaks (1964) and Ray *et al.* (1968).

Y-1980. Hack Pond, Virginia — **12,720 ± 200** / **10,770 B.C.**

Organic silt from 161 to 169 cm depth below water surface at Hack Pond, Augusta Co., Virginia (37° 59′ N Lat, 79° 00′ W Long). Core diameter, 5 cm. Sample dates top of spruce zone in pollen diagram of A. J. Craig. Subm. by H. E. Wright, Univ. of Minnesota.

Dismal Swamp series, Virginia

Peat from various stratigraphic positions in vicinity of Norfolk, Virginia. Samples coll. in connection with detailed study of Pleistocene geol. of dist. Coll. 1961 and subm. by D. R. Whitehead, Indiana Univ., Bloomington, Indiana (Whitehead, 1965).

3250 ± 100
Y-1319. Jericho Ditch **1300 B.C.**

Coarse forest peat from 2 cores, 1 m apart, 1.33 to 1.37 m depth; Sta. DS-49 on Jericho Ditch, 3.4 km N of Lake Drummond (36° 39′ 13″ N Lat, 76° 28′ 45″ W Long). Samples obtained from point in profile where increase in cypress and cedar and decrease in oak is recorded, and swamp shrubs begin to appear.

8900 ± 160
Y-1320. Station DS-1 **6950 B.C.**

Fibrous peat from 2 cores, 1 m apart, 2.10 to 2.15 m depth; Sta. DS-1 10 m N of feeder ditch, 600 m E of Lake Drummond, and 200 m W of Spillway (36° 35′ 43″ N Lat, 76° 26′ 26″ W Long). Samples obtained from base of peat, close to transition to underlying clay.

3580 ± 100
Y-1321. Station DS-1 **1630 B.C.**

Coarse peat from 2 cores, 1 m apart, .78 to .82 m depth. Samples obtained from point in profile where increase in cypress and cedar and decrease in oak is recorded, and swamp shrubs begin to appear.

4210 ± 160
Y-1322. Station LD-59 **2260 B.C.**

Fine-grained, organic lake sediment (gyttja) from 2 cores, 1 m apart, 2.11 to 2.15 m depth; Sta. LD-59 on Lake Drummond ca. 750 m N of mouth of Reddick Ditch, and 1.5 km W of mouth of Feeder Ditch (36° 35′ 31″ N Lat, 76° 27° 50″ W Long). Samples obtained from near contact between gyttja and underlying sand.

Y-167. Lake Monongahela, West Virginia **>50,000**

Wood from excavation, elev. 291 m (est.), sediments of Lake Monongahela. Sample is in position of Layer 5, Boring 2, Morgantown Experiment Sta., U.S. Bureau of Mines, Morgantown, West Virginia, 366 m N of 37° 40′ N Lat, 1370 m W of 79° 52′ 30″ W Long. Subm. by T. Arkle, Jr., W. Va. Geol. and Econ. Survey.

20,100 ± 240
Y-1981. Quicksand Pond, Georgia **18,150 B.C.**

Organic silt from 475 to 480 cm depth below water surface, at Quicksand Pond, Bartow Co., Georgia (34° 19′ N Lat, 84° 52′ W Long). Pollen diagram by W. A. Watts indicates spruce zone of Wisconsin age. Subm. by H. E. Wright.

8510 ± 100
Y-1776. Lake Louise, Georgia **6560 B.C.**

Gyttja from 1152 to 1158 cm depth at Lake Louise, Lowndes Co., Georgia (30° 43′ N Lat, 83° 15′ W Long). Subm. by H. E. Wright. Sample dates renewal of organic deposition after formation of layer of siltstone rubble.

Y-696. Piedmont Depression, Georgia **620 ± 70**
A.D. 1330

Organic material overlying inorganic bottom in depression in granite, 40 to 50 cm deep, on Piedmont of Georgia (33° 45′ N Lat, 84° 10′ W Long). Sample age gives est. of time required for development of organic material in depression. Coll. 1957 and subm. by R. B. Platt, Emory Univ. (Cotter and Platt, 1959; Burbanck and Platt, 1964).

Y-1248. Johnson County, Indiana **20,230 ± 200**
18,280 B.C.

Spruce wood (id. by B. Bruce) from cutbank of stream, Johnson Co., Indiana (Fruitdale, Ind. 7½ min. quadrangle). Coll. by W. J. Wayne; subm. by J. G. Ogden III, Ohio Wesleyan Univ. as an interlab check (OWU-8, 19,910 ± 690, Radiocarbon, 1964, v. 6, p. 342).

Wabash River series, Indiana

Wood fragments from Unit 5, silt layer, 6.6 to 9.2 m deep, along N bank of Wabash R., Tipecanoe Co., Indiana (40° 23′ 00″ N Lat, 87° 05′ 10″ W Long). Coll. and subm. by W. J. Wayne, Geol. Survey, Indiana Univ.

Y-1439. Wabash basal 10 cm of unit **>48,000**

Y-1440. Wabash 70 to 80 cm above base of unit **>48,000**

Y-1441. Wabash between 2.30 and 2.60 m from base of unit **>48,000**

Comment (W.J.W.): samples date outwash silt and sand probably deposited during earliest phase of Wisconsin glaciation. Sec. is described in Wayne (1965, p. 29-32). These sediments could possibly correlate with glacial advance suggested by Dreimanis (1960) to have extended into E Great Lakes region 50,000 to 60,000 yr ago. If so, this would represent 1st specific evidence from NW Indiana of glacial sediments of post-Sangamon age that are clearly older than bulk of Wisconsin drift.

Inca Cave series, Missouri

Bat guano from 2.4 m deposit at Inca cave, Pulaski Co., Missouri (37° 45′ N Lat, 92° 15′ W Long). Coll. to establish relation between current guano deposits and distinct patterns or lines exposed in large guano piles. Coll. 1958 by W. Elder and R. Myer and subm. by W. Elder, Univ. of Missouri.

Y-719. Inca Cave 6.4 to 15.9 cm **890 ± 80**
A.D. 1060

Y-718. Inca Cave 183.0 to 198.3 cm **37,600 ± 1500**
35,650 B.C.

Comment (W.E.): guano pile was all layered to bottom of cave, and was light brown near top. Solid black unctuous layer was from 15 to 20 cm below surface, and similar layers occurred at 153 cm and 183 cm depths. In bottom 91 cm of pile, layers were thin and appeared like varves.

Rutz Lake series, Minnesota

Copropel and plant detritus from 5.1 cm diam. and 16 m long core under 4.0 m of water in Rutz Lake, Carver Co., Minnesota (44° 52′ 09″ N Lat, 93° 51′ 28″ W Long). All samples, except Y-1922 of this series, consist of 4 cm core. Sample depth measured from surface. Lake sediments are all calcareous to some degree. Measured as part of study of postglacial vegetational fluctuations of prairie-forest border in Minnesota. Pollen diagram by J.C.B. Waddington. Coll. and subm. by E. J. Cushing, Univ. of Minnesota.

Y-1915. Rutz Lake 497 to 501 cm **1100 ± 80**
A.D. 850

Copropel (gyttja), calcareous. Sample located stratigraphically just below increase of weed pollen which marks inception of European agriculture, here ca. 1865 A.D.

Y-1916. Rutz Lake 598 to 602 cm **1420 ± 100**
A.D. 530

Copropel (gyttja), calcareous.

Y-1917. Rutz Lake 798 to 802 cm **2920 ± 80**
970 B.C.

Copropel, slightly silty, calcareous.

Y-1918. Rutz Lake 998 to 1002 cm **4240 ± 100**
2290 B.C.

Copropel, slightly silty, calcareous.

Y-1919. Rutz Lake 1298 to 1302 cm **5930 ± 100**
3980 B.C.

Copropel, slightly silty, calcareous.

Y-1920. Rutz Lake 1649 to 1653 cm **8800 ± 160**
6950 B.C.

Copropel, slightly silty, calcareous.

Y-1921. Rutz Lake 1868 to 1872 cm **10,490 ± 120**
8540 B.C.

Marly copropel. Dates postglacial boundary between *Picea-Larix* and *Pinus-Pteridium* zones in lake.

Y-1922. Rutz Lake 1962 to 1970 cm **12,000 ± 160**
10,050 B.C.

Plant detritus. Dates *Picea-Larix* pollen zone and is minimum for formation of lake, which is post-maximum of Des Moines lobe.

Horseshoe Lake series, Minnesota

Copropel and peat from core 10.2 cm in diam. and 3.24 m long under 1.05 m water in Horseshoe Lake, Isanti Co., Minnesota (45° 27′ 30″ N Lat, 93° 02′ 53″ W Long). Measured as part of study of changes in absolute pollen frequency from 10,000 to 13,000 yr B.P., dating pollen-zone boundaries and other fluctuations within regional vegetational history. Core is ca. 10 m from core from which publ. pollen diagram (Cushing, 1967) was made. Coll. and subm. by E. J. Cushing.

Y-1973. Horseshoe Lake 1035 to 1038 cm — **8510 ± 160**, **6560 B.C.**

Algal copropel, non-calcareous, with very fine laminated structure. Scattered *Naias* seed.

Y-1974. Horseshoe Lake 1076 to 1078 cm — **9200 ± 120**, **7250 B.C.**

Algal copropel, non-calcareous, with very fine laminated structure.

Y-1975. Horseshoe Lake 1116 to 1118 cm — **10,060 ± 160**, **8110 B.C.**

Algal copropel, non-calcareous, with very fine laminated structure. Dates boundary between *Picea-Larix* and *Pinus-Pteridium* zones (Cushing, 1967).

Y-1976. Horseshoe Lake 1156 to 1158 cm — **11,370 ± 200**, **9420 B.C.**

Algal copropel, non-calcareous, with very fine laminated structure.

Y-1977. Horseshoe Lake 1196 to 1198 cm — **12,320 ± 160**, **10,370 B.C.**

Algal copropel, slightly sandy, non-calcareous, with very fine laminated structure.

Y-1978. Horseshoe Lake 1235 to 1242 cm — **13,530 ± 240**, **11,580 B.C.**

Peat, brown-moss (cf. *Drepanocladus*), sandy, marly, highly calcareous, felted structure. Dates *Compositae-Cyperaceae* zone and formation of lake. Date is minimum for formation of Anoka Sand Plain and maximum for Grantsburg sublobe.

Y-1979. Andree Bog, Minnesota — **9910 ± 120**, **7960 B.C.**

Algal copropel, non-calcareous, from Andree Bog, Isanti Co., Minnesota (45° 43′ 39″ N Lat, 93° 14′ 30″ W Long). Sample from 501 to 505 cm depth from core 10.2 cm diam. Core is adjacent to core from which publ. pollen diagram (Cushing, 1964) was made. Date is in same core and 50 cm above L-727 A + B (11,300 ± 200) (Cushing, 1964). Coll. and subm. by E. J. Cushing. *Comment*: sample dates postglacial boundary between *Picea-Larix* and *Pinus-Pteridium* pollen zones at lake. Date agrees well with Y-1975 (this date list, for same stratigraphic boundary) at Horseshoe Lake.

Myrtle Lake series, Minnesota

Gyttja from pollen core at Myrtle Lake, Koochiching Co., Minnesota (47° 58′ N Lat, 94° 23′ W Long). Subm. by H. E. Wright. Pollen diagram by Janssen (1968).

2680 ± 120
Y-1778. Myrtle Lake 450 to 455 cm 730 B.C.

Dates top of rise of *Pinus*, and base of rise of *Sphagnum* and *Thuja juniperus*.

4840 ± 120
Y-1779. Myrtle Lake 595 to 600 cm 2890 B.C.

Dates base of rise of *Larix*, *Picea*, and *Abies*.

7850 ± 120
Y-1780. Myrtle Lake 790 to 795 cm 5900 B.C.

Dates base of rise of *Quercus*.

10,150 ± 160
Y-1781. Myrtle Lake 890 to 895 cm 8200 B.C.

Dates base of rise of *Pinus*.

11,120 ± 250
Y-1782. Myrtle Lake 960 to 970 cm 9170 B.C.

Wood detritus. Dates base of core with high *Picea* and *Cyperaceae*.

Kirchner Marsh series, Minnesota

Peat and gyttja from Kirchner Marsh (44° 16′ 15″ N Lat, 93° 7′ 30″ W Long), Dakota County, Minnesota. Subm. by H. E. Wright. Pollen diagrams of this locality were discussed by Wright and co-workers (1963), and by Watts and Winter (1966).

12,050 ± 150
Y-1300. Kirchner Marsh 1106 to 1110 cm 10,100 B.C.

Peat from Pollen Zone A-a/A-B boundary, Core 2.

13,270 ± 200
Y-1326. Kirchner Marsh 1177 to 1184 cm 11,320 B.C.

Gyttja from K/A-a Pollen Zone boundary.

11,760 ± 150
Y-1358. Kirchner Marsh 1190 to 1200 cm 9810 B.C.

Wood (spruce?) from same layer of plant remains as Y-1301. Date confirms Y-1301.

11,840 ± 150
Y-1301. Kirchner Marsh 1190 to 1200 cm 9890 B.C.

From lens of plant remains inbedded in clay, Core 2. *Comment* (H.E.W.): date incompatible with available pollen-stratigraphic evidence. It may, possibly, be explained by considering layer as intruding into older material by subsidence through early lake sediments.

Bog D series, Minnesota

Marl and gyttja from Bog D (47° 12′ N Lat, 95° 9′ W Long), Itasca Park, Hubbard Co., Minnesota. Subm. by H. E. Wright. Pollen diagrams by McAndrews (1966).

2720 ± 80
Y-1156. Bog D 250 to 260 cm 770 B.C.

Dates beginning of *Pinus* rise signalling replacement of deciduous forest by conifer forest.

3930 ± 100
Y-1328. Bog D 412 to 418 cm 1980 B.C.

From pollen zone boundary interpreted as forest invasion of prairie. This is marked by a decrease in *Gramineae, Artemisia, Chenopodiineae,* and *Quercus,* and increase in mesic deciduous forest elements such as *Betula, Ostrya, Ulmus,* and *Tilia.*

8560 ± 120
Y-1419. Bog D 705 to 720 cm 6610 B.C.

From top of pine-pollen zone.

11,000 ± 90
Y-1418. Bog D 770 to 790 cm 9050 B.C.

From top of spruce-pollen zone and base of pine-pollen zone.

4270 ± 100
Y-1329. Terhill Pond, Minnesota 2320 B.C.

Peat, 545 to 560 cm in core at Terhell Pond (47° 12′ N Lat, 95° 47′ W Long), Mahnomen Co., Minnesota. Subm. by H. E. Wright. Dates pollen zone boundary interpreted as forest invasion of prairie. Pollen diagrams are given by McAndrews (1966).

11,740 ± 200
Y-1327. Qually Pond, Minnesota 9790 B.C.

Gyttja 365 to 370 cm in core 10 cm in diam. from center of Qually Pond (47° 42′ N Lat, 96° 15′ W Long), Polk Co., Minnesota, on Herman Beach of glacial lake Agassiz. Coll. 1963 and subm. by H. E. Wright. Dates withdrawal of Lake Agassiz from Herman Beach; also dates lower part of Pollen Zone A-a, immediately below 5 cm *Picea* maximum of 75%, and NAP minimum of 20% (Shay, 1968).

10,500 ± 200
Y-1362. Anderson Lake, Minnesota 8550 B.C.

Gyttja 842.5 to 847.5 cm depth at Anderson Lake, Pine Co., Minnesota (46° 24′ N Lat, 92° 42′ W Long). Subm. by H. E. Wright. Dates rise of pollen of pine and deciduous trees and fall of spruce. Sample intended as secondary sample for Lamont's L-794-E at 837.5 to 842.5 cm depth and was subm. by mistake. Agreement between both dates: 10,200 ± 200 for Lamont and 10,500 ± 200 for Yale is excellent.

Jacobson Lake series, Minnesota

Gyttja from pollen core of W. A. Watts, taken at Jacobson Lake, (46° 25′ N Lat, 92° 42′ W Long), Pine Co., Minnesota. Subm. by H. E. Wright.

Y-1690. Jacobson Lake 862.5 to 867 cm Core 2 **7210 ± 80** **5260 B.C.**

Dates base of rise of *Quercus* pollen and fall of *Pinus resinosa banksiana.*

Y-1691. Jacobson Lake 575 to 605 cm **3920 ± 120** **1970 B.C.**

Dates fall of *Quercus* and herb pollen, and rise of *Pinus strobus.*

Y-1777. Red Lake Bog, Minnesota **3170 ± 100** **1220 B.C.**

Decomposed peat from depth 312 to 321 cm core RLB-5B, at Red Lake Bog, Beltrami Co., Minnesota (48° 18′ N Lat, 94° 53′ W Long). Subm. by H. E. Wright. Dates beginning of vast paludification.

Y-1983. Glatch Lake, Minnesota **9720 ± 120** **7770 B.C.**

From 1000 to 1005 cm below water surface of Glatch Lake, St. Louis Co., Minnesota (47° 29′ N Lat, 92° 26′ W Long). Dates boundary between spruce-pollen zone and pine-pollen zone. Subm. by H. E. Wright. Pollen analyses by J. C. B. Waddington.

Devils Lake series, North Dakota

Organic and carbonate fractions from core taken at Devils Lake, North Dakota (48° 1′ 50″ N Lat, 98° 57′ 30″ W Long). Depths measured from water-mud interface. Coll. and subm. by E. Callender. For details, see Callender (1967).

Y-1821. Devils Lake 66 to 86 cm
carbonate fraction **5940 ± 120** **3990 B.C.**
organic carbon fraction **1120 ± 60** **A.D. 830**

Y-1822. Devils Lake 340 to 358 cm
carbonate fraction **7520 ± 160** **5570 B.C.**
organic carbon fraction **3550 ± 100** **1600 B.C.**

Y-1823. Devils Lake 494 to 517 cm
carbonate fraction **9850 ± 160** **7900 B.C.**
organic carbon fraction **4710 ± 120** **2760 B.C.**

Comment (M.S.): in general, when no particulate carbonate is supplied to lake waters, age differences between carbonate and organic materials at same level in sediments is small. Above results imply that about ½ of carbonate is undissolved material obtained from C^{14} poor limestone.

12,520 ± 100
Y-925. Alpena, South Dakota **10,570 B.C.**

Wood (*Populus*?) from reddish-brown clay overlain and underlain by till, near Alpena, South Dakota (44° 6′ N Lat, 98° 21′ W Long). Part of log 25 to 30 cm in diam; oriented E-W, at 12.5 m depth in well bored in 1951. Surface till was mapped by Flint (1955) as end moraine of Mankato age. Wood from same till in nearby counties dated 12,760 ± 120 (10,810 B.C.) Y-595, and 12,200 ± 400 (10,250 B.C.) W-801. Log evidently represents tree overridden by Mankato glacier. Coll. by G. E. Miller and subm. by R. F. Flint, Yale Univ.

Rosebud series, South Dakota

Plant fragments from core in wet meadow on Rosebud Indian Reservation, at N edge of Nebraska Sand Hills (43° 0′ N Lat, 101° 7′ W Long), South Dakota, in heart of present prairie region. Pollen diagrams in Watts and Wright (1966). Subm. by H. E. Wright.

12,580 ± 160
Y-1359. Rosebud 555 to 560 cm **10,630 B.C.**

From near top of *Picea* zone.

12,630 ± 160
Y-1360. Rosebud 600 to 605 cm **10,680 B.C.**

From early part of *Picea* zone. *Comment* (H.E.W.): closeness of 2 dates reflects rapid deposition.

10,670 ± 140
Y-1361. Pickerel Lake, South Dakota **8720 B.C.**

Picea wood from 945 to 950 cm below water level at Pickerel Lake (45° 32′ N Lat, 97° 17′ W Long), large, permanent lake in Day Co., South Dakota. Subm. by H. E. Wright. Sample dates end of *Picea* pollen zone and beginning of *Betula* zone. Pollen, seed, and mollusk diagrams in Watts and Bright (1968).

8950 ± 160
Y-1984. Swan Lake, Nebraska **7000 B.C.**

From 1472 to 1482 cm below water surface of Swan Lake, Garden Co., Nebraska (41° 43′ N Lat, 102° 30′ W Long). Dates base of organic sediment. Subm. by H. E. Wright. Pollen counts by J. Grüger indicate prairie vegetation.

Molas Lake series, Colorado

Gyttja from NE Molas Lake, on Hwy 550, 4 mi S of Silverton, Colorado (37° 45′ N Lat, 107° 41′ W Long). Lake near top of subalpine vegetation zone, at alt 3200 m. Coll. and subm. by L. J. Maher, Jr., now Univ. of Wisconsin.

13,360 ± 120
Y-1437. Molas Lake 142 to 147 cm 11,410 B.C.

From lowest predominantly organic sediment in lake, containing oldest sediment dominated by arboreal pollen. Sample dates from beginning of local postglacial interval in San Juan Mts. (Maher, 1961).

15,450 ± 220
Y-1147. Molas Lake 170 to 175 cm 13,500 B.C.

From poorly organic sediment dominated by nonarboreal pollen. Sample provided estimate of time when lake basin was exposed by retreat of San Juan ice cap (Maher, 1961).

26,650 ± 400
Y-1665. Great Salt Lake, Utah 24,700 B.C.

Dolomite from Great Salt Lake, Utah mud flats (41° 35′ N Lat, 112° 48′ W Long). Occurs in scattered slabs ca. 30 cm diam. in elongated zone (5 m wide) ca. 10 mi from nearest Paleozoic outcrops. Coll. and subm. by R. A. Berner, Yale Univ.

Aden Crater series, New Mexico

Skin tissue and coprolite of *Nothroterium shastense* found at Aden Crater, New Mexico (34° 4′ N Lat, 107° 35′ W Long). Subm. by E. L. Simons, Yale Univ.

9840 ± 160
Y-1163a. Tissues 7890 B.C.

11,080 ± 200
Y-1163b. Coprolite 9130 B.C.

Kalaloch series, Washington

Samples for pollen analytical studies from sea-cliff sec. of interbedded gravels, sands, clays, and peats near Kalaloch in W Washington (47° 38′ N Lat, 124° 23′ W Long). Pollen analysis of samples from 1 to 2 cm intervals over 32 m sec. is in progress. Lowest dated sample (Y-2323) is about midway in sec. Coll. and subm. by C. J. Heusser, New York Univ., Tuxedo Park, N.Y.

16,700 ± 160
Y-2313. Kalaloch 15 3.0 m 14,750 B.C.

17,970 ± 300
Y-2314. Kalaloch 18 3.4 m 15,020 B.C.

18,100 ± 250
Y-2315. Kalaloch 30 4.6 m 16,150 B.C.

21,450 ± 300
Y-2422. Kalaloch 55 9.0 m 19,500 B.C.

24,300 ± 300
Y-2423. Kalaloch 60 9.5 m 22,350 B.C.

Y-2316.	**Kalaloch 94**	**15.0 m**	**40,800 ± 1000** **38,850 B.C.**
Y-2317.	**Kalaloch 95**	**15.2 m**	**39,800 ± 1200** **37,850 B.C.**
Y-2318.	**Kalaloch 100**	**15.6 m**	**40,200 ± 1000** **38,250 B.C.**
Y-2319.	**Kalaloch 105**	**16.2 m**	**39,000 ± 1200** **37,050 B.C.**
Y-2320.	**Kalaloch 108**	**16.5 m**	**40,000 ± 1200** **38,050 B.C.**
Y-2321.	**Kalaloch 111**	**16.8 m**	**42,700 ± 1600** **40,750 B.C.**
Y-2322.	**Kalaloch 118**	**17.5 m**	**>47,000**
Y-2323.	**Kalaloch 124**	**18.0 m**	**>47,000**

120 ± 80
Y-2404. Willow Creek fan, California **A.D. 1830**

Tree limb with bark, embedded in matrix of silty fine-to-coarse sand with cobbles, parallel to stratification and to surface, between 98 and 131 cm below surface of alluvial fan and 2.65 m to 2.99 m above floor of channel, Willow Creek fan, Eureka Valley, California (37° 18′ 24″ N Lat, 117° 47′ 53″ W Long). Coll. by E. C. and R. Q. Oaks, Jr.; subm. by R. Q. Oaks, Jr., Utah State Univ.

770 ± 80
Y-2405. Willow Creek fan, California **A.D. 1180**

Tree trunk with bark, embedded in matrix of silty fine-to-coarse sand with pebble gravel, parallel to stratification and to surface, between 52 and 85 cm below ground surface, and 3.11 to 3.45 m above floor of channel, Willow Creek fan, Eureka Valley, California (37° 17′ 48″ N Lat, 117° 48′ 32″ W Long). Coll. by E. C. and R. Q. Oaks, Jr. and subm. by R. Q. Oaks, Jr. *Comment* (R.Q.O.): dates place *maximum* age on inception of fan entrenchment at 2 sites along main channel. Younger sample (Y-2404) occurs closer to fan head and to area of deepest channel entrenchment (9.2 m). Lack of evident active faults on aerial photos suggests that changes in load-to-discharge ratios, causing rapid entrenchment, probably did not result from tectonic movements.

Searles Lake series, California

This series is part of study of pluvial history of Searles Lake, California (35° 43′ N Lat, 117° 20′ W Long). Samples were obtained from W. A. Gale and D. S. Arnold of Am. Potash and Chem. Corp. For complete sample descriptions and details of this investigation, see Stuiver

(1964). The following series is from Upper Salt with total thickness 19.81 m for Testhole L-U-1.

Lab. no.	Fraction	Depth in meters	Age, yr B.P.	Testhole
Y-1200.	Carbonates	1.60 to 1.65	6890 ± 140	L-U-1
Y-1200B.	Organic	1.60 to 1.65	6630 ± 390	L-U-1
Y-1201.	Carbonates	4.57 to 4.62	9700 ± 180	L-U-1
Y-1202.	Carbonates	9.45 to 9.48	11,100 ± 180	L-U-1
Y-1202B.	Organic	9.45 to 9.48	11,010 ± 150	L-U-1
Y-1203.	Carbonates	11.43 to 11.45	10,600 ± 100	L-U-1
Y-1204.	Carbonates	12.80 to 12.83	10,460 ± 170	L-U-1
Y-1204B.	Organic	12.80 to 12.83	11,510 ± 150	L-U-1
Y-1205.	Carbonates	15.87 to 15.95	9720 ± 200	L-U-1
Y-1206.	Carbonates	18.59 to 18.61	9850 ± 180	L-U-1
Y-1207.	Carbonates	19.68 to 19.71	9840 ± 80	L-U-1

Following series is for Parting Mud, where average thickness of cores is 371 cm. Depth is given as relative position between top and bottom.

Lab. no.	Fraction	Rel. depth %	Age, yr B.P.	Testhole
Y-1208B-1.	Organic	0.0 to 0.4	10,680 ± 90	L-U-1
Y-1208B-2.	Organic	0.4 to 0.8	10,900 ± 90	L-U-1
Y-1209B.	Organic	0.8 to 1.4	10,230 ± 80	L-U-1
Y-1210B-1.	Organic	0.0 to 2.7	10,060 ± 90	X-23
Y-1210B-2.	Organic	0.0 to 2.7	10,410 ± 120	X-23
Y-1209.	Carbonates	0.8 to 1.4	10,630 ± 80	L-U-1
Y-1210.	Carbonates	0.0 to 2.7	11,470 ± 100	X-23
Y-1211.	Carbonates	6.2 to 6.9	11,010 ± 110	X-23
Y-1211B.	Organic	6.2 to 6.9	10,590 ± 110	X-23
Y-1212.	Carbonates	12.8 to 14.9	10,440 ± 90	X-20
Y-1212B.	Organic	12.8 to 14.9	11,800 ± 130	X-20
Y-1213.	Carbonates	27.7 to 29.8	13,100 ± 230	X-20
Y-1213B.	Organic	27.7 to 29.8	13,710 ± 270	X-20
Y-1214.	Carbonates	45.2 to 45.7	17,710 ± 280	X-23
Y-1214B.	Organic	45.2 to 45.7	18,800 ± 240	X-23
Y-1215.	Carbonates	61.0 to 62.4	19,380 ± 250	X-20
Y-1215B.	Organic	61.0 to 62.4	19,970 ± 280	X-20
Y-1216.	Carbonates	75.3 to 75.6	21,380 ± 340	X-23
Y-1216B.	Organic	75.3 to 75.6	22,300 ± 280	X-23
Y-1217.	Carbonates	95.9 to 97.9	20,650 ± 210	X-23
Y-1217B.	Organic	95.9 to 97.9	24,630 ± 460	X-23
Y-1218.	Carbonates	99.3 to 100	22,450 ± 380	L-U-1
Y-1218B.	Organic	99.3 to 100	23,710 ± 320	L-U-1

Following series is for Lower Salt and Bottom Mud.
Total thickness of Lower Salt is 10.93 m for Testhole L-U-1.

	Fraction	Position	Age, yr B.P.	Testhole
Y-1219B.	Organic	269 to 272 cm below top of Lower Salt	24,600 ± 400	L-U-1
Y-1220B.	Organic	424 to 427 cm below top of Lower Salt	27,500 ± 800	L-U-1
Y-1221.	Carbonates	546 to 549 cm below top of Lower Salt	25,800 ± 500	L-U-1
Y-1222.	Carbonates	785 to 788 cm below top of Lower Salt	24,400 ± 400	L-U-1
Y-1222B.	Organic	785 to 788 cm below top of Lower Salt	28,000 ± 600	L-U-1
Y-1223B.	Organic	882 to 885 cm below top of Lower Salt	32,000 ± 1000	L-U-1
Y-1224.	Carbonates	Top 5 cm of Bottom Mud	32,300 ± 900	X-23
Y-1224B.	Organic	Top 5 cm of Bottom Mud	32,700 ± 800	X-23

Lake Mohave series, California

Shells and tufa from 3 localities at Lake Mohave (35° 21′ N Lat, 116° 9′ W Long), California. Coll. and subm. by C. N. Warren, Univ. of California, Santa Barbara.

13,620 ± 160
Y-1585. Outlet Channel **11,670 B.C.**

Shell (*Anodonta*) and snails from 286 to 288 m high "beach" facing outlet channel at N end of Silver Playa (35° 23′ 10″ N Lat, 116° 7′ 45″ W Long). Coll. from throughout the 70 cm of deposit. Sample antedates artifacts of Lake Mohave complex found lying on deflated surface of deposit.

14,550 ± 140
Y-1586. Locality A **12,600 B.C.**

Shell (*Anodonta*) from horizontally bedded, water-laid layer of sand and pebbles (Stratum 3B), exposed at 6-strata arroyo cut in bar in NW edge of Silver Playa (35° 23′ N Lat, 116° 7° 10″ W Long). Alt of sample: ca. 284 m. Dates period of overflow.

15,350 ± 240
Y-1587. Locality A **13,400 B.C.**

Shell (*Anodonta*) from horizontally bedded, very hard, partially calichefied, indurated, coarse sand deposit (Stratum 1). Alt of sample: ca. 283 m. Dates presumed earlier period of overflow.

Y-1588. Locality C **13,040 ± 120**
11,090 B.C.

Tufa from rocky, indurated, gray sand deposit (Stratum 1), lowest of 11-strata gravel pit exposure, cut into talus overlying a pediment at NW edge of Silver Playa (35° 21′ 27″ N Lat, 116° 9′ W Long). Thickness of stratum unknown.

Y-1589. Locality C **13,290 ± 140**
11,340 B.C.

Shell (*Anodonta*) from greatly concentrated, tightly packed shell deposit with gray sand assoc. (Stratum 4). Deposit represents lowest of 3 shell strata recognized at exposure, at alt 279 m. Dates early high level of Lake Mohave.

Y-1590. Locality C **11,320 ± 120**
9370 B.C.

Tufa from rock and sand deposit (Stratum 5).

Y-1591. Locality C **10,700 ± 100**
8750 B.C.

Shell (*Anodonta*) from much concentrated, shell deposit (Stratum 6), with gray sand assoc. Dates late high stand of Lake Mohave.

Y-1592. Locality C **9900 ± 100**
7950 B.C.

Tufa from rock and gray sand, deposit (Stratum 7).

Y-1593. Locality C **10,580 ± 100**
8630 B.C.

Shell (*Anodonta*) from sand deposit (Stratum 8). Dates late high stand of Lake Mohave.

Y-2406. Bench Mark Bay **10,270 ± 160**
8320 B.C.

Shell from 9 to 46 cm below surface at Bench Mark Bay, San Bernardino Co., California (35° 15′ 22″ N Lat, 116° 9′ W Long). Alt 282.5 m at surface. Assoc. with 4 man-made flakes and 1 possible artifact. Subm. by C. N. Warren, Univ. of California, Santa Barbara. *Comment* (C.N.W.): provides 1st date for cultural remains assoc. with deposits of Pleistocene Lake Mohave.

Y-2407. Northwest Beaches, Low Beach **9340 ± 140**
7390 B.C.

Shell from buried deposits at alt 283.2 m at Low Beach in NW corner of Silver Playa, San Bernardino Co., California (35° 23′ 30″ N Lat, 116° 8′ W Long). Surface elev. 283.4 m. Dates last lake stand recorded in Beach deposits at this location. Subm. by C. N. Warren.

Y-2408. Northwest Beaches, High Beach **12,450 ± 160**
10,500 B.C.

Shell from 1.3 m below surface of high beach at Northwest Beaches, NW corner of Silver Playa, San Bernardino Co., California (35° 23′ N Lat, 116° 8′ W Long; alt 287.5 m). Subm. by C. N. Warren.

Y-2409. Fallen Down House Bay **12,990 ± 160**
11,040 B.C.

Shell from Fallen Down House Bay, W side of Silver Playa, San Bernardino Co., California (35° 21′ N Lat, 116° 8° 30″ W Long). Alt 283.1 m. Subm. by C. N. Warren.

Y-2410. Bench Mark Island **9960 ± 200**
8010 B.C.

Tufa from highest lake stand recorded on Bench Mark I., NW corner of Silver Playa, San Bernardino Co., California (35° 22′ N Lat, 116° 09′ W Long). Tufa adhering to rocks just above beach at 287.9 m. Tufa is derived from rocky face ca. 61 cm higher. Subm. by C. N. Warren. *Comment* (C.N.W.): date is much younger than expected and at variance with other dates. This may be due to problems assoc. with tufa dating. Above dates make it possible to correlate deposits with previously dated lake deposits.

Y-1993. Manix Lake, California **>47,000**

Anodonta californiensis shells form 10 cm thick layer, near top of a sec. of lacustrine sandy shale, 35 m thick deposited in Pleistocene Lake Manix (34° 57′ 51″ N Lat, 116° 33′ 15″ W Long), central Mojave Desert, California (Blackwelder and Ellsworth, 1936). Shale yielded remains of fossil fish, vertebrates, and aquatic bird bones interpreted as late Pleistocene by H. Howard (1955). Coll. and subm. by A. M. Bassett, San Diego State College. *Comment* (A.M.B.): date is minimum shell bed.

Aguas Buenas Cave series, Puerto Rico

Two samples of calcite, taken 17 cm apart, from top and bottom of stalagmite from Aguas Buenas Cave, Puerto Rico (18° 15′ 54″ N Lat, 66° 06′ 29.3″ W Long). Cave is located in Los Sumideros region of barrio Sumidero, Municipio de Aguas Buenas, of ca. 280 m. Sample ages determine growth rates (0.3 m/yr) of stalagmite; estimated C^{13} values used for age calculations is –5°/00W.R.T. P.D.B. Coll. and subm. by C. W. Thayer, Yale Univ., New Haven, Conn.

Y-2411. Top **1100 ± 80**
A.D. 850

Y-2412. Bottom **1610 ± 80**
A.D. 340

Holetown series, Barbados

Coral fragments from cemented coral ridge in 15 m water, 600 m from shore opposite Holetown, Barbados (13° 11′ N Lat, 59° 39′ W Long). Coll. and subm. by E. Mountjoy, McGill Univ.

Y-1729. Holetown 1 **520 ± 60**
A.D. 1430

Y-1730. Holetown 2 **1500 ± 60**
A.D. 450

Same as Y-1729, only less bored and infilled with younger material.

Dates determine cessation of growth of these corals. See also Macintyre (1966) and Macintyre, Mountjoy, and d'Anglejan (1969, in press).

1380 ± 120
Y-1623. Lake Cuscachapa, El Salvador **A.D. 570**

Boring 6 m long was made in ca. 4 m water with Davis sampler in this small lake by E. S. Deevey. Lake, ca. 650 m alt, (13° 58′ N Lat, 89° 40′ W Long), is at foot of site of Tazmal. Diatom-gyttja sample, ca. 9.5 m below water surface is at boundary between Pollen Zones Ch-2 and Ch-3a (Tsukada and Deevey, 1967).

160 ± 160
Y-1624. Lake Guija, El Salvador **A.D. 1790**

Core, ca. 8179 m, taken with Davis sampler in ca. 6.2 m water, in Estero San Juan, near inlet of Rio Cusmapa by E. S. Deevey in 1950. Lake, 426 m alt, (14° 16′ N Lat, 89° 31′ W Long), located on boundary between Guatemala and El Salvador, was probably created by eruptions of Volcano San Diego that dammed up Rios Angue and Ostua. Sandy clay sample, 9.2 m in core, is located at level slightly above boundary between Pollen Zones Gj-3b and Gj-3a at base of prominent rise of Zea Mays pollen (Tsukada and Deevey, 1967).

B. South America

Punta Pingüinos series, Argentina

Peat from 7.6 m high shore outcrop in Punta Pingüinos, 4 km S of city of Ushuaia, Tierra del Fuego, Argentina (54° 51′ S Lat, 68° 20′ W Long). Peat sampled from 2.3 to 3.2 m from surface of cliff, and stratified between gravel deposit at top interpreted as of either marine or glacial origin, and 4.5 m thick drift deposit at bottom (Auer, 1959, p. 32). Coll. by Ing. Agr. Catani, and subm. by Väinö Auer, Helsinki Univ. (For discussion of Argentina series, see Auer, 1950, 1951, 1959, 1963, and 1965).

7660 ± 100
Y-190. Punta Pingüinos 1 **5710 B.C.**

Underlying thin sand stratum inbedded within peat horizon.

7450 ± 100
Y-191. Punta Pingüinos 2 **5500 B.C.**

Overlying sand stratum. Corresponds to same regressive ocean stage as Ya Verán sample (Y-137). Peat is overlain by marine clay and sand, which shows ocean transgression to 6 m level corresponding to Littorina transgression in Baltic Sea.

8110 ± 100
Y-180. San Julián Bay, Argentina **6160 B.C.**

Mollusks from 20 cm depth at 9 to 10 m high bank on S coast of San Julián Bay (49° 23′ S Lat, 67° 49′ W Long), Province of Santa Cruz, Argentina. Coll. 1952 and subm. by Väinö Auer. Sample dates 9 to 10 m high transgression of shoreline. Corresponds to Echineis transgression in Baltic Sea.

Y-137. Estancia Ya Verán, Argentina **7350 ± 100** **5400 B.C.**

Peat from profile exposed at Ya Verán ranch, some 20 km W of mouth of Río Negro (40° 55′ S Lat, 62° 50′ W Long), Argentina. Sample inbedded within sandy beach deposit which is, in turn, interstratified between underlying sea clays and alternated alluvial sands and clays. Peat originated from eroded bogs further upstream. Coll. and subm. by Väinö Auer. Sample dates position of sea level in mouth of Río Negro at time when Fennoscandia was in so-called Ancylus II period, and Baltic Sea was fresh water lake. Chronologically between eustatic Echineis and Littorina transgressions.

Lago Lácar series, Argentina

Peat mixed with tephra from volcanic-ash Layer I, which lies at 5 m depth in bog at W end of Lacar Lake (40° 10′ S Lat, 71° 40′ W Long), Prov. of Neuquén, Argentina. Coll. 1936 and subm. by Väinö Auer.

Y-1880. Lago Lácar 4.8 to 5.05 m **7210 ± 350** **5260 B.C.**

Y-1881. Lago Lácar 5.05 to 5.4 m **7340 ± 400** **5390 B.C.**

Dates reflect possible non-synchronism between deposition of Layer I at this locality and those in Tierra del Fuego, dated 8900 ± 110 (Y-188) and 9380 ± 90 (Y-189) (Radiocarbon, 1959, v. 1, p. 155).

Lago Traful series, Argentina

Peat from below and above volcanic-ash Layer II, which lies at 1.8 to 2.5 m depth in bog at W end of Traful Lake (40° 32′ S Lat, 71° 35′ W Long), Prov. of Neuquén, Argentina. Coll. 1938 and subm. by Väinö Auer.

Y-1882. Lago Traful 1 **550 ± 100** **A.D. 1400**

From 25 cm above volcanic-ash Layer II.

Y-1883. Lago Traful 2 **1440 ± 120** **A.D. 510**

From 25 cm below volcanic-ash Layer II.

Lago Nahuel Huapi series, Argentina

Peat from below and assoc. with volcanic-ash Layer I, which lies at 3.3 to 4.15 m in bog at W shore of Nahuel Huapi Lake (41° 2′ S Lat, 71° 48′ W Long), facing Puerto Blest, Province of Neuquén, Argentina. Coll. 1938 and subm. by Väinö Auer.

Y-1884. Lago Nahuel Huapi 3.55 to 3.75 m **2500 ± 120** **550 B.C.**

Y-1885. Lago Nahuel Huapi 4.2 to 4.5 m **3360 ± 120**
1410 B.C.

General Comment: dates do not agree with stratigraphic and palynological evidence available.

C. Europe

Y-2377. Sandnes, Norway **38,100 ± 1000**
36,150 B.C.

Shells (*Mya truncata, Macoma calcarea,* and *Saxicava arctica*) from 20 to 30 m thick sec. of glacio-marine clay at Sandnes, SW Norway (58° 51′ N Lat, 5° 45′ E Long). Coll. and subm. by B. G. Andersen. Clay that underlies thin till sheet of Weichsel age was supposed to represent early Weichsel or pre-Weichsel event (Andersen, 1965, p. 102).

Muurasjärvi Bog series, Pihtipudas, Finland

Carex peat from hand-dug sec. at Muurasjärvi Bog, Pihtipudas, Finland (63° 38′ N Lat, 25° 20′ E Long). Coll. 1963 and subm. by R. Aario, Univ. of Helsinki.

Y-1443. Muurasjärvi 100 to 103 cm **4230 ± 120**
2280 B.C.

Pollen frequences: *Picea* 23%, *Alnus* 7%, *Pinus* 15%, *Betula* 54%, *Tilia* 1%. Horizon corresponds to time immediately following spread of spruce.

Y-1442. Muurasjärvi 103 to 106 cm **4550 ± 60**

Pollen frequences: *Picea* 1%, *Pinus* 19%, *Alnus* 5%, *Betula* 69%, *Ulmus* 1%, *Tilia* 1%. Horizon corresponds to time immediately preceding spread of spruce.

Särkijärvi Bog series, Kalkkinen, Finland

Peat and wood with gyttja from hand-dug sec. at Särkijärvi Bog, Kalkkinen, Finland (61° 28′ N Lat, 25° 38′ E Long). Coll. 1963 and subm. by R. Aario.

Y-1445. Särkijärvi 68 to 72 cm **5100 ± 100**
3150 B.C.

Pollen frequences: *Picea* 7%, *Pinus* 42%, *Alnus* 11%, *Betula* 35%, *Corylus* + *Myrica* 3%, *Ulmus* 1%, *Tilia* 1%. Horizon corresponds to time immediately following spread of spruce.

Y-1444. Särkijärvi 72 to 75 cm **5360 ± 100**
3410 B.C.

Pollen frequences: *Picea* 1%, *Pinus* 42%, *Alnus* 11%, *Betula* 39%, *Corylus* + *Myrica* 3%, *Tilia* 1%. Horizon corresponds to time immediately preceding spread of spruce. *Comment* (R.A.): according to these and other C^{14} dates from Finland, it is possible to conclude that general spread of spruce occurred during yr 5500 B.P. and 2000 B.P. in E-W direction (Aario, 1965).

Cumberland series, England

3630 ± 160
Y-2387. Cumberland charcoal 1680 B.C.

Charcoal from buried paleosol, Haverigg, coast of Cumberland, England (54° 11′ N Lat, 3° 15′ E Long). Coll. and subm. by J. T. Andrews, Univ. of Colorado.

550 ± 100
Y-2388. Cumberland shells A.D. 1400

Shells from shingle above present storm level, Hodbarrow Point, coast of Cumberland, England (54° 11′ N Lat, 3° 15′ E Long). Coll. and subm. by J. T. Andrews.

7790 ± 160
Y-2427. Cumberland wood 5840 B.C.

Wood from buried forest off Ravenglass, Cumberland coast, England (54° 25′ N Lat, 3° 30′ E Long). Subm. by J. T. Andrews. *Comment* (J.T.A.): dates form part of series made to study sea-level changes on this part of NW England coast. Current investigations by J. T. Andrews, M. Stuiver, and C. A. M. King, Univ. of Nottingham. Dates indicate major transgressions occurred ca. 8000 C^{14} yr ago. Stratigraphy relating to Y-2387 indicates both higher and lower sea levels and gives maximum date for dune formation at Haverigg. Y-2388 gives evidence of higher storm levels. Marine transgression at Ravenglass predates several other age determinations on drowned forest around British coast but it is in close agreement with transgression in Scotland marked by accumulation of Carse clay. Cumberland was heavily glaciated and sea-level changes reflect changes in isostatic and eustatic components.

7560 ± 160
Y-2361. Burnmoor Tarn, England 5610 B.C.

Lake sediment from just before Boreal-Atlantic transition, from 415 to 425 cm core 655, Burnmoor Tarn (54° 25′ N Lat, 3° 17′ W Long) Cumberland, England. Subm. by W. Tutin, Univ. of Leicester, England. *Comment* (W.T.): result corresponds well with existing dates for late-Boreal in other parts of England, and indicates synchronism between dry period suggested by recession in curves for iodine and iodine/carbon ratio at this site, and dry period in late-Boreal which Godwin postulated on stratigraphc grounds for SE England (Godwin, 1956).

Loch Sionascaig series, Scotland

Lake sediment from Loch Sionascaig, Wester Ross, Scotland (58° 3′ N Lat, 5° 10′ W Long). Subm. by W. Tutin.

4020 ± 100
Y-2362. Loch Sionascaig 250 to 260 cm 2070 B.C.

From main deforestation horizon; blanket bog vegetation replaces pine forests. *Comment* (W.T.): result shows that change in vegetation around this lake from forest to blanket bog, accompanied by cultural pollens, and corresponds with base of curve for *Plantago lanceolata,* dates from Late Neolithic times and is therefore contemporaneous with period of occupation recorded by chambered cairns of NW Scotland. This reinforces suggestion that destruction of mid-Postglacial pine forest in this region was anthropogenic.

Y-2363. Loch Sionascaig 350 to 360 cm **6250 ± 140**
4300 B.C.

From horizon where *Alnus* first appears in pollen spectra. *Comment* (W.T.): result places expansion of *Alnus* (alder) in this part of NW Scotland in middle of Atlantic period as chronologically defined, *i.e.*, ca. 1000 yr later than alder expansion in England which has been used to determine Zone-boundary VI/VIIa (Boreal-Atlantic transition).

Y-2364. Loch Sionascaig 425 to 435 cm **7880 ± 160**
5930 B.C.

From early Postglacial horizon where main expansion of *Pinus* pollen is found. *Comment* (W.T.): result dates major expansion of pine forest at this site as approx. contemporaneous with late-Boreal pine phase in N England, which Y-2361 represents, where it was transient phase. Comparison of iodine curves for these 2 sites suggests that in oceanic climate of NW Scotland, there was no late-Boreal dry phase.

Y-428. Olen, Belgium **>49,000**

Peat from 4.6 m stratigraphic exposure at Olen, Belgium (51° 9′ N Lat, 4° 54′ E Long) at depth 4.2 to 4.9 m, imbedded between eolian sands. Pollen spectrum of peat, which shows evidence of cryoturbation at top, is characterized by *Picea-Carpinus* assoc. Coll. and subm. 1956 by R. Vanhoorne, Inst. Royal Sci. Nat., Belgium. Presumed age: Eemian (interglacial Riss-Würm).

Y-429. Oedelem, Belgium **>48,000**

Peat from 2.15 m stratigraphic exposure at Oedelem, Belgium (51° 11′ N Lat, 3° 19′ E Long) at depth 1.75 to 2.15 m imbedded between eolian sands. Pollen spectrum of peat, which shows evidence of cryoturbation at top, is characterized by *Picea-Carpinus* assoc. Coll. and subm. 1956 by R. Vanhoorne. Presumed age: Eemian or Early Weichselian.

Eernegem series, Belgium

Peat from 3 horizons in 2 stratigraphic cuts at Eernegem, Belgium (51° 7′ N Lat, 3° E Long). Coll. and subm. 1956 by R. Vanhoorne. Presumed age: Eemian.

Y-430. Eernegem 1 **>50,000**

From 2.4 m exposure at depth 1.7 to 2.4 m, imbedded between eolian sands. Pollen spectrum of peat characterized by *Picea-Carpinus* assoc.

Y-436. Eernegem 2 **>47,000**

From a 2.7 m exposure at depth 1.85 to 2.25 m imbedded between eolian sands. Pollen spectrum of peat characterized by *Picea-Carpinus* assoc. and dominance of *Pinus*.

Y-431. Eernegem 2 **>50,000**

From same exposure as above, but lower peat horizon. Sample depth is 2.5 to 2.7 m imbedded between eolian sands. Pollen spectrum of peat is characterized by a *Picea-Carpinus* assoc. and dominance of *Alnus*.

Y-432. St. Gillis-Wass, Belgium **12,030 ± 120**
10,080 B.C.

Peat from pit at depth 4 m at St. Gillis-Wass, Belgium (51° 15′ N Lat, 4° 4′ E Long), embedded between eolian sands. Peat contains macrospores from *Selaginella selaginoides*. Thickness of peat layer: 0.20 m. Presumed age: Bölling.

Y-1145. Oerel, Bremervorde District, Germany **>46,500**

Highest Interstadial at ca. 4 m depth. Subm. by the late W. Selle.

Y-1438. Castellaro, Italy **13,200 ± 120**
11,250 B.C.

Peat from 8.4 m deep core at bog in Castellaro, Province of Mantova, Italy (45° 22′ 47″ N Lat, 10° 50′ E Long), at depth 6.5 to 6.9 m. Sample dates post-Würm III deposit. Coll. and subm. by F. Lona, Univ. degli Studi di Parma. (For discussion, see Bertoldi, 1965).

Lago Di Monterosi series, Italy

Additional gyttja samples from cores under 5 m water, Lago di Monterosi (42° 12′ N Lat, 12° 18′ E Long). Coll. 1959 by Enrico Bonatii and W. T. Edmondson; subm. by G. E. Hutchinson and U. Cowgill (Radiocarbon: 1961, v. 3, p. 126-140; 1962, v. 4, p. 250-262).

Y-977. Monterosi MII 150.5 to 171.5 cm **5870 ± 200**
3920 B.C.

Y-978. Monterosi MII 224 to 237 cm **24,100 ± 600**
22,150 B.C.

Y-979. Monterosi MII 263.5 to 278.5 cm **18,600 ± 600**
16,650 B.C.

Y-1640. Lago di Monterosi 223 to 225 cm, 227 to 230, 237 to 240 cm, from Core 2 M2 **24,400 ± 600**
22,450 B.C.

Y-1641. Lago di Monterosi 250.5 to 253, 260.5 to 263.5 cm, from Core 2, M2 **24,500 ± 1000**
22,550 B.C.

Comment (G.E.H.): Y-977 gives useful date in middle of Period B, long oligotrophic phase of lake preceding culture disturbance in Roman times (Y-976, 2220 ± 120 B.P.). Y-978 confirms previously publ. Y-974, indicating that transition between initial rather more eutrophic period A and long oliogotrophic Period B, occurred ca. 24,000 B.P. Y-979 was intended to give date for inception of sedimentary sequence in basin but is clearly contaminated.

Lake Huleh series, Israel

Core III (33° 04′ 31″ N Lat, 35° 37′ 44″ E Long) was taken in center of Lake Huleh, Israel by U. M. Cowgill, summer, 1963. Core was 54 m long and used for pre-historic and late Pleistocene climatological studies. Subm. by G. E. Hutchinson, Yale Univ. and U. M. Cowgill, Univ. of Pittsburgh.

Y-2424. Lake Huleh III 386 to 396 cm, organic **2480 ± 100**
530 B.C.

Loss of weight on ignition (LWI) 7.8%; gray stiff lake sediment with some local dark patches and occasional shell.

Y-2509. Lake Huleh III 1395 to 1405 cm, carbonate **7260 ± 140**
5310 B.C.
6810 ± 140
4860 B.C.

LWI 8.4%; gray lake sediment, shell absent.

Y-2510. Lake Huleh III 1495 to 1505 cm, carbonate **7400 ± 160**
5450 B.C.
8930 ± 120
6980 B.C.

LWI 11.2%; gray lake sediment, shell absent.

Y-2511. Lake Huleh III 1674 to 1677 cm, organic **7700 ± 200**
5750 B.C.

LWI 8.6%; gray lake sediment, shell absent.

Y-2425. Lake Huleh III 2290 to 2300 cm, organic **9770 ± 200**
7820 B.C.

LWI 6.7%; gray lake sediment, shell absent.

Y-2512. Lake Huleh III 3475 to 3485 cm, organic **16,250 ± 200**
14,300 B.C.
19,120 ± 300
17,170 B.C.

LWI 9.4%; gray lake sediment, shell absent.

Y-2513. Lake Huleh III 4095 to 4100 cm, organic **20,200 ± 400**
18,250 B.C.
carbonate **23,200 ± 600**
21,250 B.C.

LWI 10.9%; darker gray sediment, more organic looking material.

Y-2514. Lake Huleh III 4165 to 4175 cm, organic **21,050 ± 400**
19,100 B.C.
22,400 ± 400
20,450 B.C.

LWI 15.5%, peat with shell layers.

Y-2515. Lake Huleh III 4434 to 4435 cm — **24,650 ± 400** / **22,700 B.C.**

LWI 19.7%, peat.

Y-2516. Lake Huleh III 4630 to 4634 cm — **26,400 ± 400** / **24,450 B.C.**

LWI 34.6%, peat with shell layers.

Y-2426. Lake Huleh III 4848 to 4853 cm — **32,900 ± 800** / **30,950 B.C.**

LWI 56.6%, peat with shell layers.

Y-2517. Lake Huleh III 4970 cm — **29,700 ± 800** / **27,750 B.C.**

LWI 55.2%, peat with shell layers.

Comment (G.E.H., U.M.C.): early history represented by this core is rather complicated; it is a very shallow water deposit, in which variations of level are probably represented by alternating shell layers with coarse peat. At 4941 cm a lacustrine episode intervenes but is transitory. Above this, there is, again, shallow water of variable depth. At 4425 cm a 2nd lacustrine episode becomes apparent followed by a shallow water period. Finally, at 4165 cm, main lacustrine episode begins, and remains for rest of core.

The problem of carbonate dates being somewhat older than organic dates has been discussed by Deevey *et al.* (1954). Emergent plants, such as *Nuphar*, derive carbon directly from the air and are therefore in equilibrium with carbon in the atmosphere. Submerged vegetation contains carbon in equilibrium with bicarbonate in water. Evidently all dates are a little too great, owing to presence of old carbonate carbon in the water.

Sample at 4970 cm is 3000 yr younger than previous sample at 4850.5 cm. Period represented by 4970 cm precedes short early lacustrine episode. Material present may perhaps be peat formed from emergent plants giving younger date.

Sedimentation rate based on organic carbon dates is considerably greater in upper half of core than in lower one. It rises gradually with the exception of an increase at 4632 cm until it reaches a maximum at 7700 yr when it slowly declines to what it had been ca. 16,000 yr.

D. Asia

Y-1982. Barmaseur Lake, Iran — **3130 ± 120** / **1180 B.C.**

From 500 to 550 cm depth of core at Barmaseur Lake, Iran (31° 32′ N Lat, 49° 40′ E Long). Sample dates basal sec. of core. Subm. by H. E. Wright.

Lake Mirabad series, Iran

Peat and shell marl from Lake Mirabad, Iran. Subm. by H. E. Wright and W. van Zeist.

Y-1758. Mirabad 475 to 483 cm **10,790 ± 200**
8840 B.C.

Sample consisted of white shell marl; marks top of rise of oak pollen curve and correlates, on palynological grounds, with B/C pollen zone boundary at Lake Zeribar, dated at ca. 5500 B.C. Older date may be explained by carbonate C^{14} deficiency.

Y-1759. Mirabad 720 cm **10,370 ± 120**
8420 B.C.

From peaty layer at base of core. Date seems reasonable when compared with Lake Zeribar diagram. Pollen diagram by Van Zeist (1967).

Y-1302. Lake Lalabad, Iran **>40,000**

From 959 to 975 cm depth of Core I-1 at Lalabad Lake, Iran (34° 29′ N Lat, 46° 54′ E Long). Subm. by H. E. Wright. Pollen analysis indicates steppe vegetation in region now at edge of oak woodland.

Lake Nilofar series, Iran

Organic sediment from Core 63-B-2 at Lake Nilofar, W Iran (34° 24′ N Lat, 45° 52′ E Long). Subm. by H. E. Wright. Pollen analysis by K. Wasylikowa.

Y-1684. Lake Nilofar 119 to 122 cm **4960 ± 120**
3010 B.C.

Dates base of organic lake sediment (oak pollen zone) that overlies black soil on gray marsh clay (mixed herb pollen zone). Date marks time of artificial damming of spring to make lake.

Y-1685. Lake Nilofar 337 to 345 cm **28,400 ± 1600**
26,450 B.C.

Dates base of gray clay (mixed herb pollen zone) and top of organic lake sediment (chenopod pollen zone). Correlates with Zone A/B boundary at Lake Zeribar. Results are consistent with Lake Zeribar sequence of Van Zeist (1967).

Lake Zeribar series, Iran (cont'd.)

Marl from core taken near lake edge of floating sedge mat on W side of Lake Zeribar in oak woodland near Merivan, Iran (35° 31′ N Lat, 46° 7′ E Long). Coll. 1963 and subm. 1964 by H. E. Wright and R. Megard. Pollen diagrams given by Van Zeist and Wright (1963), and Van Zeist (1967), seeds by Wasylikowa (1967), and Cladocera by Megard (1967).

Y-1432. Lake Zeribar 1410 to 1420 cm **8100 ± 160**
6150 B.C.

From top of Cladoceran zone of which base is given by Y-1431. Northern types (*Leydigia leydigi* and *Eurycercus*) absent above this level.

Y-1687. Lake Zeribar 1710 to 1720 cm **11,480 ± 160**
9530 B.C.

Dates base of steep rise in oak pollen curve.

Y-1686. Lake Zeribar 1890 to 1900 cm **13,650 ± 160** **11,700 B.C.**

Dates base of continuous oak pollen curve and beginning of *Artemisia* descent.

Y-1431. Lake Zeribar 2535 to 2545 cm **22,000 ± 500** **20,050 B.C.**

Base of core, in chenopod-*Artemisia pollen* zone.

Tsubogakure series, Shiga Heights, Japan

In August, 1958, 8.68 m core was taken almost at center of Tsubogakure bog (alt 1500 m; 36° 43′ N Lat, 138° 30′ E Long; ca. 40 m across) in central Honshu, Japan. Coll. and subm. by M. Tsukada, Yale Univ.

Y-1130. Tsubogakure Core 1 790 to 795 cm **9740 ± 440** **7790 B.C.**

Y-1131. Tsubogakure Core 1 760 to 765 cm **8810 ± 260** **6860 B.C.**

Y-1132. Tsubogakure Core 1 680 to 685 cm **8740 ± 320** **6790 B.C.**

Comment (M.T.): first date (Y-1130), slightly below top of R I pollen zone, permits estimate of R I/R II boundary of ca. 9500 B.P. (Tsukada, 1967a). Other dates (Y-1131, Y-1132) from *Quercus* maximum in early R II (Japanese hypsithermal) interval are not significantly different, necessitating more C^{14} dates around this level for reasonable acceptance of time span of maximum of deciduous species (Tsukada, 1967b).

Kumanoyu series, Hokkaido, Japan

Samples coll. from below 110 cm peat outcrop, ca. 8 m thick, alt. 136 m, (42° 05′ N Lat, 140° 40′ E Long) along Hakodate R.R. line in Oshima Peninsula, S Hokkaido. Coll. and subm. by J. Nakamura and M. Tsukada.

Y-1133. Kumanoyu, 160 cm **3530 ± 110** **1580 B.C.**

Y-1134. Kumanoyu, 130 cm **7615 ± 400** **5665 B.C.**

Y-1135. Kumanoyu, 110 cm **10,770 ± 110** **8820 B.C.**

Comment (M.T.): 110-cm level shows end of Boreal forest period; abrupt decline of spruce pollen can be seen from levels 0.9 m (ca. 50%) to 0.8 m (ca. 3%), indicating hiatus between these levels. During long Boreal period (>7-m-thick peat), corresponding to latter part of last Glacial period, subalpine conifer forest belt was at least 1000 m lower than it is at present (Nakamura and Tsukada, 1960). Y-1135 date confirms that Pleistocene ended ca. 10,000 yr ago in S Hokkaido. Ages of Y-1133 and Y-1134 do not gree with paleoecological evidence and are most likely contaminated by younger material.

Lake Nojiri series, Japan

Clay gyttja from a 2.4 m core taken near center of W basin of Lake Nojiri (654 m alt, 36° 49′ N Lat, 138° 13′ E Long), Japan. Coll. and subm. by M. Tsukada. *Comment* (M.T.): paleontologic and archaeologic excavations made at 10 to 56 m offshore of lake uncovered remains of *Megaceros* and *Palaeoloxodon namadicus naumanii* (see Gak-267-269; Kigoshi *et al.*, 1964), and overlying artifacts belonging to Japanese facies of Upper Paleolithic. Bottom part of core (2.25 to 2.4 m) is characterized by dominance of subalpine conifer pollen and by minimal pollen from broad-leaf deciduous trees (Tsukada, 1967a). Pollen of *Fagus, Quercus, Carpinus,* and *Ulmus* are dominant from 2.2 to 0.75 m. Subalpine conifers again slightly increase toward surface of lake sediment (Tsukada, 1967b).

1530 ± 160
Y-1699. Lake Nojiri 0.275 to 0.3 m A.D. 420

Sample located at RIIIb/RIIIa boundary and determines age of beginning of intensified forest destruction in lowlands of central Japan (Tsukada, 1966a; Tsukada and Stuiver, 1966).

4830 ± 60
Y-1602. Lake Nojiri 0.68 to 0.75 m 2880 B.C.

Sample corresponds with beginning of RIII period (Tsukada and Stuiver, 1966).

11,800 ± 160
Y-1603. Lake Nojiri 2.35 to 2.4 m 9850 B.C.

Sample corresponds with L period.

Lake Suwa series, Japan

Silty gyttja from 12.4 m core taken under ca. 6.5 m water, on S shore of Lake Suwa (759 m alt, 36° 03′ N Lat, 138° 05′ E Long), central Honshu, Japan.

2000 ± 80
Y-1604. Lake Suwa 4.45 to 5.55 m 50 B.C.

4990 ± 100
Y-1605. Lake Suwa 11.95 to 12.00 m 3040 B.C.

Lake Yogo series, Japan

Silty clay from 11.1 m core, taken in 9.5 m water, ca. 800 m N of basin of Yogo-ko (134 m alt, 35° 31′ N Lat, 136° 12′ E Long), Japan. Coll. and subm. by M. Tsukada. *Comment*: Yogo-ko had been part of Lake Biwa for considerably longer period. Its base is regarded as Tertiary peneplain which dropped by down-warping accompanied with faulting. An important feature is record of pollen succession of *Sciadopitys verticillata* and *Cryptomeria japonica,* native only to Japan today.

3850 ± 80
Y-1606. Lake Yogo 4.90 to 500 m 1900 B.C.

Y-1607. Lake Yogo 10.9 to 11.0 m **8920 ± 140**
6970 B.C.

Ukinuno Pond series, Japan

Gyttja from 15.4 m core, taken in ca. 3 m of water, center of Ukinuno-no-ike (380 m alt, 35° 08′ N Lat, 132° 36′ E Long), W Honshu, Japan. Coll. and subm. by M. Tsukada. *Comment*: in this area, *Cryptomeria japonica* and other temperate species are scattered on grassland which stretches to top of Mt. Sanpei. A few pollen of *Podocarpus* were found from 15.0 m level.

Y-1608. Ukinuno Pond 5.9 to 6.0 m **1760 ± 100**
A.D. 190

Y-1609. Ukinuno Pond 14.91 to 14.99 m **5720 ± 120**
3770 B.C.

Oda Pond series, Japan

Core, 4.0 m, taken with 1½ in. Livingstone sampler below ca. 0.5 m water, near center of Oda-no-ike (ca. 700 m alt, 33° 13′ N Lat, 131° 15′ E Long), Kyushu, Japan. Coll. and subm. by M. Tsukada. *Comment*: lake basin may be small explosion crater of Volcano Kuju group, which may have been formed during early Holocene.

Y-1610. Oda Pond 1.85 to 1.90 m **3830 ± 80**
1880 B.C.

Oldest sedge peat overlying silty gyttja.

Y-1611. Oda Pond 3.15 to 3.20 m **6710 ± 140**
4760 B.C.

Silty clay, overlain by 23 cm volcanic ash which was probably derived from Volcano Aso (1592 m in alt.). Date indicates last big eruption of Volcano Aso.

Tashuiku Tan series, Taiwan

Core, 11 m, taken under ca. 4.5 m water near lake basin (620 m alt, 23° 45′ N Lat, 120° 45′ E Long), Tashuiku Tan, Nan Tou Hsien, central Taiwan, which originated in small depression on undulating lateritic surface in middle Pleistocene (Tsukada, 1967c).

Y-1794. Tashuiku 390 to 400 cm **7960 ± 100**
6010 B.C.

Peaty clay; intensified agricultural activities have begun from this level.

Y-1795. Tashuiku 510 to 520 cm **9050 ± 120**
7100 B.C.

Wood, corresponds to peak of hemlock and pine pollen.

Y-1796. Tashuiku 735 to 739 cm **9640 ± 100**
7690 B.C.

Wood fragments, oldest datable sample in Tashuiku Tan core.

Jih Tan series, Taiwan

Core, 12.70 m, taken under ca. 26.5 m water at Jih Tan (745.5 m alt; 23° 52′ N Lat, 120° 55′ E Long), Nan Tou Hsien, Taiwan, (for details of palynological results, see Tsukada, 1966). Coll. and subm. by M. Tsukada.

Y-1612. Jih Tan 1.70 to 1.79 cm **4200 ± 60**
2250 B.C.

Silty gyttja from just below abrupt increase of *Liquidambar*.

Y-1613. Jih Tan 4.25 to 4.35 m **12,380 ± 160**
10,430 B.C.

Silty gyttja. Slight increase of *Liquidambar* pollen was found at this level.

Y-1614. Jih Tan 7.45 to 7.50 **35,500 ± 1500**
33,550 B.C.

Silty gyttja. This level indicates end of peat growth and beginning of rise of water level.

Y-1615. Jih Tan 9.75 to 9.80 m **>47,000**

Fine sedge peat, probably indicating end of cold climate in Taiwan.

Y-1616. Jih Tan 11.75 to 11.85 m **>47,000**

Silty clay with some organic fragments. Pollen assemblages indicate cold climate.

Yueh Tan series, Taiwan

Core, 11.8 m, taken in ca. 26.7 m of water, center of Yueh Tan (755.5 m alt; 23° 51′ N Lat, 120° 54′ E Long), Nan Tou Hsien, Taiwan. Additional dates for this core in Section III.

Y-1617. Yueh Tan 5.41 to 5.51 m **4130 ± 80**
2180 B.C.

Silty gyttja. Above this level, *Liquidambar* increases upwards.

Y-1618. Yueh Tan 11.0 to 11.79 m **9670 ± 100**
7720 B.C.

Silty gyttja.

Lake Guam series, New Guinea

Wood from Lake Guam deposit, Morobe dist., Huon Peninsula, near Mt. Sarawaket, New Guinea (6° 19′ S Lat, 147° 7′ E Long). Coll. by A. B. Costin; subm. by H. M. van Deusen (Costin, A. B., Archbold Expedition report, Am. Mus. of Nat. History, N.Y., in press).

Y-1619. Guam 198 to 229 cm **5660 ± 80**
3710 B.C.

Y-1620. Guam 229 to 244 cm **6420 ± 80**
4470 B.C.

Limestone Valley series, New Guinea

Peat and organic material from "Limestone Valley," Morobe dist., Huon Peninsula, Saruwaged Mts. across Sarawaket plateau, New Guinea (6° 25′ S Lat, 147° 4′ E Long). Coll. by A. B. Costin; subm. by H. M. Van Deusen.

11,230 ± 100
Y-1622. Limestone Valley 137 to 152 cm 9280 B.C.

Organic material from 137 to 152 cm.

2640 ± 80
Y-1647. Limestone Valley 76 to 90 cm 690 B.C.

Peat from 76 to 90 cm.

E. Africa

8890 ± 160
Y-1377. Wadi Or, Egypt 6940 B.C.

Small land snail (*Zootecus insularis*) from surface layer 0 to 1.0 m thick, Wadi Or, Eastern Desert, Southern Egyptian Nubia (27° 50′ N Lat, 31° 30′ E Long). Sinqari Member of Inieba Formation. Coll. 1963 by C. A. Reed, T. Lovejoy, and I. Hilmy, and subm. by C. A. Reed Univ. of Illinois at Chicago.

12,500 ± 120
Y-1446. New Ballana I, Egypt 10,550 B.C.

Shells (*Corbicula*), fresh-water pelecypod mollusc, from vertical face, New Ballana I site, 5.5 km S of Daraw (24° 22′ N Lat, 32° 56′ E Long). Masmas Formation. Coll. by K. W. Butzer, C. Hansen, C. A. Reed, and E. Leigh; subm. by C. A. Reed. Butzer and Hansen (1967, p. 337) conclude, on basis of stratigraphic sequence as correlated with other radiocarbon determinations, that this date is too young by several millennia.

11,090 ± 200
Y-1526. Arminna Temple, Egypt 9140 B.C.

Shell of Nile fresh-water "oyster" (*Etheria elliptica*) from 1.75 to 1.95 m depth near Arminna temple, Egypt (22° 24′ N Lat, 31° 46.5′ E Long). Arminna Member of Gebel Silsila Formation. Coll. 1963 by K. W. Butzer, C. Hansen, and C. A. Reed; subm. by C. A. Reed.

Y-1527. Arminna Temple, Egypt Recent

Sand-polished wood truck of dead shrub found at ground surface in 1963 by C. A. Reed, ca. 6 km WSW Arminna Temple. Shrub, which lived for more than 50 yr, evidently grew in natural catchment basin after one or more rainfalls.

13,850 ± 200
Y-1806. N end, Gebel Silsila 2A 11,900 B.C.

Shells (*Unio willcocksii*) from N end of Kom Ombo plain. Gebel Silsila Formation. Coll. and subm. by C. A. Reed.

Y-1643. Abu Simbel East, Egypt **13,360 ± 120**
11,410 B.C.

Shells of fresh-water pelecypod (*Unio willcocksii*) from Nile R. Sample was recovered from garbage pit containing catfish bone and chert flakes of uncertain age. Pit was dug into deposit of Nile gravel at +156 m on E bank of Nile R. in S Egypt (22° 18′ N Lat, 31° 37′ E Long). Coll. and subm. by R. Giegengack, Yale Univ.

Wadi Toshka series, Egypt

Fresh-water mollusc shells Nile silt in S bank of Wadi Toshka on E side of Nile R. in S Egypt (22° 31′ N Lat, 31° 55 ′E Long). Coll. and subm. by R. Giegengack, 1965.

Y-1644. Wadi Toshka, 8E-F101 **12,640 ± 400**
10,690 B.C.

Two types of gastropod shells recovered from fine, sandy, clay-bearing Nile silt 15 cm thick directly underlying 1.5 m stratum of Middle Silt, a key bed in fluvial sequence.

Y-1645. Wadi Toshka, 8E-F102 **12,390 ± 120**
10,440 B.C.

Pelecypod shells (*Corbicula consobrina*) from sandy, jointed Nile silt directly overlying Middle Silt and 1.85 to 2.10 m above highest occurrence of Y-1644.

Nile series, Egypt

Shells from Nile R. Valley, coll. and subm. by R. F. Giegengack.

Y-1807. Modern shells **$\delta C^{14} = +32.6 \pm 0.5\%$**

Shells of small modern fresh-water clam (*Corbicula* sp.) from wave-washed accumulations at height of Nile flood of Aug.-Sept. 1963, ca. 117 m MSL, Nile R. Valley, S Egypt (22° 27′ N Lat, 31° 49′ E Long).

Y-1808. Wadi Arminna **12,010 ± 160**
10,060 B.C.

Shells of small fresh-water clams (*Corbicula consobrina*) from coarse, sandy Nile "silt" at 134.5 m MSL up tributary arm of Wadi Arminna (22° 26′ N Lat, 31° 51′ 30″ E Long).

Y-1809. **12,010 ± 200**
10,060 B.C.

Shells of small fresh-water clams (*Corbicula consobrina*) from thin layer of somewhat deteriorated Nile silt at 138 m MSL (22° 28′ N Lat, 31° 48′ E Long).

Y-1810. **12,100 ± 160**
10,150 B.C.

Shells of small fresh-water clam (*Corbicula consobrina*) from dense, clayey, jointed Nile silt ca. 135 m MSL (22° 44′ N Lat, 32° 04′ E Long).

Lake Naivasha series, Kenya

Core from Crescent Lake—Lake Naivasha, Kenya (0° 46′ S Lat, 36° 25′ E Long). Coll. by J. L. Richardson and R. L. Kendall; subm. by D. A. Livingstone. (See Richardson, 1964, 1966, for details).

3000 ± 60
Y-1436. Lake Naivasha Meter 8 1050 B.C.

Dates dry episode in history of Lake Naivasha.

5650 ± 120
Y-1339. Lake Naivasha Meter 15 3700 B.C.

Dates transition from high water phase to low fluctuating water phase in history of lake.

9200 ± 160
Y-1340. Lake Naivasha Meter 28 7250 B.C.

Dates base of core and provides minimum age for Crescent Lake.

4880 ± 100
Y-1575. Lake Rudolf, Kenya 2930 B.C.

Shells of freshwater oyster (*Etheria elliptica* Lamarck) from 67 m level of Lake Rudolf near Dangatotha, Kenya (3° N Lat, 36° W Long). Coll. by B. Patterson and subm. by D. A. Livingstone. Sample provides date for high level of Lake Rudolf during pluvial period, presumably last.

Pilkington Bay series, Uganda

Core P-2 from Pilkington Bay near Jinja, Uganda, in Lake Victoria (0° 17′ S Lat, 33° 19′ E Long). Coll. by R. L. Kendall and J. L. Richardson; subm. by D. A. Livingstone, Duke Univ. Additional dates for this core in Section III. *Comment* (D.A.L.): samples date tropical rain forest phase in history of Lake Victoria, most important vegetational phenomenon to be uncovered yet by pollen analysis in Africa (see Kendall, 1968, for details).

3240 ± 100
Y-1572. Pilkington Bay 4.55 to 4.75 m 1290 B.C.

Dates beginning of sharp decline in pollen of *Moraceae*.

9550 ± 200
Y-1573. Pilkington Bay 12.49 to 12.70 m 7600 B.C.

Dates rise of several important forest taxa.

13,750 ± 200
Y-1574. Pilkington Bay 17.12 to 17.30 m 11,800 B.C.

Dates beginning of sedimentation in present pluvial episode.

14,730 ± 200
Y-1408. Pilkington Bay 17.45 to 17.65 m 12,780 B.C.

Dates upper part of desiccated layer laid down or modified at time when lake surface was at least 9 m below present level.

Mahoma Lake series, Uganda

Two cores from Mahoma Lake, Ruwenzori Range, Uganda (0° 21′ N Lat, 29° 58′ E Long). Coll. and subm. by D. A. Livingstone. (See Livingstone, 1967, for details).

4670 ± 80
Y-1410. Mahoma 2.11 to 2.45 m 2720 B.C.

From Core 3 (M60D-3). Dates prominent ash layer and *Afrocrania* pollen zone.

12,700 ± 120
Y-1411. Mahoma 4.50 to 4.70 m 10,750 B.C.

From Core M60-D5. Sample dates transition from pollen spectra dominated by alpine and subalpine elements to pollen spectra dominated by montane rain forest elements.

6890 ± 100
Y-1409. Kitandara Lake, Uganda 4940 B.C.

Core 12C, depth 11.10 to 11.35 m, Kitandara Lake, Ruwenzori Range, Uganda (0° 21′ N Lat, 29° 53′ E Long). Coll. by J. L. Richardson and R. L. Kendall; subm. by D. A. Livingstone. Sample gives minimum age close to true age of deglaciation at ca. 4000 m on W side of mts.

2960 ± 60
Y-1413. Bujuku Lake, Uganda 1010 B.C.

Depth 4.08 to 4.37 m, Bujuku Lake, Ruwenzori Range, Uganda (0° 22′ N Lat, 29° 54′ E Long). Coll. by D. A. Livingstone, J. L. Richardson, and R. L. Kendall; subm. by D. A. Livingstone. Sample gives minimum age for deglaciation at alt ca. 4000 m on E side of mts.

8050 ± 140
Y-1412. Lake Rukwa, Tanganyika 6100 B.C.

Depth 20.00 to 20.405 m, Lake Rukwa, Tanganyika (8° 30′ S Lat, 32° 40′ E Long). Coll. by D. A. Livingstone and R. L. Kendall; subm. by D. A. Livingstone. Sample dates most prominent of 4 ash layers in accessible part of Lake Rukwa sec.

11,690 ± 300
Y-1414. Lake Tanganyika, Zambia 9740 B.C.

Core No. Tang 2-2 taken in >400 m water, Lake Tanganyika near Mpulungu, Zambia (8° 30′ S Lat, 30° 50′ E Long). Coll. by D. A. Livingstone and R. L. Kendall, subm. by D. A. Livingstone. Depth 5.49 to 5.92 m. Sample dates most prominent of 4 ash layers in accessible part of Lake Tanganyika sec.

21,600 ± 400
Y-1415. Lake Ishiba Ngandu, Zambia 19,650 B.C.

Core from 3.175 to 3.475 m depth from Lake Ishiba Ngandu, Zambia (11° 15′ S Lat, 31° 45′ E Long). Coll. by D. A. Livingstone and J. L. Richardson; subm. by D. A. Livingstone. Sample dates transition from organic sand to clay-gyttja.

Lake Chishi series, Zambia

Core from Lake Chishi, Zambia (8° 55′ S Lat, 29° 46′ E Long). Coll. by J. L Richardson and S. A. Livingstone; subm. by D. A. Livingstone.

Y-1576. Chishi 2.50 to 2.70 m — **3640 ± 100**
1690 B.C.

Sample dates transition from clay to gyttja.

Y-1416. Chishi 6.55 to 6.75 m — **33,900 ± 2000**
31,950 B.C.

Sample dates change from peat to lake mud.

V. ARCHAEOLOGIC SAMPLES

A. North America

New Brunswick series, Canada

Shell and charcoal from 3 Woodland ceramic sites, shell heaps, in region of St. Andrews, New Brunswick (45° 30′ N Lat, 67° 30′ W Long). Coll. and subm. by R. Pearson, Univ. of Hawaii (Pearson, 1966).

Y-1291. New Brunswick — **1880 ± 80**
A.D. 70

Shell from 91 to 99 cm depth from BgDsl. Coll. 1960.

Y-1292. New Brunswick — **1900 ± 100**
A.D. 50

Charcoal from 61 cm depth from BgDs6. Coll. 1962.

Y-1293. New Brunswick — **2370 ± 80**
420 B.C.

Charcoal from 41 to 61 cm depth from BgDs10. Coll. 1962.

Y-1845. Canton Point site, Maine — **Modern**

Lodge pole stake found in bottom of trench, some 152 cm below present level at Canton Point site, Maine (44° 28′ N Lat, 70° 18′ W Long). Coll. and subm. by P. G. Ward, Maine Archaeol. Soc.

Y-1373. Litchfield, New Hampshire — **3620 ± 110**
1670 B.C.

Fragments of wood charcoal assoc. with shattered spear point and flint chips in fire pit, at Litchfield, New Hampshire (42° 50′ N Lat, 71° 29′ W Long). Coll. and subm. by E. Finch, New Hampshire Archeol. Soc.

Rutland series, Vermont

Charcoal samples taken from hearths in Rutland Co., Vermont (43° 47′ 50″ N Lat, 73° 8′ 45″ W Long). Coll. and subm. by W. A. Ritchie, New York State Mus. (Ritchie, 1965, p. 5).

Y-1815. Rutland — **1830 ± 80**
A.D. 120

Charcoal from 2 small, adjacent hearths, Features 1 and 2 lying on a few cm above bedrock and 18 to 20 cm below surface, at KI site, Rutland Co., Vermont. Burned bone and quartzite flakes, but no artifacts were found in and near these fireplaces. It was hoped that sample would provide 1st date for this earliest known Laurentian phase in NE. Date is much too recent, however.

2320 ± 100
370 B.C.

Y-1855. Rutland

Charcoal from hearth area measuring ca. 38 × 75 cm, in Stratum 3 brown soil, resting on bedrock, at KI site. Coll. by J. A. Tuck. Subm. as check on Y-1815 of this series. Date is also too late to pertain to Vergennes phase.

2730 ± 120
780 B.C.

Y-1399. Soapstone Hill, Massachusetts

Charcoal from small hearth at 155 cm depth in Soapstone Hill site, Indian steatite quarry in Millbury, Massachusetts (42° 45′ N Lat, 71° 45′ W Long). Coll. and subm. by W. W. Horne (Fowler, 1966).

3750 ± 100
1800 B.C.

Y-1923. Oak Island site, Massachusetts

Charcoal from pit, assoc. with Oak Island site, North R., township of Norwell, Massachusetts (70° 49′ N Lat, 42° 10′ W Long). Site evidences 2 Archaic components, Early and Late, separated by 30 cm silt layer (sterile). Sample obtained from pit deposit having typological assoc. with Late Archaic. Coll. and subm. by William Fowler, Mass. Archaeol. Soc.

Frank Vincent series, Massachusetts

Charcoal from Frank Vincent site, Main St., Vineyard Haven, Martha's Vineyard, Massachusetts (41° 26′ 21″ N Lat, 70° 35′ 07″ W Long). Coll. and subm. by W. A. Ritchie. Several duplicate samples were run owing to confusion stratigraphically at site (Ritchie, W. A., The archaeology of Martha's Vineyard, a framework for the prehistory of southern New England: Natural History Press, N. Y., in press).

1600 ± 60
A.D. 350

Y-1811. Frank Vincent

Charcoal from Feature 5, small pit, originating at base of Stratum 1B, 68 cm from site surface. Coll. by F. Schambach; subm. by W. A. Ritchie. Pit contained Levanna-type points and cord-decorated, shell-tempered potsherd. Sample should date Late Woodland horizon at site.

720 ± 100
A.D. 1230

Y-1852. Frank Vincent

Charcoal from Feature 28, large refuse filled pot traceable to base of Stratum 1B. Sample came from lower part, 75 to 100 cm from surface, assoc. with shell-tempered potsherd and a few other artifacts. Subm. as check on Y-1811 of this series.

2050 ± 80
100 B.C.

Y-1812. Frank Vincent

Charcoal from Feature 22, hearth near bottom of this pit feature, 81 to 89 cm from site surface. Coll. and subm. by W. A. Ritchie. Pit opened from top of Stratum 2; Rossville type point in feature and sherds of grit-tempered pottery found nearby. Sample should date latter part of Middle Woodland period.

890 ± 100
Y-1853. Frank Vincent **A.D. 1060**

Charcoal from Feature 2, large refuse-filled pit, which appeared to originate near base of Stratum 3A. Sample was obtained from much thickened portion of shell Stratum 2, where it slumped into sunken top of Feature 2, at 48 cm beneath surface. Sample dates early level of Stratum 2. Subm. as check on Y-1812 of this series.

2030 ± 60
Y-1813. Frank Vincent **80 B.C.**

Charcoal from Feature 14, small hearth at top of Stratum 3A, 45 to 53 cm below site surface. Coll. and subm. by W. A. Ritchie. Sample dates appearance of steatite vessels (Transitional stage) at site.

990 ± 80
Y-1814. Frank Vincent **A.D. 960**

Charcoal from Feature 7, small pit apparently originating at base of Stratum 3A, 74 cm from site surface. Coll. by F. Schambach. Feature produced Squibnocket Triangle and bone projectile point. Sample dates middle horizon of Stratum 3, part of Late Archaic horizon of site.

2050 ± 80
Y-1854. Frank Vincent **100 B.C.**

Charcoal from Feature 15, cooking pit lined with burned stones, dug into Stratum 4 from same level of Stratum 3A, and should therefore date this horizon. Sample coll. at 102 cm from surface. Rossville type projectile point lay just over stones at 89 cm from surface. Subm. as check on Y-1814.

Hornblower II series, Massachusetts

Charcoal from Hornblower II site, Squibnocket Pond, town of Gay Head, Martha's Vineyard, Massachusetts (41° 19′ 34″ N Lat, 70° 46′ 42″ W Long). Coll. 1964 by N.Y. State Mus. and Sci. Service expedition and subm. by W. A. Ritchie (*op cit.*, above).

570 ± 60
Y-1528. Hornblower **A.D. 1380**

Charcoal from Feature 1, a pit, in Sec. EONO-E5NO, 46 cm deep, which opened from Stratum 1, 33 cm below surface. Dates most recent, Late Woodland, occupational horizon at site.

4140 ± 100
Y-1529. Hornblower **2190 B.C.**

Charcoal from Feature 10, a pit, 46 cm deep, which originated near bottom of Stratum 3, at 81 cm below surface. Sample dates Stratum 3, Archaic horizon at site, which produced quartz point complex.

4200 ± 160
Y-1530. Hornblower **2250 B.C.**

Charcoal from Feature 6, a hearth, 20 cm deep, which originated at base of Stratum 4, 76 cm below surface. Sample dates Archaic Stratum 4, which produced Laurentian types of projectile points.

790 ± 80
Y-1653. Hornblower **A.D. 1160**

Charcoal from ash bed 5 to 13 cm thick which seemed to pertain to Stratum 1B.

Pratt series, Massachusetts

Charcoal from Pratt site, Howard Ave., Vineyard Haven, town of Tisbury, Martha's Vineyard, Massachusetts (41° 26′ 21″ N Lat, 70° 36′ 07″ W Long). Coll. by N.Y. State Mus. and Sci. Service expedition and subm. by W. A. Ritchie (*op. cit.*, above).

2470 ± 120
Y-1531. Pratt **520 B.C.**

Charcoal from Feature 10, a pit 71 cm deep, apparently originating in Stratum 3. Dates Stratum 3, evidently belonging to Early Woodland stage.

2380 ± 80
Y-1532. Pratt **430 B.C.**

Charcoal from Feature 13, hearth 5 to 10 cm deep, evidently dug from Stratum 2 into Stratum 3. Sample dates Stratum 2, trampled shell and black sand Stratum, with Vinette 1 potsherds and lobate and straight-stemmed projectile points, of Early Woodland provenience.

Cunningham series, Massachusetts

Charcoal from Cunningham site, Vineyard Haven, town of Tisbury, Martha's Vineyard, Massachusetts (41° 26′ 07″ N Lat, 70° 35′ 50″ W Long). Coll. by N.Y. State Mus. and Sci. Service expedition; subm. by W. A. Ritchie (*op. cit.*, above).

1550 ± 80
Y-1533. Cunningham **A.D. 400**

Charcoal from Feature 1, small hearth 17 cm deep, in NE quad of Test Sec. 1. Hearth originated 116 cm from surface. No artifacts present in feature.

800 ± 80
Y-1652. Cunningham **A.D. 1150**

Charcoal from midden area 50 cm from surface. Dates 2B Stratum of this large, Middle Woodland site, and establishes age of major component.

3430 ± 100
Y-1374. Flat River site, Rhode Island **1480 B.C.**

Charcoal from cremation Pit 4 at Flat R. site, Washington, Rhode Island (41° 42′ N Lat, 71° 36′ W Long). Pit contained burned stem knife of Late Archaic Period and Pit 4 was located near Pit 5, which yielded 9 burnt projectile points, diagnostic of Stone Bowl Industrial age, Late Archaic. Coll. and subm. by William Fowler, Massachusetts Archaeol. Soc.

Y-1664. Binette site, Connecticut **4340 ± 120**
2390 B.C.

Charcoal from near N entrance and E wall of Shelter A, which is 1 of 2 rock shelters in Binette site, Naugatuck, Connecticut (41° 28′ 8″ N Lat, 73° 0′ 16″ W Long). Sample was 221 cm below datum and near bottom of stratigraphic level pertaining to Vosburg component. Closest assoc. artifacts were 2 Brewerton eared-notched projectile points, 223 to 229 cm below datum and 3.1 cm from sample horizontally. Points were resting on top of lowest level of culturally sterile stratigraphy. Also at approx. same depth, as well as above sample were several Bosburg points. Coll. and subm. 1965 by W. O'Connor and D. H. Thompson, Quinnipiac College, Hamden, Connecticut. *Comment* (D.H.T.): later 2 previously reported dates for Vosburg complex: Y-1535: 2780 ± 80 (B.C.) at Sylvan Lake rock shelter, and M-287: 2524 ± 300 (B.C.) at Bannerman site (Funk, 1965), but still within range of variation for Bannerman site date. (For summary of components in Binette site, see Thompson, D. H., The Binette site, Naugatuck, Connecticut: Eastern States Archaeol. Federation: Bull. 27, in press.)

Y-1315. Croton Point, New York **5850 ± 200**
3900 B.C.

Charcoal from Croton Point site, stratified shell midden near Harmon, Westchester Co., N.Y. (41° 11′ 12″ N Lat, 73° 54′ 6″ W Long) from lowest oyster shell horizon, assoc. with undiagnostic cultural material. Coll. 1962 by Bert Salwen, Columbia Univ.; subm. by Irving Rouse (Salwen, 1965).

Farrell site series, New York

Charcoal from Farrell site, Caledonia, Livingston Co., N.Y. (42° 58′ 36″ N Lat, 77° 44′ 2″ W Long). Site is on terrace of Genesee R. being destroyed by gravel pit operation (Hayes, 1966). Coll. 1967 and subm. by C. F. Hayes, III, Rochester Mus.

Y-2345. Farrell 20 to 69 cm **3980 ± 160**
2030 B.C.

Sample from Pit 72, Level H, 20 to 69 cm depth. Pit contained Burial 5, as well as large quantities of fresh-water clam shell, stone, flint, and bone tools, refuse bone, and flint debris.

Y-2346. Farrell 10 to 15 cm **3890 ± 120**
1940 B.C.

Sample is from Level B, 10 to 15 cm depth, Pit 70. Pit contained projectile points, refuse bone, and flint debris. No fresh-water clam shell present.

General Comment (C.F.H.): samples appear to satisfactorily date previously unrecognized facet of Late Archaic in W N.Y. Relationships can be seen with earlier Lamoka and Woodchuck Hill sites, but projectile point typology suggests trend toward Normanskill type of River phase of Late Archaic in E N.Y. (Hayes, 1966).

Y-1816. Prickly Pear Hill, New York **1160 ± 60**
A.D. 790

Charcoal from Prickly Pear site, Croton, New York (41° 13′ N Lat, 73° 54′ W Long) from depth 25 cm. Sample was near edge of pit containing ca. 1000 lbs. quarzite chipping debris. Coll. and subm. by Louis Brennan, Briarcliff College. *Comment* (L.B.): test age is late Middle Woodland, and is not considered related to cache of quartzite.

Y-1894. Frog Mound, New York **3710 ± 100**
1760 B.C.

Charcoal from group of rock fragments near center of Frog Mound, Livingstone Co., N.Y. (42° 45′ 37″ N Lat, 77° 50′ 13″ W Long). Depth of sample 45 cm. Coll. 1957 by Rochester Mus. of Arts and Sci.; subm. by M. E. White, State Univ. of N.Y. at Buffalo.

Y-1895. Caneadea Mound, New York **1780 ± 200**
A.D. 170

Charcoal from 67 cm below surface at Caneadea Mound, Alleghany Co., N.Y. (42° 24′ 30″ N Lat, 78° 9′ 29″ W Long). Coll. and subm. by M. E. White.

O'Neil series, New York

Samples are from 3 stratigraphic levels and cultural components at O'Neil site, Cayuga Co., N.Y. (43° 04′ 48″ N Lat, 76° 35′ 09″ W Long). Excavated by New York State Mus. and Sci. Service, 1962; coll. and subm. by W. A. Ritchie.

Y-1273. O'Neil **3960 ± 100**
2010 B.C.

Charcoal from Feature 33, probably hearth, 71 to 97 cm below present surface. Material came from basal 10 cm of feature which contained no artifacts. However, Brewerton Side-Notched point occurred in Stratum 3 only 30 cm from pit edge. Point was in apparent assoc. with subsoil pocket containing cache of 36 rough flint quarry blanks, typical of Archaic Brewerton phase, which this sample dates (Ritchie, 1965, p. 91).

Y-1274. O'Neil **3200 ± 100**
1250 B.C.

Charcoal from probable hearth in Stratum 2, 76 cm below present surface. Susquehanna Broad point found 6 cm directly over feature. Sample dates beginning of Transitional period at this site, containing newly defined Frost Island complex (Ritchie, 1965, p. 156).

Y-1275. O'Neil **800 ± 80**
A.D. 1150

Charcoal from Feature 15, large "roasting platform," composed of burned stones and black dirt, 30 cm below present surface. Middle Woodland potsherds and projectile points found around periphery. Sample was believed to date Middle Woodland period, Point Peninsula culture at this site, but is obviously too late. Feature must therefore relate to Late Woodland period, Owasco culture occupation.

1710 ± 80
Y-1277. O'Neil **A.D. 240**

Charcoal from possible hearth in Stratum 2 at 52 cm below present surface. Steatite potsherds and Susquehanna Board points found at about same level in this square. Sample was believed to date end of Transitional period zone containing newly defined Frost Island phase. However, date is too late for Transitional period and apparently this feature was intrusive from base of Stratum I into top of Stratum 2. It therefore probably relates to Middle Woodland period, Point Peninsula occupation of site.

790 ± 80
Y-1278. O'Neil **A.D. 1160**

Charcoal from Feature 20, basin-shaped pit with maximum diam. 102 cm and maximum depth 58 cm. Date allocates feature to Late Woodland period occupation.

1790 ± 80
Y-1276. Lewiston, New York **A.D. 160**

Charcoal from possible cremation, at 152 cm below datum, in burial mound at Lewiston, New York (43° 10′ 30″ N Lat, 79° 02′ 30″ W Long). Coll. by R. L. McCarthy; subm. by W. A. Ritchie. Several burials and assoc. artifacts at site are indicative of Hopewellian influence in W New York; this sample provided 1st radiocarbon date (Ritchie, 1965, p. 215-217).

Lamoka Lake series, New York

Charcoal from hearths at base of occupational deposits at Lamoka Lake site, Schuyler Co., N.Y. (42° 25′ N Lat, 77° 05′ W Long). This is type site for Lamoka culture. Coll. and subm. by W. A. Ritchie.

4500 ± 80
Y-1279. Lamoka **2550 B.C.**

Charcoal from hearth ca. 38 cm diam. and 15 cm thick, enclosed in subsoil ca. 76 cm below present surface (Ritchie, 1965, p. 45).

4490 ± 80
Y-1280. Lamoka **2540 B.C.**

Charcoal from hearth ca. 38 cm diam. and 30 cm thick, enclosed in subsoil, ca. 76 cm below present surface (Ritchie, 1965, p. 45).

Kipp Island series, New York

Charcoal from Kipp Is. site, Seneca Co., N.Y. (42° 59′ 32″ N Lat, 76° 43′ 39″ W Long). Coll. and subm. by W. A. Ritchie.

1640 ± 100
Y-1378. Kipp Island **A.D. 310**

Charcoal from Kipp I. site from Feature 4, small hearth, dug into subsoil depth 25 cm, diam. 30 cm. Date seems consistent within Kipp I. site sequence, marking Hopewellian influence horizon of cultural development at site (Ritchie, 1965, p. 228).

Y-1379. Kipp Island **1320 ± 100**
A.D. 630

Charcoal from Feature 11, pit measuring 132 × 102 × 36 cm. This central New York date and date for Tufano site in E New York (see next sample) are in close agreement, and similar ceramics assoc. with 2 samples relate both to Kipp Island phase of Late Point Peninsula culture (Ritchie, 1965, p. 228).

Y-1382. Tufano site, New York **1250 ± 100**
A.D. 700

Charcoal from Feature 7, cooking pit 23 cm deep, Tufano site, Greene Co., N.Y. (42° 18′ 43″ N Lat, 73° 47′ 14″ W Long). Coll. by F. F. Schambach; subm. by W. A. Ritchie. Date closely agrees with estimated antiquity, based upon typology of assoc. ceramics which pertain to Kipp Island phase of late Point Peninsula culture.

Y-1383. Potts site, New York **2690 ± 100**
740 B.C.

Charcoal from fired subsoil basin area 43 cm deep, Potts site, Oswego Co., N.Y. (43° 17′ 27″ N Lat, 76° 17′ 30″ W Long). Excavated by N.Y. State Mus. and Sci. Service; coll. and subm. by W. A. Ritchie. Subm. in hope that feature would prove to be Early Hunter (Paleo-Indian) hearth, but date is obviously much too late (Ritchie, 1965, p. 22-30).

Y-1380. Kelso site, New York **560 ± 100**
A.D. 1390

Charcoal from Feature 6, small hearth, Kelso site, Onondaga Co., New York (43° 1′ N Lat, 76° 28′ 24″ W Long). Coll. by R. E. Funk; subm. by W. A. Ritchie (Ritchie, 1965, p. 308).

Y-1381. Garoga site, New York **620 ± 100**
A.D. 1330

Charcoal from deep pit, Feature 11, Garoga site, Fulton Co., N.Y. (43° 1′ N Lat, 74° 32′ W Long). Coll. by R. E. Funk; subm. by W. A. Ritchie. Feature was 99 cm in diam. and 147 cm deep. Archaeologic data point to age of ca. A.D. 1500-1550 (Ritchie, 1965, p. 317-320).

Y-2347. Castle Gardens site, New York **4090 ± 100**
2140 B.C.

Castle Gardens site, Broome Co., N.Y. (42° 04′ 28″ N Lat, 76° 05′ 30″ W Long). Charcoal from Feature 2, large U-shaped roasting pit (diam. ca. 150 cm, depth 66 to 122 cm) originating at base of Stratum 2. Assoc. artifacts included netsinkers, side-notched and stemmed projectile points. Sample should date lower levels of Stratum 2 at this Late Archaic site. Excavated by New York State Mus. and Sci. Service. Coll. by D. R. Wilcox; subm. by W. A. Ritchie.

Y-2348. Cottage site, New York **1810 ± 100**
A.D. 140

Cottage site, Tioga Co., N.Y. (42° 03′ 39″ N Lat, 76° 08′ 26″ W Long). Charcoal from Feature 4, shallow basin-shaped roasting bed (diam.

ca. 102 cm, depth ca. 10 cm) originating near base of Stratum 1. Feature contained numerous charred nuts, pitted stone, hammerstone and 5 Middle Woodland sherds. Sample should date Middle Woodland occupation at site. Excavated by New York State Mus. and Sci. Service. Coll. by F. Schambach; subm. by W. A. Ritchie.

Westheimer site series, New York

Westheimer site, Schoharie Co., N.Y. (42° 41′ N Lat, 74° 18′ W Long). Charcoal samples from site excavated by New York State Mus. and Sci. Service. Coll. and subm. by R. E. Funk and W. A. Ritchie.

1500 ± 80

Y-2349. Westheimer site **A.D. 450**

Westheimer site, charcoal from small, basin-shaped hearth 56 cm in diam. and 18 cm deep, located in Sec. E20N50 and originating in Stratum 3. In hearth were many sherds of incised Middle Woodland pot. In midden surrounding feature were Fox Creek stemmed projectile points (formerly called Steubenville Stemmed). Should date Middle Woodland component of Stratum 3.

1540 ± 80

Y-2350. Westheimer site **A.D. 410**

Charcoal from small, basin-shaped hearth in Sec. E20N90, originating in Stratum 3. Hearth was 25 cm in diam. and 15 cm deep. Top of feature had multi-pitted stone. Near hearth were several Fox Creek Stemmed points. Sample should date Middle Woodland component of Stratum 3.

2520 ± 100

Y-2351. Westheimer site **570 B.C.**

Charcoal from large oval feature, 112 cm long, 79 cm wide and 10 cm thick, in Sec. E10N200 and confined to Stratum 5. Basal fragment of small biface blade was directly assoc.; few fabric-marked potsherds and other artifacts occurred in surrounding midden, but data are too few to permit cultural allocation of Stratum 5.

Sylvan Lake rock shelter series, New York

Charcoal from Sylvan Lake rock shelter, Dutchess Co., N.Y. (41° 37′ 29″ N Lat, 73° 42′ 43″ W Long). Coll. by R. E. Funk; subm. by W. A. Ritchie (Funk, 1967, p. 139-160).

4730 ± 80

Y-1535. Sylvan Lake **2780 B.C.**

Charcoal from Feature 2, small hearth 23 cm deep, at depth 91 cm. Sample dates Archaic Laurentian occupation of Stratum 3.

4160 ± 140

Y-1536. Sylvan Lake **2210 B.C.**

Charcoal from Feature 5, hearth 74 to 89 cm below datum, within Stratum 2. Sample dates beginning of Bare Island occupation of site.

Y-1655. Sylvan Lake **6560 ± 100**
4610 B.C.

Charcoal from Feature 6, small hearth 10 cm deep, originating in Stratum 2 at depth 137 cm. Hearth occurred in levels intermediate between Vosburg Laurentian zone of Stratum 2, 76-94, and Stratum 3, which contained a few broad side-notched and stemmed projectile points. Sample dates pre-Vosburg Archaic manifestation in lower Hudson Valley.

Nahrwold series, New York

Charcoal from Nahrwold site, town of Middleburgh, Schoharie Co., N.Y. (42° 34′ 30″ N Lat, 74° 20′ 37″ W Long). Coll. by New York State Mus. and Sci. Service expedition; subm. by W. A. Ritchie (Ritchie, W. A., The Archaeology of New York State: 2nd, revised ed., Natural History Press, N.Y., in press).

Y-1650. Nahrwold **500 ± 80**
A.D. 1450

Charcoal from pit, Feature 51, Component A. Sample dates Castle Creek, Late Woodland component on site.

Y-1651. Nahrwold **2710 ± 80**
760 B.C.

Charcoal found in scattered fragments from ca. 15 cm to 38 cm below subsoil level, in Trench 2, Feature 2, Component B. Sample dates Early Woodland complex on site.

Y-1654. Scaccia site, New York **2820 ± 60**
870 B.C.

Charcoal from Feature 19, pit 75 cm deep, Scaccia site, town of Liecester, Livingston Co., N.Y. (42° 46′ 21″ N Lat, 77° 52′ 36″ W Long). Coll. by N.Y. State Mus. and Sci. Service expedition; subm. by W. A. Ritchie. Sample dates important Early Woodland site (Ritchie, W. A., *op. cit.*, above.)

Y-1534. Roundtop, New York **880 ± 60**
A.D. 1070

Charcoal from Feature 30, storage pit, 183 × 152 × 97 cm (on subsoil level (Roundtop site, Endicott, Broome Co., N.Y. (42° 5′ 10″ N Lat, 76° 4′ 31″ W Long). Coll. by N.Y. State Mus. and Sci. Service expedition; subm. by W. A. Ritchie. Sample dates occupation of Early Owasco complex. Feature produced earliest dated cultigens in New York State.

Adequentaga series, New York

Two charcoal samples from Adequentaga Site II, Oneonta, N.Y. (42° 27′ N Lat, 75° 01′ 15″ W Long). Coll. and subm. by B. E. Raemsch, Hartwick College.

Y-1756. Adequentaga 41 cm **3440 ± 120**
1490 B.C.

Charcoal from Adequentaga Site II, Oneonta, N.Y. Sample dates Brewerton phase of Boreal Archaic.

Y-1757. Adequentaga 30 cm **2930 ± 100**
980 B.C.

Charcoal from Adequentaga Site II, Oneonta, N.Y. Sample dates Hunter's Home phase of Owasco.

Munson site series, New York

Two samples from 23 and 28 cm depth beneath topsoil, at base of topsoil on river gravel, taken from hearth, Munson site, N.Y. (42° 28′ 30″ N Lat, 75° 07′ W Long). Coll. and subm. by B. E. Raemsch. Both samples are test pit samples.

Y-1772. Munson 23 cm **160 ± 60**
A.D. 1790

Y-1773. Munson 28 cm **410 ± 60**
A.D. 1540

This sample was given H_2SO_4 treatment for rootlets which may account for slightly greater age. Net sinkers of unknown culture were found with this sample.

Catella site series, New York

Charcoal samples from Brooks-Catella site, same as Adequentaga site II, New York (42° 27′ N Lat, 75° 01′ 15″ W Long). Coll. and subm. by B. E. Raemsch.

Y-1954. Catella 13 cm **390 ± 80**
A.D. 1560

Charcoal from hearth assoc. with Woodland materials: Levanna point and Owasco pottery.

Y-1955. Catella 30.5 cm **490 ± 120**
A.D. 1460

Charcoal from hearth assoc. with Woodland materials: Levanna point and Owasco pottery. No cultural determination has been made.

Y-1956. Catella 76 cm **1190 ± 120**
A.D. 760

Charcoal assoc. with hammerstone, some cracked rock and scattered chips of flint; 33 cm below was culture producing Late Archaic artifacts.

Y-1960. Catella 79 cm **1240 ± 80**
A.D. 710

No cultural determination available.

Y-1961. Catella 39 cm **3460 ± 80**
1510 B.C.

Charcoal from hearth assoc. with artifacts from Brewerton phase of Boreal Archaic.

Y-1999. Catella 102 cm **3560 ± 80**
1610 B.C.

Charcoal from hearth lying on top of glacial gravel where flint chisel, side-notched end scraper, several burins and used flake knives were found. Charcoal and proto-archaic stage artifacts are not related. Sample belongs to Brewerton phase of Boreal Archaic.

Y-1689. Howlett Hill site, New York **570 ± 60**
A.D. 1380

Wood charcoal from large post mold in House I, Howlett Hill site, Onondaga Co., N.Y. (43° 0′ 40″ N Lat, 76° 12′ 33″ W Long). Sample assoc. with sherds of cord-wrapped paddle impressed late Oak Hill vessel. Site is of terminal Oak Hill phase Iroquois affiliation, probably proto-Onondaga. Coll. and subm. by J. A. Tuck, Syracuse Univ., now at Memorial Univ. of Newfoundland.

Furnace Brook site series, New York

Wood charcoal from Furnace Brook site, Onondaga Co., N.Y. (43° 0′ 44″ N Lat, 76° 12′ 0″ W Long). Furnace Brook is intensively occupied Iroquois site which was occupied during nearly entire Oak Hill period, almost certainly by same community which later lived at Howlett Hill (Y-1689, above). Dates delimit Oak Hill phase in Onondaga sub-area very well. Coll. 1966 and subm. by J. A. Tuck.

Y-1817. Furnace Brook **650 ± 60**
A.D. 1300

Wood charcoal from large post mold in House 1, assoc. with cord-wrapped paddle impressed pottery.

Y-1818. Furnace Brook **580 ± 60**
A.D. 1370

Wood charcoal from several large post molds in inner stockade line of this site. Assoc. with sherds typical of Oak Hill phase.

Y-1819. Chamberlin site, New York **660 ± 60**
A.D. 1290

Wood charcoal from large roasting pit assoc. with pottery, pipe fragment, ovate knife, and food remains, all of which are typical of terminal Owasco Castle Creek phase which this site represents. Coll. 1966 and subm. by J. A. Tuck.

Y-2374. Bloody Hill site, New York **530 ± 80**
A.D. 1420

Wood charcoal from Bloody Hill Site, Onondaga Co., N.Y. (42° 58′ 30″ N Lat, 76° 02′ 30″ W Long). Sample was found in large ceremonial roasting pit containing ceramics, projectile points and pipe fragments all typical of early Chance phase of Iroquois development as well as broken human bones which suggest some early Iroquois cannibalistic ritual. Coll. 1967 and subm. by J. A. Tuck.

Y-2375. Burke site, New York **360 ± 80**
A.D. 1590

Wood charcoal from Burke site, Onondaga Co., N.Y. (42° 57′ 12″ N Lat, 76° 0′ 38″ W Long). Sample was found in cooking pit assoc. with material remains and structures typical of terminal Chance phase Iroquois which this site represents. Revision of date after manner described in Stuiver and Suess (1967) to ca. 1480 A.D. makes it more acceptable for terminal Chance phase. Coll. and subm. by J. A. Tuck.

550 ± 80
Y-2376. Schoff site, New York **A.D. 1400**

Wood charcoal from Schoff site, Onondaga Co., N.Y. (42° 58′ 58″ N Lat, 76° 12′ 56″ W Long). Sample was found in large cooking pit assoc. with material typical of earliest Chance phase Iroquois. Site was occupied by same community as were the Furnace Brook and Howlett Hill sites (Y-1817, Y-1818, and Y-1689, this date list). Coll. and subm. by J. A. Tuck.

2560 ± 120
Y-1384. Rosenkrans site, New Jersey **610 B.C.**

Charcoal from cremation burial, No. 9, in grave pit 90 cm deep, Rosenkrans site Sussex Co., New Jersey (41° 06′ N Lat, 74° 59′ W Long). Coll. by L. M. Haggerty, Hackensack, N.J.; subm. by W. A. Ritchie (1965, p. 203).

Twombly Landing site series, New Jersey

Charcoal and shells from Twombly Landing, oyster shell midden site on 30 m terrace of Hudson R. Palisades Park, New Jersey (40° 58′ N Lat, 73° 55′ W Long). Coll. and subm. by Louis Brennan, Briarcliff College. (For report of Twombly Landing, see Brennan, 1967).

4750 ± 120
Y-1761. Twombly Landing, lower level **2800 B.C.**

Charcoal from hearth in yellow clay underneath shell midden on 30 m terrace of Hudson R. Midden contains oyster (*Crassostrea virginica*), ribbed mussel (*Modiolus demissus*), bay scallop (*Pecten irradians*), and hard clam (*Venus mercenaria*). Black flint point of a Taconic tradition was found at bottom of shell heap. Point is considered older than shells.

4120 ± 80
Y-1957. Twombly Landing **2170 B.C.**

Shell fragments from band of discolored soil found under main body of midden ridge. *Comment* (L.B.): bands are considered animal burrows because of younger age.

550 ± 80
Y-2338. Kutay site, Pennsylvania **A.D. 1400**

Charcoal from bell-shaped shell and refuse filled pit, Kutay site, 2.7 km N of Bushkill, Pennsylvania, on 1st terrace of Delaware R. (74′ 57′ 55″ N Lat, 41° 7′ 18″ W Long). Pit contained pitted stones, grinding stone, pestle, triangular points, mussell shell opener, potter's clay, fire-cracked rock, Chance Incised and Deowango rim sherds. Coll. and subm. by W. F. Kinsey, Franklin and Marshall College.

Brodhead-Heller site series, Pennsylvania

Charcoal from Brodhead-Heller site, 10.8 km N of Bushkill, Pennsylvania, ca. 9 m above normal water level (75° 55′ 00″ N Lat, 41° 0′ 45″ W Long). Coll. by W. F. Kinsey and Charles McNett; subm. by W. F. Kinsey.

3120 ± 120
Y-2339. Brodhead-Heller 46 to 61 cm 1170 B.C.
From fishtail level, Orient phase.

3570 ± 100
Y-2340. Brodhead-Heller 1620 B.C.
From Hearth 2, 2 Perkiomen jasper scrapers, jasper chips, Perkiomen phase.

3390 ± 100
Y-2341. Brodhead-Heller 107 to 122 cm 1440 B.C.
Weathered argillite chips and Dry Brook type point, Dry Brook phase.

3660 ± 120
Y-2342. Brodhead-Heller 152 to 168 cm 1710 B.C.
Assoc. with unfinished spréarthrower weight, Laurentian.

Zimmerman site series, Pennsylvania

Charcoal from Zimmerman site on broad terrace 4 km N of Dingman's Ferry, Pennsylvania (74° 58′ 54″ N Lat, 41° 15′ 11″ W Long). Coll. by David Werner; subm. by W. F. Kinsey.

3230 ± 120
Y-2343. Zimmerman 1280 B.C.
From Hearth 4, Level 3. Fishtail period, Orient phase.

3600 ± 80
Y-2344. Zimmerman 1650 B.C.
From Hearth 59, Level 4, assoc. with Susquehanna Broad Spear, Susquehanna phase.

3670 ± 100
Y-1826. Peters-Albricht site, Pennsylvania 1720 B.C.
Charcoal from fire pit at Peters-Albricht site (36-Pi-22), in upper Delaware valley Pike Co., Pennsylvania (74° 59′ 35″ N Lat, 41° 05′ 50″ W Long). Sample assoc. with basal part of point id. as Lehigh type, which is considered part of cultural assemblages transitional between Archaic and Woodland periods. Coll. and subm. by W. F. Kinsey.

1560 ± 80
Y-1537. Moundsville, West Virginia A.D. 390
Charcoal from Fairchance Mound, Site 46-Mr-13. This is small Middle Woodland mound near Moundsville, West Virginia (39° 55′ N Lat, 80° 44′ W Long). Coll. and subm. by Edward McMichael, West Virginia Geol. Survey (McMichael, 1965).

St. Albans site series, West Virginia

Charcoal from 46-Ka-27, stratified alluvial valley site in West Virginia (38° 23′ N Lat, 81° 48′ W Long). Coll. and subm. by B. Broyles, West Virginia Geol. Survey (Broyles, 1966).

8160 ± 100
Y-1540. St. Albans 61 to 67 cm 6210 B.C.
From 61 to 67 cm depth, Zone 12, assoc. with Kanawha projectile points.

8250 ± 100
Y-1539. St. Albans 101 cm 6300 B.C.

From 101 cm depth, Zone 14, assoc. with Le Croy projectile points.

8930 ± 160
Y-1538. St. Albans 265 cm 6980 B.C.

From depth 265 cm, Zone 25, assoc. with Kirk projectile points.

1170 ± 60
Y-1541. Turkey Creek Mound, West Virginia A.D. 780

Charcoal from 2.4 m depth at 46-Pu-2 site, Adena mound (38° 20′ N Lat, 81° 58′ W Long), West Virginia (McMichael, 1965).

Forsyth series, North Carolina

Charcoal from Site WF-8x, stratified rock shelter, near Yadkin R., Forsyth Co., North Carolina (36° N Lat, 80° 25′ W Long). Coll. and subm. by E. P. Banks, Wake Forest College.

510 ± 100
Y-1407. Forsyth 109 to 124 cm A.D. 1440

From Sq. 15RO SE at top of humus layer and under large slab that sealed off entire cultural deposit.

3210 ± 120
Y-1406. Forsyth 170 to 183 cm 1260 B.C.

From Sq. 15R5 NW at bottom of ceramic layer.

Y-1787. Forsyth 193 to 206 cm Modern

From Sq. 20R5 N at earliest ceramic level of site. Date anomalous.

4220 ± 160
Y-1405. Forsyth 204 to 231 cm 2270 B.C.

From Sq. 15R5 SW and assoc. with Savannah river point.

8850 ± 300
Y-1788. Forsyth 345 to 355 cm 6900 B.C.

From Sq. 15R5. No cultural material assoc.

Pike County series, Kentucky

Charcoal from Pi-13 site, Pike Co., Kentucky (37° 20′ 39″ N Lat, 82° 20′ 5″ W Long). Coll. and subm. by Robert Dunnell, Univ. of Washington.

580 ± 60
Y-1803. Pike County A.D. 1370

From stockade post, Feature 2, defining initial Fort Ancient component at site. Sample depth 40 to 50 cm, consisting of remnants of burned post.

710 ± 60
Y-1805. Pike County A.D. 1240

From Feature 8, pit assoc. with the 2nd stockade rebuilding at site. Sample consisted of charcoal resulting from burning of stockade.

Y-1804. Pike County, Pi-16 site, Kentucky **5270 ± 80**
3320 B.C.

Charcoal from midden concentration at Slone to Thacker phase, Archaic campsite, Pi-16, in Pike Co., Kentucky (37° 24′ 8″ N Lat, 82° 20′ 5″ W Long). Coll. and subm. by Robert Dunnell. Site represents one of series of seasonal camps established by same group over period of time. Sample obtained from middle part of stratigraphic sequence, immediately preceding appearance of pottery in stratigraphic column.

Y-1349. Cave, SE Utah **250 ± 60**
A.D. 1700

Juniper bark, part of lining of shallow cist, at 42Sa735 site, dry cave, Utah (37° 27′ N Lat, 110° 30′ W Long). Sample was covered by 30 cm thick layer of eolian sand. Coll. and subm. by W. D. Lipe, State Univ. of New York at Binghamton (Day, 1963, p. 243-244; Lipe, 1967, p. 112-148).

Y-1350. Pithouse, SE Utah **1700 ± 80**
A.D. 250

Charcoal from charred beam found in fill of Basketmaker pithouse at 42Sa363 site, Utah (37° 25′ N Lat, 110° 20′ W Long). Coll. and subm. by W. D. Lipe (Sharrock, Day, and Dibble, 1963, p. 151-159; Lipe, 1967, p. 112-148).

Clovis site series, New Mexico

Soil and bones from newly excavated area at Clovis site, also known as "Blackwater Draw Locality no. 1," Roosevelt Co., New Mexico (34° 17′ N Lat, 103° 19′ W Long). This area, S Wall Locality B, is adjacent to S Wall Locality A excavated in 1964 by G. Agogino and I. Rovner (Agogino, G. and Rovner, I., Preliminary report of a stratified post-Folsom sequence at Blackwater Draw Locality no. 1: in press). Stratigraphy follows rather closely classic sequence described by Sellards and Evans (1960) on S Pit Locality, approx. at center of former pond, and less typical N Wall Locality sequence excavated in 1962 and 1963 (Haynes and Agogino, 1966). Gradual transition of environments of deposition reflected in nature of sediments is best recorded at this locality, where fluvial-pond-marsh-meadow-desert sequence is evidenced and aggradational type of deposition is well documented in some units. Stratigraphic units named from bottom to top. Coll. and subm. by Alberto Isequilla, Univ. of Paris (Isequilla, A. and Agogino, G., The Clovis site: Current research problems and their significance to the Late Pleistocene history of the Great Plains: in press).

Y-1989. Clovis **8450 ± 280**
6500 B.C.

Bison methapodial from Unit G_2, a zonal soil developed on upper layers of dune sequence. Additional fragments of bison bone, individual molars were found scattered on soil surface, together with small rodent bones. Sample bearing marks of rodent teeth. No cultural material assoc.

Y-2360. Clovis **680 ± 80**
A.D. 1270

Organic matter from same horizon as above.

Y-1990. Clovis **7610 ± 160**
5660 B.C.

Bison bone from bone bed in highly organic silt deposit (Haynes and Agogino Unit E_1; Sellards and Evans "carbonaceous silt"). Assoc. with cultural remains including points with collateral, pressure retouching.

Y-1991. Clovis **8430 ± 200**
6480 B.C.

Bison bone from bone bed in silty, diatomaceous pond deposit (Haynes and Agogino Unit D; Sellards and Evans "diatomaceous earth"). Assoc. with presently undefined cultural remains.

General Comment (A.I.): Y-1989 of above series is incompatible with stratigraphic evidence which assigns rather recent date for development of Unit G_2, which is confirmed by Y-2360, also of above series. This date demonstrates redeposition, probably by rodent activity, of at least bison bones assoc. to unit. Y-1990 and Y-1991, both of above series, appear 1500 to 2000 yr younger than expected date when compared to A-489 (9890 ± 290, Radiocarbon, 1966, v. 8, p. 14) and A-379 (10,250 ± 320, Radiocarbon, 1964, v. 6, p. 100-101), and by stratigraphic correlation with several sites in Llano Estacado. In general terms, this anomaly can be attributed to problems assoc. with bone dating.

San Lorenzo Tenochtitlan series, Mexico

Charcoal from 3 contiguous sites in S Veracruz, Mexico, collectively known as San Lorenzo Tenochtitlan (17° 45′ N Lat, 94° 45′ W Long). These, especially San Lorenzo site, are noted for their numerous Olmec sculptures, including finest and largest colossal heads known. With support of Natl. Sci. Foundation, Yale Univ. conducted excavations in area from 1966 to 1968. Analysis of pottery and other artifacts, in conjunction with radiocarbon dating described below, has resulted in following sequence of phases:

Phase	Approx. Dates	Period
Villa Alta	A.D. 900-1200	Early Post-Classic
Palangana	600- 400 B.C.	Middle Formative (second half)
Nacaste	900- 800 B.C.	Early to Middle Formative Transition
San Lorenzo	1150- 900 B.C.	Early Formative
Chicharras	1250-1150 B.C.	Early Formative
Bajío	1350-1250 B.C.	Early Formative
Ojochi	1450-1350 B.C.	Early Formative

Only part of sequence is based on C^{14} dates directly; remainder is indirectly dated through ceramic comparisons with sites in other regions of Mesoamerica.

San Lorenzo phase marks apogee of Olmec culture in area, during which vast majority of basalt monuments were carved. It is preceded by 3 ceramic phases of which 1st, Ojochi, resembles Ocós culture of Guatemala coast, while latest, Chicharras, already has Olmec figurines. Dates on San Lorenzo phase confirm what was already known through pottery studies, that it must be approx. contemporary with Cuadros phase on Guatemala coast, with Chiapa I in Grijalva Depression, with San José Mogote phase in Oaxaca, and with Olmec-like occupation at Tlatilco and Tlapacoya (see below). Monuments were mutilated and buried at close of San Lorenzo phase; subsequent occupation, Nacaste, shares many ceramic traits with Chiapa II and cannot be much later than 800 B.C. What was probably major re-occupation of zone by people coming from La Venta region of Tabasco is represented by Palangana phase. After period of abandonment lasting more than a millennium, San Lorenzo Tenochtitlan is colonized by Post-Classic people bringing in Fine Orange and plumbate pottery.

Some samples come from deeply buried village below modern settlement of Tenochtitlan on Río Chiquito, and were exposed in steep bank (locally known as Remolino) cut by that river. Majority are from San Lorenzo itself, to SW of Tenochtitlan. Most dates are consistent with present knowledge of Early Formative period in Mesoamerica and with currently-held ideas about enormous antiquity of Olmec civilization, confirming that latter is at least as old as 1200 B.C. along Gulf Coast of Mexico. Few anomalous dates seem to result from either contamination with Villa Alta material (Y-1907) or with asphalt lumps.

3010 ± 80
Y-1797. San Lorenzo, Level 10 **1060 B.C.**

Charcoal from 3 hearths in Level 10 of Cut 1, Remolina excavations. San Lorenzo phase. Coll. 1966 by R. A. Diehl, Penn. State Univ., and M. D. Coe, Yale Univ. Subm. by M. D. Coe.

3100 ± 140
Y-1798. San Lorenzo, Level 12 **1150 B.C.**

Charcoal from hearth in Level 12, Cut 1, Remolino excavations. San Lorenzo phase. Coll. 1966 by R. A. Diehl and M. D. Coe. Subm. by M. D. Coe.

4100 ± 80
Y-1799. San Lorenzo, Level 14 **2150 B.C.**

Charcoal from 4 hearths in Level 14, Cut 1, Remolino excavations. San Lorenzo phase. Probably contaminated with asphalt. Coll. 1966 by R. A. Diehl and M. D. Coe. Subm. by M. D. Coe.

3050 ± 100
Y-1800. San Lorenzo, Level 18 **1100 B.C.**

Charcoal from 4 hearths in Level 18 of Cut 1, Remolino excavations.

San Lorenzo phase. Coll. 1966 by R. A. Diehl and M. D. Coe. Subm. by M. D. Coe.

3090 ± 80
Y-1801. San Lorenzo, Level H **1140 B.C.**

Charcoal from hearth in Level H of Cut 4, Remolino excavations. San Lorenzo phase. Coll. 1966 by R. A. Diehl and M. D. Coe. Subm. by M. D. Coe.

2870 ± 140
Y-1802. San Lorenzo, TE-Re.4′ **920 B.C.**

Charcoal from hearth series assoc. with deposit of whole and broken pottery vessels of San Lorenzo phase, Remolino excavations. Coll. 1966 by R. A. Diehl and M. D. Coe. Subm. by M. D. Coe.

1620 ± 120
Y-1907. San Lorenzo, SL-Mon. 21-2/I **A.D. 330**

Charcoal from offering directly underneath Monument 21. Should date final placement of this monument. Coll. 1966 by R. A. Diehl and subm. by M. D. Coe. Date is inconsistent with results for whole series. Recent analysis of assoc. pottery shows that stratigraphic situation was confused, and charcoal from Villa Alta phase (estimated A.D. 900 to 1200) was probably present.

2960 ± 120
Y-1908. San Lorenzo, SL-CC-L/D **1010 B.C.**

Charcoal from hearth in Level D of Central Court, Cut 1. San Lorenzo phase. Coll. 1967 by R. A. Diehl and subm. by M. D. Coe.

3090 ± 80
Y-1911. San Lorenzo, SL-Mon. 30-1d **1140 B.C.**

Charcoal from hearth at top of Floor 7, Zone D, Cut 1, Monument 30 excavations. This zone predates setting of monument (plain stela) and contains Chicharras phase pottery. Coll. 1967 and subm. by M. D. Coe.

3070 ± 80
Y-1912. San Lorenzo, SL-Mon. 30-2d **1120 B.C.**

Charcoal from hearth at 1.66 m below datum, within Zone D, Cut 2, Monument 30 excavations. Chicharras phase. Coll. 1967 and subm. by M. D. Coe.

3260 ± 120
Y-1933. San Lorenzo, SL-Mon. 30-1r **1310 B.C.**

Charcoal from dark sand layer (Zone Q) of Cut 1, Mon. 30 excavations. Bajío phase. Coll. 1967 and subm. by M. D. Coe.

4210 ± 100
Y-1931. San Lorenzo, SL-Mon. 23-2i **2260 B.C.**

Charcoal from various concentrations in Zone I, Cut 2, Monument 23 excavations. Some wood id. as palm. Chicharras phase. Coll. 1967 and subm. by M. D. Coe. Date is too old, and inconsistent with other dates in series.

Y-1934. San Lorenzo, SL-NW-M.I-3-Zone C **2980 ± 100**
1030 B.C.

Charcoal from just above bright red clay fill of Zone D in Mound B2-1 excavations. San Lorenzo phase. Coll. 1967 by P. Krotser and subm. by M. D. Coe. Sample should date beginning of construction on this temple substructure.

Y-1936. San Lorenzo, SL-PNW-St. IIkA **2980 ± 80**
1030 B.C.

Charcoal from wood id. as *Pinus ayacahuite* from Zone A in 2.75 to 2.90 m level of Stratigraphic Pit II. San Lorenzo phase. Coll. 1967 by P. Krotser and subm. by M. D. Coe.

Y-1937. San Lorenzo, SL-PNW-St. III A **2990 ± 70**
1040 B.C.

Charcoal from Zone A in 2.90 to 3.05 m level of Stratigraphic Pit II. San Lorenzo phase. Coll. 1967 by P. Krotser and subm. by M. D. Coe.

Y-1939. San Lorenzo, SL-PNW-St. IIn A **3090 ± 120**
1140 B.C.
$\delta C^{13} = -26.9‰$

Charcoal from Zone A in 3.20 to 3.35 m level of Stratigraphic Pit II. (PDB). San Lorenzo phase. Coll. 1967 by P. Krotser and subm. by M. D. Coe.

Y-2379. San Lorenzo **3210 ± 90**
1260 B.C.

Charcoal from concentrations in Zone A (dark sandy midden) in 6.50 to 7.40 level of stratigraphic Pit II. Bajío phase. Coll. 1967 by P. Krotser and subm. by M. D. Coe.

La Venta, Mexico

Y-2378. La Venta **1370 ± 80**
A.D. 580

Charcoal from probable sweatbath (*temascal*), Stirling Group, La Venta, Tabasco, Mexico (18° 10′ N Lat, 94° 05′ W Long). Coll. 1968 by R. F. Heizer and subm. by M. D. Coe. Feature is ring of stones, burned, covered by abundant charcoal. Another sample from same feature (UCLA-1350) was dated 1150 ± 80 yr B.P. Excavators believe that "sweatbath" is substantially later than Olmec occupation of site (Heizer *et al.*, 1968); dates suggest Early Classic.

Valley of Mexico

Tlatilco series, No. 1, Mexico

Charcoal from lenses in stratified refuse at Tlatilco, Mexico (19° 30′ N Lat, 99° 15′ W Long). From pit excavated on flats between Río Hondo and Río Totolica, ca. 100 m E of church of San Luís Tlatilco, in municipality of San Bartolo Naucalpan, NW suburb of Mexico City. Site is renowned for burial offerings, age and relationships of which are in dispute. Coll. 1963 by Paul Tolstoy and subm. by M. D. Coe.

2360 ± 120
Y-1626. Tlatilco Pit 2, Zone A **410 B.C.**

Sq. 2, 90 to 100 cm. Sample comes from near boundary between yellow loam containing Preclassic material and loose dark fill above it, of Tula date. It represents latest Preclassic in Pit 2 area and may, in fact, date Atoto subphase at Tlatilco. However, ceramic material is inadequate to distinguish possible thin occupation of this sub-phase from bulk of underlying Totolica refuse. It is impossible to demonstrate Atoto occupation anywhere in Pit 2 on purely cultural grounds.

2660 ± 50
Y-1627. Tlatilco Pit 2, Zone G-1 **710 B.C.**

Sq. 5, 160 to 170 cm. Charcoal-bearing surface separated by 10 to 20 cm of loam from that dated by Y-1629. Close in time to 1st of 3 minor flooding episodes at locality. Sample probably dates threshold of Totolica sub-phase.

2430 ± 60
Y-1628. Tlatilco Pit 2, Zone C **480 B.C.**

Sq. 3, 100 to 110 cm. Zone C is latest provenience unit seemingly free of disturbances due to Postclassic (Tula) activity at site. It contains evidence of 3rd and last flooding. Culturally, it marks close of Totolica, and perhaps beginning of Atoto sub-phase.

2760 ± 160
Y-1629. Tlatilco Pit 2, Zone H-1 **810 B.C.**

Sq. 6, 190 to 200 cm. Charcoal and burnt earth resting directly on clean sand. Sample probably represents end of Iglesia sub-phase.

General Comment (P.T.): relative age of samples of this series is consistent with their depth and stratigraphic position. Dates and cultural evidence alike support idea that known occupation refuse at Tlatilco is contemporaneous with La Pastora phase at El Arbolillo (roughly Vaillant's "Late El Arbolillo I" and continues into time range of latest or Cuautepec phase at that site (Vaillant's "El Arbolillo II"). This placement of Tlatilco refuse is somewhat earlier in time than that proposed initially by Tolstoy and Guénette (1965) on basis of second-hand study of El Arbolillo data. On ceramic grounds, Tolstoy believes that many or most Tlatilco graves are contemporaneous with refuse deposits and may date, from later part of refuse sequence (ca. 600 to 400 B.C.?). This does not mean that all distinctive or notorious peculiarities of Tlatilco burial furniture date from this time range. On the contrary, it is likely that some graves at Tlatilco are earlier and belong to Ayotla or Justo phase occupants (see below, Y-2353 and Y-2354), whose refuse remains to be found.

Lateness of Y-1628 and Y-1626 suggests that Late Preclassic Ticoman phases in Valley of Mexico may have been rather brief, perhaps spanning no more than 3 or 4 centuries preceding advent of Tzacualli phase at Teotihuacan.

Tlatilco series, no. 2, Mexico

Charcoal from concentrations assoc. with burials at Tlatilco, Mexico (19° 30′ N Lat, 99° 15′ W Long). Coll. 1963 by A. Romano and subm. by M. D. Coe.

Y-2380. Tlatilco **3180 ± 120**
1230 B.C.

Charcoal from Burial No. 74, Trench 36, Tlatilco IV excavations. Included in offering with this burial was one of pottery masks for which Tlatilco is noted.

Y-2381. Tlatilco **3090 ± 100**
1140 B.C.

Charcoal from Burial No. 80, Tlatilco IV excavations. This burial contained flat-bottomed bowl carved with Olmec hand-paw-wing motif, and thus should be contemporary with San Lorenzo phase on Gulf Coast. Date confirms this placement.

El Arbolillo East series, Mexico

Charcoal from stratified refuse in 5.4 m deep pit sunk on the lower slope of Cerro Chiquihuite, E of Ticoman–Cuautepec Rd., in El Arbolillo (19° 32′ N Lat, 99° 08′ W Long) or La Pastora, in municipality of Cuautepec. Pit is in vicinity of Vaillant's deepest cuts (G and B), and was dug in expectation (apparently fulfilled) of obtaining refuse comparable to earliest material found by Vaillant (1935). Designation "East" serves to distinguish this locality from one dug W of Ticoman-Cuautepec Rd., which provided materials of latest phase at El Arbolillo, Cuautepec phase. Coll. 1965 by Paul Tolstoy, and subm. by M. D. Coe.

Y-1924. El Arbolillo East, Sq. C **2670 ± 120**
720 B.C.

Charcoal from Pit 2, Sq. C, level 100 to 120 cm.

Y-1925. El Arbolillo East, Sq. A **2540 ± 140**
590 B.C.

Charcoal from Pit 2, Sq. A, level 160 to 180 cm.

Y-1927. El Arbolillo East, Sq. T **2590 ± 100**
640 B.C.

Charcoal from Pit 2, Sq. T, level 200 to 220 cm, to 80 cm NW of beginning of trench.

General Comment (P.T.): deposit in all cases is fairly loose dark soil containing extremely dense cultural refuse, mainly potsherds, ash, and charcoal. Stratigraphy and cultural criteria indicate that samples represent single phase, named La Pastora phase, and which probably corresponds to Vaillant's "Late El Arbolillo I."

Except for Y-1924, agreement between relative age and stratigraphic position is good. All dates probably apply to La Pastora phase. Therefore, initial or El Arbolillo phase at site is not dated directly. Yet, it is likely that entire occupation at site will be dated later than 1000 B.C. La Pastora phase itself probably lasts from ca. 750 B.C. to ca. 550 B.C.

Equations, both cultural and chronometric, between Tlatilco and El Arbolillo refuse columns support this dating. In addition, new evidence from Ayotla (Tlapacoya) (see below) places 1st emergence of El Arbolillo-like culture in Basin of Mexico at ca. 975/950 B.C., and implies that initial settlement of El Arbolillo itself (El Arbolillo phase; probably Vaillant's "Early El Arbolillo I" took place somewhat later (900/875 B.C.?).

Ayotla (Tlapacoya) series, Mexico

Charcoal from lenses in stratified refuse, from pit excavated on S edge of present village of Tlapacoya (18° 17′ N Lat, 98° 55′ W Long), at foot of hill of same name, some 20 km SE of Mexico City and E of toll rd. leading to Puebla. Location is *not* that of Late Preclassic pyramid reported in literature (Barba, 1956). Site, designated as Ayotla to differentiate it from site of later pyramid, has been known for some time as source of art objects of "Olmec" style. Excavations have revealed remarkable assemblage (Ayotla and Justo phases) which differs substantially from others described for Valley of Mexico. It is strikingly similar to so-called Olmec assemblages form outside Basin, both in nearby Morelos and further afield, in Veracruz (San Lorenzo) (Coe, Diehl, and Stuiver, 1967) and in Oaxaca (San Jose Mogote) (Flannery *et al.*, 1967). Coll. 1967 by Paul Tolstoy and subm. by M. D. Coe.

Y-2352. Ayotla site, Bomba phase **2980 ± 100** **1030 B.C.**

1.85 to 2.05 m depth. Yellow sandy stratum with ash and charcoal lenses. Phase marked by appearance for 1st time of features typical of later El Arbolillo pottery: composite-silhouette bowls, white ware with double-line-break motif incised on lip, C figurines, and other traits.

Y-2353. Ayotla site, Justo phase **2890 ± 80** **940 B.C.**

2.65 to 2.85 m depth. Bottom of yellow zone near boundary with clayey layer. Phase is "Olmec" in usual sense of term, characterized by such features as flat-based vessels, differentially-fired rims, excised white ware, and distinctive figurines.

Y-2354. Ayotla site, Ayotla phase **3020 ± 80** **1070 B.C.**

2.85 to 3.05 m depth. Dark clayey stratum with ash and charcoal. Ayotla phase forms continuum with Justo, but differs from it in relative popularity of certain types and attributes.

General Comment (P.T.): apparent inversion of Y-2352 and Y-2353 is of no great moment, in view of considerable overlap of dates in their 1σ ranges. Consideration of ranges in relation to stratigraphy, which is orderly and easily seen, suggests 975/950 B.C. as most acceptable boundary date between Justo and Bomba. Ayotla probably begins ca. 1150/1100 B.C., Justo ca. 1050 B.C. Ayotla and Justo phases appear older than any ceramic phases hitherto established for Valley of Mexico. This is confirmed by occurrence below Bomba remains, latter manifestly representing emergent stage of ceramic tradition which prevails at El Arbolillo. Finally, correspondence of our dates with those obtained for similar materials at San Lorenzo in Veracruz (Y-1798, -1801, -1800, -1797, -1802) and at San José Mogote in Oaxaca is remarkable. It not only reinforces dates obtained for Ayotla and Justo, but suggests intimate contacts between distant portions of Mesoamerica at early time level.

Teotihuacan series, Mexico

Charcoal samples from Teotihuacan, Mexico (19° 44′ N Lat, 98° 52′ W Long).

1620 ± 80
Y-1264. Teotihuacan, Burial 10 **A.D. 330**

Charcoal from inside vessel which accompanied Burial 10, Zacuala Palace. Coll. 1962 by L. Sejourné and subm. by M. D. Coe.

1660 ± 80
Y-1265. Teotihuacan, Burial 24 **A.D. 290**

Charcoal from inside vessel which accompanied Burial 24, Zacuala Palace. Coll. 1962 by L. Sejourné and subm. by M. D. Coe.

1790 ± 80
Y-1266. Teotihuacan, Offering 1 **A.D. 160**

Charcoal from inside frescoed vase placed in Offering 1, W side of Structure III (Quetzalpapálotl Palace). Coll. 1962 by J. Acosta and F. Muller and subm. by M. D. Coe.

General Comment (M.D.C.): these dates, which pertain to so-called Teotihuacan III period, are remarkably consistent with each other and with others already publ. for Classic Teotihuacan (Bernal, 1965). They suggest culmination of Teotihuacan culture was reached during A.D. 150 to 300 time span, although city continued to expand its residential zones thereafter, until its final destruction ca. A.D. 650.

San Felipe site series, Guatemala

Charcoal from stratified cultural deposits pertaining to 2 occupations at small site (15° 40′ N Lat, 89° 00′ W Long) in Dept. of Izabal. Earliest occupation defines San Felipe phase, typologically related to Late Formative period. Later occupation (Y-2418 and Y-2419 of this series) defines Santa Rosa phase of Late Classic period. Coll. 1967-68 and subm. by Barbara Voorhies, Yale Univ.

2090 ± 100
Y-2414. San Felipe phase **140 B.C.**

From Test Pit F, 2.05 to 2.20 m below Stake I. Scattered burnt branches.

2070 ± 100
Y-2415. San Felipe phase **120 B.C.**

From Test Pit F, 1.33 to 1.74 m below Stake I. Scattered burnt branches.

1970 ± 100
Y-2416. San Felipe phase **20 B.C.**

From Test Pit F, 0.90 to 1.00 m below Stake I. Scattered burnt branches.

2160 ± 100
Y-2417. San Felipe phase **210 B.C.**

From Test Pit B, 2.20 to 2.40 m below Stake O. Scattered burnt branches and intermixed carbonized corozo nuts.

1310 ± 100
Y-2418. Santa Rosa phase **A.D. 640**

From Md. II, Cut 8, 0.75 m below Stake X.

1430 ± 100
Y-2419. Santa Rosa phase **A.D. 520**

Md. II, Cut 6, 1.10 m below stake O′.

B. West Indies

Arroyo Del Palo series, Cuba

Charcoal from Arroyo del Palo site, ca. 5 km ESE of town of Mayari, Prov. of Oriente, Cuba 20° 38′ 42″ N Lat, 75° 38′ 45″ W Long). Coll. 1964 by E. Tabio and J. Guarch; subm. by J. Tabio, Acad. Sci., Cuba.

760 ± 60
Y-1555. Arroyo del Palo, 75 to 100 cm **A.D. 1190**

From Trench 2B, sec. B, under small ash lens overlying sterile yellowish clay. Assoc. with incised pottery; lithic industry mainly consisting of waste flint but with some knives, scrapers, and flakes; hematite and limonite "paint stones"; and 6 shell gouges.

970 ± 80
Y-1556. Arroyo del Palo, Cave 10 **A.D. 980**

From 25 cm depth, at Cave 10 on E bank of Arroyo del Palo. *Comment* (J.T.): typological grounds, cultural material corresponds with Ostionoid series.

Damajayabo series, Cuba

Charcoal and charred bones from Damajayabo, stratified site in E Cuba (19° 55′ N Lat, 75° 39′ W Long). Coll. by F. M. Arango; subm. by I. Rouse.

3250 ± 100
Y-1764. Damajayabo 1.34 m **1300 B.C.**

Charcoal from preceramic, Ciboney component, Period I, at depth 1.34 m in Trench 51.

1120 ± 160
Y-1994. Damajayabo 0.9 m **A.D. 830**

Charred bone from ceramic, Sub Taino component, Period IIIb, at depth 0.9 m, in Trench 55.

General Comment (I.R.): Y-1764 agrees with 3 comparable Period I dates from Dominican Republic: IVIC-5, 2450 B.C. (Radiocarbon, 1965, v. 7, p. 54), Tx-54, 2190 B.C. (Radiocarbon, 1964, v. 6, p. 158), and Y-1422, 2160 B.C., this date list. Date for Y-1994 corresponds nicely to comparable Y-1556, 980 A.D., this date list (Rivero de la Calle, 1966).

Y-206. Potrero Del Mango, Cuba **810 ± 80**
A.D. 1140

Charcoal from stump in Sec. Y-5, level 0.75 to 1.00 m, at bottom of Excavation 1, Potrero del Mango site (21° 2′ N Lat, 75° 41′ W Long), Banes, Oriente, Cuba. Assoc. with pottery of Bani style dating from Period IV. Coll. 1941 and subm. by I. Rouse (Rouse, 1942, p. 66-71). *Comment* (I.R.): date meets expectation.

White Marl series, Jamaica

Charcoal from 2 trenches dug in 1.5 m squares at White Marl site, village site in St. Catherine Parish, Jamaica (17° 55′ N Lat, 77° 3′ W Long). Coll. by R. R. Howard and subm. by J. Silverberg, Univ. of Wisconsin.

Y-1750. Trench A, 6′ N, Level I **460 ± 120**
A.D. 1490

Y-1753. Trench A, 6′ M, Level II **650 ± 60**
A.D. 1300

Y-1751. Trench A, 6′ N, Level V **760 ± 60**
A.D. 1190

Y-1754. Trench A, 6′ M, Level VII **720 ± 60**
A.D. 1230

Y-1785. Trench B, 13′ F, Level IV **650 ± 60**
A.D. 1300

Y-1784. Trench B, 13′ F, Level IX **820 ± 60**
A.D. 1130

Y-1755. Trench B, 13′ F, 1.5 m **600 ± 60**
A.D. 1350

Burial 2.

Y-1786. Trench B, 13′ G, 1.5 m **600 ± 60**
A.D. 1170

Burial 3.

780 ± 80
A.D. 650

Y-1897. Bottom Bay, Jamaica **1300 ± 120**
A.D. 650

Charcoal from Unit 6, Level II in Bottom Bay site (17° 52′ N Lat, 77° 34′ W Long), Jamaica. This yielded pottery of Little River style, dating from Period III (Rouse, 1964, fig. 5). Coll. 1966 by T. L. Vanderwal; subm. by I. Rouse. *Comment* (I.R.): Ostionoid pottery should date same as that of early Ostianes style in Puerto Rico (Y-1236, A.D. 710, Y-1242, A.D. 820, this date list). Its range overlaps theirs.

Y-1422. Mordan, Dominican Republic **4560 ± 80** **2610 B.C.**

Charcoal from 75 to 100 cm top, preceramic level at Mordan site, Prov. of Azva, Dominican Republic (18° 22′ N Lat, 71° 6′ W Long). Coll. by J. M. Cruxent, L. Chanlate, and E. Ortega; subm. by M. A. Tamers. *Comment*: interlab check: Tx-54 (4140 ± 130) (Radiocarbon, 1964, v. 6, p. 158) and IVIC-5 (4400 ± 170) (Radiocarbon, 1965, v. 7, p. 63). Sample represents 1st date on Meso-Indian complex in Dominican Republic.

Y-1850. Cueva Universitaria, Dominican Republic **1680 ± 100** **A.D. 270**

Charcoal from Cueva Univ. No. 1, Las Paredones (18° 28′ N Lat, 60° 42′ W Long), municipality of La Caleta, Dominican Republic. Assoc. with potsherds of indeterminate style and with carved stone beads and pendant. Coll. 1967 and subm. by I. Rouse. *Comment* (I.R.): sample was obtained to date new style of stone carving discovered in caves of Las Paredones; considerably earlier than expected.

Y-1896. La Romana, Dominican Republic **940 ± 80** **A.D. 1010**

Charcoal from lower layer in La Romana site at Caleta (18° 26′ N Lat, 68° 58′ W Long), municipality of La Romana, Dominican Republic. Assoc. with 1st Saladoid pottery found in Dominican Republic. Coll. 1966 by R. Alegria; subm. by I. Rouse. *Comment* (I.R.): pottery resembles that of Cuevas style in Puerto Rico; date was expected to be the same, but it is 500 yr later (cf. Y-1240 A.D. 510, this date list). Sample consisted of 2 small ones which had to be combined; possibly one was assoc. with upper layer of site, which should date ca. A.D. 1200.

Hacienda Grande series, Puerto Rico

Charcoal from Sec. D, Hacienda Grande site (18° 26′ N Lat, 65° 53′ W Long), Loiza, Puerto Rico. Coll. 1962 by I. Rouse and R. Alegria to date Hacienda Grande style of pottery, which is earliest in Puerto Rico (Period IIb).

Y-1232. Hacienda Grande, 0.50 to 0.75 m **1580 ± 80** **A.D. 370**

Y-1233. Hacienda Grande, 1.25 to 1.50 m **1830 ± 80** **A.D. 120**

General Comment (I.R.): dates fit nicely into our sequence for Saladoid movement into Antilles (Y-1337, this date list).

Cueva Maria la Cruz series, Puerto Rico

Charcoal from Sec. A, Cueva Maria la Cruz, (18° 26′ N Lat, 65° 53′ W Long), Loiza, Puerto Rico, Meso-Indian (Archaic) deposit, thought to date from Period IIb (Alegria, Nicholson, and Willey, 1955). Coll. 1962 by I. Rouse and R. Alegria; subm. by I. Rouse.

Y-1234. Cueva Maria la Cruz, 0.125 to 0.250 m — **1920 ± 120** — **A.D. 30**

Y-1235. Cueva Maria la Cruz, 0.500 to 0.625 m — **1910 ± 100** — **A.D. 40**

General Comment (I.R.): consistent with dates for Meso-Indian site of Krum Bay on neighboring island of St. Thomas (I-620, 225 B.C.; I-621, 450 B.C.; Bullen and Sleight, 1963, p. 41).

Monserrate series, Puerto Rico

Charcoal from Sec. A, Monserrate site (18° 23′ N Lat, 65° 45′ W Long), Luquillo, Puerto Rico. Coll. 1962 by I. Rouse and R. Alegria; subm. by I. Rouse.

1240 ± 80
Y-1236. Monserrate 0.75 to 1.00 m — **A.D. 710**

Assoc. pottery is of early Ostiones style and dates from Period IIIa.

1360 ± 80
Y-1237. Monserrate 1.50 to 1.75 m — **A.D. 590**

Assoc. pottery is of Cuevas style and dates from Period IIb.
General Comment (I.R.): dates are internally consistent and agree with others from Puerto Rico.

Santa Elena series, Puerto Rico

Charcoal from Sec. A, Santa Elena (18° 27′ N Lat, 66° 16′ W Long), Toa Baja, Puerto Rico. Coll. 1962 by I. Rouse and R. Alegria; subm. by I. Rouse.

740 ± 80
Y-1238. Santa Elena 0.15 to 0.25 m — **A.D. 1210**

Assoc. pottery is of Capa style and dates from Period IV.

1060 ± 80
Y-1239. Santa Elena 1.25 to 1.50 m — **A.D. 890**

Assoc. pottery is of Santa Elena style and dates from Period IIIb.
General Comment (I.R.): dates agree well with relative chronology for Santa Elena and Capa styles (Rouse, 1964, fig. 5).

1440 ± 80
Y-1240. Cuevas site, Puerto Rico — **A.D. 510**

Charcoal from Sec. C, level 1.25 to 1.50 m, Cuevas site (18° 21′ N Lat, 66° 1′ W Long), Trujillo Alto, Puerto Rico. Coll. 1962 by I. Rouse and R. Alegria to date Cuevas style pottery, Period IIb. *Comment* (I.R.): meets our expectations and agrees with other date for Cuevas style, Y-1237, 590 A.D., this date list.

Ostiones series, Puerto Rico

Charcoal from Sec. A, Ostiones site (18° 5′ N Lat, 67° 12′ W Long), Cabo Rojo, Puerto Rico. Coll. 1962 by I. Rouse and R. Alegria; subm. by I. Rouse to date Ostiones style pottery, Period III.

900 ± 80
Y-1241. Ostiones, 0.25 to 0.50 m **A.D. 1050**

1130 ± 80
Y-1242. Ostiones, 1.00 to 1.25 m **A.D. 820**

General Comment (I.R.): dates fit stratigraphy of site. It had been thought that Y-1241 would be slightly earlier.

700 ± 80
Y-1243. Cayito site, Puerto Rico **A.D. 1250**

Charcoal from Sec. B, level 0.25 to 0.50 m, Cayito site (17° 58′ N Lat, 66° 24′ W Long), Santa Isabel, Puerto Rico. Coll. 1962 by I. Rouse and R. Alegria; subm. by I. Rouse to date Boca Chica style, Period IV. *Comment* (I.R.): date agrees well with relative chronology (Rouse, 1964, fig. 5).

680 ± 80
Y-1244. Capá site, Puerto Rico **A.D. 1270**

Fragment of wooden post from excavation at ball court of Capá (18° 18′ N Lat, 66° 47′ W Long), Utuado, Puerto Rico. Pottery of Capá style, dating from Period IV. Coll. 1949 by R. Alegria; subm. by I. Rouse. *Comment* (I.R.): should be comparable to Y-1238 and Y-1243, this date list.

Morel series, Guadeloupe

Charcoal from Morel site (16° 20′ N Lat, 61° 19′ W Long), Guadeloupe. Coll. 1961 by E. Clerc; subm. by I. Rouse.

1400 ± 80
Y-1245. Morel, 1.50 m **A.D. 550**

From Sector 4, accompanied by Saladoid pottery of late Period IIb.

1100 ± 80
Y-1246. Morel, 0.20 to 0.30 m **A.D. 850**

From Sector 6, accompanied by coarse, post-Saladoid pottery, supposedly dating from Period III.

General Comment (I.R.): previous analyses from this site (Y-1136, Y-1137, Y-1138, Radiocarbon, 1963, v. 5, p. 336-337) dated 1st occupation of site; now Y-1245, above, dates 2nd and Y-1246, above, dates 3rd. Results are as expected.

Diamant site series, Martinique

Charcoal from Diamant site (14° 29′ N Lat, 61° 2′ W Long). Coll. by J. Pettijean-Roget, Soc. d'Hist. de la Martinique; subm. by R. Bullen through I. Rouse.

Y-1762. Diamant, 1.00 to 1.10 m **1490 ± 60 A.D. 460**

Assoc. with pottery of Period IIb.

Y-1763. Diamant, 0.56 m **>37,000**

Assoc. with pottery of Period IV.

General Comment (I.R.): Y-1762 of above series agrees with comparable Period IIb dates from Guadeloupe: Y-1136, A.D. 570 (Radiocarbon, 1963, v. 5, p. 336) and Y-1245, A.D. 550, this date list (Rouse and Cruxent, 1963). Date for Y-1763 is anomalous.

Y-1337. Grande Anse site, Martinique **1450 ± 80 A.D. 500**

Charcoal from level 0.50 to 0.80, Cut A, in Grande Anse site (14° 50′ N Lat, 61° 4′ W Long), Le Lorraine, Martinique, F.W.I. From upper part of refuse, underlying 50 cm sterile soil and assoc. with cross-hatched, Saladoid pottery of late Period IIb. Coll. 1962 by J. Pettijean-Roget; subm. by Irving Rouse. *Comment* (I.R.): agrees with other dates for Saladoid spread into Antilles (Rouse and Cruxent, 1963, p. 122) also Y-1245, Y-1232, Y-1237, this date list.

Y-1336. Lovers Retreat site, Tobago **1300 ± 120 A.D. 650**

Charcoal from level 0.80 to 0.90, Pit A, Lovers Retreat site (11° 13′ N Lat, 60° 45′ W Long), Tobago, W.I. This is lower of 2 occupations and is distinguished by Saladoid pottery of Mount Irvine style, dating from Period III. Sample from later occupation was too small to analyze. Coll. 1961 by G. Gilchrist; subm. by I. Rouse. *Comment* (I.R.): result as expected.

C. South America

Cartagena series, Colombia

Charcoal samples from sites in vicinity of Cartagena, Dept. del Bolivar, on W shore of Cienaga de Tesca lagoon (10° 27′ N Lat, 75° 30′ W Long). Coll. 1962 by H. Bischof; subm. by Irving Rouse. Canapote Shell Mound samples were from large stratified shell mound of early ceramic period. Several cultural periods were recognized in stratigraphical superposition and named, starting with oldest: Canapote, Tesca, Early Barlovento, Middle Barlovento, Late Barlovento (Bischof, 1966).

Y-1317. Canopote Shell Mound, 190 to 210 cm **3890 ± 100 1940 B.C.**

Cut A, Layer 10, 190 to 210 cm below surface. Scattered charcoal pieces in refuse layer. Dates later part of Canapote period. *Comment* (H.B.): below layer 10 are 60 cm refuse deposits containing Canapote pottery until sterile sand is reached at 270 cm depth. Tesca period sherds of types assoc. with Y-1760 of this series are found in this cut in Layer 4, 80 to 110 cm below surface.

Y-1760. Canopote Shell Mound, 250 to 300 cm **3730 ± 120**
1780 B.C.

Cut D, Layer 4, 250 to 300 cm below surface. Scattered charcoal pieces from refuse layer. Dates early part of Tesca period. *Comment* (H.B.): above Layer 4, Tesca period pottery is up to 30 cm below surface (Layers 2-3). Canapote period sherds of types assoc. with Y-1317 of this series are found in this cut, Layer 6, 340 to 360 cm below surface. Canapote pottery continues down to sterile clay at 440 cm depth.

Y-1318. Barlovento Shell Mound **3510 ± 100**
1560 B.C.

Site was tested in 1954 by Gerardo Reichel-Dolmatoff. Charcoal from charcoal lenses exposed by collapse of E profile of original excavation (Cut II, D-F, 150 cm below surface; Reichel-Dolmatoff, 1955). *Comment* (H.B.): coll. for comparison with shell-based USGS dates W-741 (2980 ± 120 B.P., Radiocarbon, 1960, v. 2, p. 180), W-743 (3140 ± 120, Radiocarbon, 1960, v. 2, p. 180), W-739, (3470 ± 120, Radiocarbon, 1960, v. 2, p. 180) which date Barlovento period at Barlovento site (Rubin and Alexander, 1960). Stratigraphically, Y-1318 of this series is more recent than W-743 (depth 300 cm) and contemporary to, or older than W-741 (depth 100 cm). In radiocarbon age, Y-1318 instead corresponds to W-739 (depth 600 cm). Discrepancy cannot be explained at present, but both USGS series, which is internally consistent, and Y-1760 seem to indicate that Y-1318 is too old a date for late Barlovento period. Dates seem to place Canapote period mainly before 1900 B.C., gradual transition to Tesca period in yrs between 1800 and 1900 B.C. and major part of Tesca period after 1800 B.C. Beginning of Barlovento period cannot be determined at present, but Early and Middle Barlovento should be older than 12-13th centuries B.C. Too little is known about cultural materials assoc. with W-739 to utilize it for dating any specific part of Barlovento sequence.

Y-1316. Crespo site **660 ± 80**
A.D. 1290

Charcoal from fill of pit of unknown function (well?), assoc. with Crespo sherds. *Comment* (H.B.): Crespo phase is related to Tierra Alta Ciénaga de Oro styles (Sinú Valley). Site has been described by A. Dussán de Reichel (1954).

Y-730. Las Mercedes, Colombia **1360 ± 120**
A.D. 590

Charcoal from 3.4 m below surface of thick cultural deposit at Las Mercedes site (9° 41′ N Lat, 74° 48′ W Long), on bank of Magdalena R., Zambrano, Dept. of Bolivar, Colombia. Sample was obtained from near base of long ceramic sequence showing important similarities (including rocker-stamping) to other Formative cultures in Mesoamerica (Reichel-Dolmatoff, 1965, p. 122-3). Coll. 1959 and subm. by Gerardo Reichel-Dolmatoff, Inst. Colombiano de Antropol. Two samples from higher levels in deposit Y-728 at .2 m depth and Y-729 (both unpubl.) at 2.4 m depth, consisted mainly of tar with age greater than 17,000 yr.

Y-732. Bucarelia, Colombia **990 ± 80**
A.D. 960

Charcoal from 1.00 m below surface at Bucarelia site (9° 41′ N Lat, 74° 48′ W Long), Zambrano, Dept. of Bolivar, Colombia. Coll. 1959 and subm. by Gerardo Reichel-Dolmatoff.

Y-1421. El Chao, Venezuela **540 ± 80**
A.D. 1410

Charcoal from Sec. B-10, 1.75 to 2.00 m below surface at El Chao site, Carache Valley, State of Trujillo, Venezuela (9° 36′ N Lat, 70° 15′ W Long). Coll. by E. Wagner; subm. by M. A. Tamers, Inst. Venezolano de Inv. Cient., Caracas, Venezuela. *Comment*: interlab check: Tx-189 (610 ± 95, Radiocarbon, 1965, v. 7, p. 296); and IVIC-62 (690 ± 110, Radiocarbon, 1965, v. 7, p. 59).

Y-1230. La Cucaracha, Venezuela **1600 ± 100**
A.D. 350

Charcoal from depth 0.65 m in test pit at La Cucaracha site (10° 38′ N Lat, 63° 15′ W Long), Carúpano, state of Sucre, Venezuela. Pottery is of El Mayal style, dating from Period IIb. Coll. 1960 by E. Wagner and J. M. Cruxent; subm. by I. Rouse. *Comment* (I.R.): date is not significantly different from Y-297, 1795 ± 80, (Science, 1957, v. 126, no. 3279, p. 908-919), for same style (Rouse and Cruxent, 1963).

Y-1231. Rio Guapo, Venezuela **1630 ± 100**
A.D. 320

Charcoal from refuse bed in bank of Rio Guapo, near Rio Chico (10° 17′ N Lat, 65° 58′ W Long) State of Miranda, Venezuela. It was accompanied by pottery of Rio Guapo style, Period IIb. Coll. 1960 by J. M. Cruxent; subm. by I. Rouse. *Comment* (I.R.): date agrees with others obtained for Period IIb pottery, e.g., Y-1230, above.

Cerro Iguanas series, Venezuela

Charcoal from Cerro Iguanas preceramic shell midden of Period I near Tucacas, state of Falcon, Venezuela (10° 45′ N Lat, 68° 19′ W Long).

Y-852. Cerro Iguanas, 1.75 to 2.00 m **5550 ± 100**
3600 B.C.

Coll. 1958 by J. M. Cruxent; subm. by I. Rouse.

Y-853. Cerro Iguanas, 1.75 to 2.00 m **5190 ± 120**
3240 B.C.

Coll. 1958 by J. M. Cruxent; subm. by I. Rouse.

Y-854. Cerro Iguanas, 3.00 to 3.25 m **5580 ± 160**
3630 B.C.

Coll. 1958 by J. M. Cruxent; subm. by I. Rouse.

Y-1247. Cerro Iguanas, 0.25 to 0.50 m **5540 ± 250**
3590 B.C.

Coll. 1962 and subm. by I. Rouse.

General Comment (I.R.): it had been hoped that Y-1247 would date transition from preceramic to ceramic occupation at top of site, but result is not significantly different from those obtained deeper in midden. Series extends Meso-Indian occupation of Venezuela 1500 yr back from previously known dates (Y-455, Radiocarbon, 1959, v. 1, p. 167).

Y-1199. Los Pozos, Venezuela **>41,000**

Charcoal from presumed Paleo-Indian hearth in excavation at Poz-600-S, Sec. L, depth 2.9 m, Los Pozos de royo Gomez, Taima Taima, state of Falcon, Venezuela (11° 28′ N Lat, 69° 32′ W Long). Coll. 1962 by J. M. Cruxent; subm. by I. Rouse. *Comment*: most likely coal and not charcoal.

Ancón series, Peru

Charcoal from Site PV45-84, Cut II, Level 2, at Ancón (11° 50′ 30″ S Lat, 77° 7′ W Long) Peru. Excavation covers 40 sq m in refuse deposit averaging 15.5 cm depth. Level 2 consists of all of refuse below upper 3 or 4 cm. Deposit consists of sand and gray ash containing abundant land snail shells, moderate numbers of sea shells, large quantities of charcoal, flakes, chips and cores, and a few fish bones and definite stone artifacts. Assemblage represents Luz complex. Coll. 1962 and subm. by E. Lanning, Columbia Univ.

Y-1303. Level 2 (1) **7380 ± 120**
5430 B.C.

Wood charcoal.

Y-1304. Level 2 (2) **6520 ± 120**
4570 B.C.

Tillandsia charcoal. *Comment*: dates confirm UCLA-202 (7140 ± 100) from same locality.

Y-1543. Early Shakimu complex, central Ucayali Basin, Peru **2600 ± 100**
650 B.C.

Site UCA-34, Jose's Hill (8° 15.5′ S Lat, 74° 39.5′ W Long), Perú. Charcoal, mainly burned palm kernels, from Feature 13, small gully cutting into side of hill, filled (probably intentionally to stop further erosion) with very rich midden containing quantities of Early Shakimu sherds and some nearly complete vessels of that complex. Early Shakimu midden here was capped with thin Hupa-iya occupation layer, and subsequently by very deep and rich midden of Yarinacocha complex, but there was no intrusion of materials from later occupations into Shakimu midden in feature. Yarinacocha complex occupation at site has been dated (Inst. of Phys. and Chem. Research of Tokyo, N-313) at 1860 ± 110 (A.D. 90) a date completely compatible with date on Early Shakimu, which shows considerable evidence of cultural relationship with Kotosh complex in Huánuco Basin (Izumi and Sono, 1963: especially Pls. 132: *9-11, 14*; 76: *4, 6, 14*). Coll. 1964 and subm. by D. Lathrap, Univ. of Illinois. (See Lathrap, 1968 for discussion of geomorphologic context of Central Ucayali sequence and Lathrap, 1958, 1962, and 1967 for further information on cultural content.)

Y-1544. Caimito complex, central Ucayali Basin, Peru **630 ± 60**
A.D. 1320

Charcoal, entirely from burned palm kernels, contained within inverted olla of Caimito complex, from Caimito site, TAM-2 (8° 51′ S Lat, 74° 20′ W Long). Date is in agreement with another date on Caimito complex materials from nearby site, TAM-1 (N-310) 575 ± 105 (A.D. 1375). Ceramics of Caimito complex are nearly identical to those of Napo phase as defined by Meggers (1966 Plates 72-6), and less closely related to Marajoara phase (Meggers and Evans, 1957). Caimito complex is intrusive into Central Ucayali Basin and has absolutely no antecedents there. Caimito dates are completely compatible with Napo dates (Evans and Meggers, 1962) since there is some evidence which suggests that Caimito materials should be slightly later than those on Río Napo in Ecuador. Coll. 1964 and subm. by D. Lathrap.

Y-1545. Cumancaya complex, central Ucayali Basin, Peru **1140 ± 80**
A.D. 810

Mixed charcoal from lowest layer of rectangular grave filled with several layers of smashed pottery of Cumancaya complex. Feature was encountered at Caimito site, TAM-2 (8° 51′ S Lat, 74° 20′ W Long), but not one sherd of Caimito complex ceramics (dominant component on site) occurred within this feature and Cumancaya sherds were not encountered elsewhere on site. Absolute absence of Caimito sherds in fill of pit suggests that pit was dug and refilled before any Caimito occupation had occurred in area, suggestion strongly supported by date. Cumancaya complex was 1st id. as cultural entity in 1956 (Lathrap, 1958) and was designated Corrugated Ware complex. Far more abundant materials from some sites studied in 1962 and 1964 have permitted sharper definition. Complex is characterized by several distinctive shapes and by all-over striated surfaces (what is usually called brushing but what in this case is almost certainly produced by split kernel of particular species of palm), all-over corrugated surfaces, and complex zoned bichrome designs emphasizing interlocking scroll and interlocking step-fret motifs. Total available evidence suggests that Cumancaya complex is intrusive into Central Ucayali Basin. Complex is closely related to Naneini complex of Alto Pachitea sequence which is also clearly intrusive into that area. Univ. of Pennsylvania date (P-996) 1264 ± 51 (A.D. 701) is compatible with Cumancaya date (Allen, 1968). Coll. 1964 and subm. by D. Lathrap. (See Lathrap, 1968 for discussion of geomorphologic context of Cumancaya complex.)

Y-1546. Transition between the Pangotsi and Nazaratequi complexes, Nazaratequi River, Alto Pachitea, Peru **2620 ± 100** **670 B.C.**

Charcoal from Levels 10 and 11, 2′ 3″ to 2′ 9″ of Cut D, Site PAC-14, Casa de la Tia, on Nazaratequi R. (10° 30′ S Lat, 74° 30′ W Long). Univ. of Pennsylvania Sample P-993 dates Level 13 of same cut, level containing greatest concentration of Pangotsi materials. Date of 3225 ± 68 (1275 B.C.) is thus indicated for midpoint in Pangotsi occupation here. P-995 dates charcoal from Levels 5 and 6 of same cut. Unfortunately, date 1346 ± 69 cannot be applied directly to Nazaratequi component here since levels involved contain considerable mechanical admixture of midden materials from ultimate occupation of site by people of Enoqui complex. Coll. 1964 by William L. Allen and subm. by D. Lathrap. (See Allen, 1968, for detailed discussion of ceramic complexes involved.)

Toquepala Cave series, Peru

Y-1325. Toquepala Cave **9580 ± 160** **7630 B.C.**

Charcoal taken from strata which appears to show 1st occupation of cave. This was extracted at depth 1.6 to 1.7 m, Toquepala, Peru (17.24 S Lat, 70.25 W Long). Coll. and subm. by E. G. Garcia, Peru Copper Corp.

Y-1372. Toquepala Cave **9490 ± 140** **7540 B.C.**

Charcoal from slightly lower level than Y-1325, evidently assoc. with same occupation. Coll. and subm. by E. G. Garcia.

Tafi Del Valle series, Argentina

Charcoal from 2 sites at Tafi del Valle, Province of Tucuman, Argentina (27° S Lat, 66° W Long). Coll. with objective of dating earliest horizons of pottery making in Argentinian NW archaeologic area. Coll. and subm. 1960 by A. Rex Gonzalez, Univ. of La Plata.

Y-888. El Mollar 2.22 m **2300 ± 70** **350 B.C.**

From Trench E. W. at depth 2.22 m in mound El Mollar. Assoc. with crude pottery of Tafi type and red plain ware. Sample dates Tafi culture. Few intrusive sherds of Condorhuasi Polychrome style are present in mound.

Y-889. El Mollar 2.3 to 2.9 m **1960 ± 60** **10 B.C.**

Same as above, but from depth 2.3 to 2.9 m, under big blocks of rock.

Y-890. Room 4. S4 (Km. 64) **1380 ± 70** **A.D. 570**

Also belonging to Tafi culture but with intrusive pottery of Later Candelaria style. Sites and results are discussed by Gonzales and Nunez

Requeiro (1962) and by Gonzales (1960-1962 and 1961-1964). Samples Y-888 and Y-890 were run in 1 counter, Y-889 in counter designed later. As both counters gave reliable results over long time interval there is no basis for Gonzales' assumption that change in equipment has influenced dates.

D. Europe

Mallorca series, Spain

All samples were coll. and subm. by J. S. Kopper and W. Waldren, Deya Archaeol. Mus. Mallorca, Spain (J. S. Kopper and W. Waldren, 1967; Bordoy, Waldren, and Kopper, 1968).

3790 ± 80
Y-1789. Mallorca, Cueva de los Muertos 1840 B.C.

Charcoal from 100 cm depth (Beaker pottery level) Parapit of entrance, Cueva de los Muertos (39° 44′ 25″ N Lat, 2° 35′ 32″ E Long) Mallorca, Spain. Culture Pre-Talayotic, Beaker (Reflux) burial.

2230 ± 100
Y-1859. Mallorca, Cueva de los Muertos 280 B.C.

Charred human bones from cremation pit assumed Post-Talayotic. Right center assoc. with Ceramics "E", from 50 cm depth, Cueva de los Muertos (39° 44′ 25″ N Lat, 2° 35′ 32″ E Long), Mallorca, Spain. Culture Post-Talayotic, burial.

2180 ± 80
Y-1791. Mallorca, Cueva de son Puig 230 B.C.

Bone fragments from 100 cm depth, rear center, Cueva de son Puig, (39° 41′ 56″ N Lat, 2° 38′ 28″ E Long).

2960 ± 80
Y-1856. Mallorca, Figueral de son Real West 1010 B.C.

Charcoal from Monumento de son Real, W, Naveta: Edifice, Mallorca, Spain (39° 43′ 50″ N Lat, 3° 11′ 18″ E Long), Culture Talayotic, habitation refuse.

2920 ± 80
Y-1857. Mallorca, Figueral de son Real, Inferior 970 B.C.

Charcoal from Monumento de son Real, Inferior, Naveta Central, Mallorca, Spain (30° 43′ 50″ N Lat, 3° 11′ 18″ E Long), Culture Talayotic, habitation refuse.

Y-1858. Mallorca, Figural de son Real, 990 ± 80
Intermediate A.D. 960

Charcoal from Monumento de son Real, Intermediate, outside grade, Mallorca, Spain. Culture Moorish, habitation refuse.

3470 ± 120
Y-1824. Mallorca, Cueva de son Marroig 1520 B.C.

Bone fragments from Burial area 30 cm depth, Cueva de son Marroig (39° 44′ 25″ N Lat, 2° 35′ 32″ E Long), Mallorca, Spain. Culture Pre-Talayotic, burial.

Y-2359. Muleta Cave **2910 ± 120**
960 B.C.

Charred bone from kitchen fire in lowest human habitational stratum, Muleta Cave, Deya, Mallorca, Spain (39° 47′ 15″ N Lat, 2° 40′ 10″ E Long). Subm. by J. S. Kopper and W. Waldren. Culture Pre-Talayotic, habitation refuse.

E. Asia

Y-1851. Non Nok Tha, Thailand **3170 ± 200**
1220 B.C.

Charcoal from Non nok tha site, small mound, near village of Ban Nadi, ca. 80 km NW of Khon Kaen, Thailand (ca. 16° 25′ N Lat, 102° 20′ E Long). Site contains evidence of several stratified layers, of which 20 were studied through test excavations. Eight layers show unequivocal evidence of bronze working, below 12 other layers in which both bronze and iron are present. Sample came from disturbed area in Layer 20, and may belong to Layer 17 or 18. Coll. 1965 by W. Solheim II, Hamilton Parker, and Donn Bayard, and subm. by W. Solheim II, Univ. of Hawaii (Solheim, 1967 a,b,c; 1968; Solheim and Gorman, 1966).

Ryukyu Islands series, Japan

Shell and bone from sites in Ryukyu Islands, between Japan and Formosa (Pearson, 1967; Pearson, R., The archaeology of the Ryukyu Islands: a regional chronology from 3000 B.C. to the Historic period: Univ. of Hawaii Press, in press).

Y-1681. Ryukyu Islands, Yashima shell mound 69 to 76 cm **2660 ± 80**
710 B.C.

Shells from 69 to 76 cm depth, Layer 10, Yashima shell mound, Kamahara, Okinawa (26° 18′ N Lat, 127° 45′ E Long). Coll. and subm. by R. Pearson, Univ. of Hawaii. Jomon culture, Yashima phase, earliest ceramic phase in Okinawa.

Y-1682. Ryukyu Islands, Hirota burial site **1470 ± 80**
A.D. 480

Bones from lower layer, Tanegashima, Hirota burial site (30° 25′ N Lat, 130° 58′ W Long). Coll. 1959 by N. Kokubu and M. Nagai; subm. by R. Pearson. Early Yayoi, date too recent when compared with ceramic sequence.

Y-1697. Ryukyu Islands, Funaura shell mound 61 cm **940 ± 60**
A.D. 1010

Shell from 61 cm depth from test trench, Funaura shell mound in W Iriomote (24° 24′ N Lat, 123° 48′ W Long). Apparently non-ceramic. Coll. and subm. by Richard Pearson.

Y-1698. Ryukyu Islands, Aguni shell mound 84 cm **2710 ± 80**
760 B.C.

Shell from 84 cm depth, Aguni shell mound, Aguni I., Kerama

Islands. Jomon culture, Yashima phase (26° 35′ N Lat, 127° 13′ W Long). Coll. and subm. by R. Pearson.

Y-1716. Ryukyu Islands, Garabi Go cave 12 to 25 cm **1190 ± 60 A.D. 760**

Shell from 12 to 25 cm depth, Garabi Go cave, Arakawa, Okinawa (26° 8′ N Lat, 127° 45′ W Long). Noguni phase, ceramic proto-historic culture with iron agricultural tools, reef-adapted. Coll. and subm. by R. Pearson.

Yüanshan Shellmound series, Taiwan, (Formosa)

Yüanshan shell mound is located in N part of Taipei city, Taiwan (Formosa) (25° 4′ 30″ N Lat, 121° 30′ 42″ E Long), and was excavated in Sept. 1964 under direction of W. H. Sung and K. C. Chang. Description and discussion of excavated material was given by Sung and Chang, (1964) and Chang and Stuiver (1966). Materials suitable for C^{14} measurements were available only from layers representing Yüanshan culture. Yüanshan cultural materials postdate Corded Ware phase of same site.

Y-1549. Yüanshan 40 cm **3190 ± 80 1240 B.C.**

Shells (*Corbicula subsulcate*) or (*Corbicula maxima*).

Y-1548. Yüanshan 120 cm **3540 ± 80 1590 B.C.**

Shells, same species as Y-1549.

Y-1547. Yüanshan 200 cm **3860 ± 80 1910 B.C.**

Shells, same species as Y-1549.

Tapenkeng series, Taiwan, Formosa

Charcoal from Tapenkeng, stratified site 20 km NW of Taipei city, Taiwan, (Formosa) (25° 9′ 14″ N Lat, 121° 24′ 28″ E Long). Coll. and subm. 1964 by K. C. Chang, Yale Univ. Both Yüanshan (upper) and Corded Ware (lower) cultural phases are represented at site.

Y-1497. Tapenkeng 3 and 4 **890 ± 80 A.D. 1060**

From undisturbed Corded Ware stratum.

Y-1498. Tapenkeng 5, 6, and 7 **2030 ± 80 80 B.C.**

From near kiln or hearth of Yüanshan phase.

Y-1551. Tapenkeng 11 **2850 ± 200 900 B.C.**

From 1.42 m depth, bottom of main Yüanshan cultural phase of site.

Y-1552. Tapenkeng 9, 10, and 12 **19,670 ± 450 17,720 B.C.**

Coal contamination probable.

20,380 ± 400
Y-1553. Tapenkeng 15 and 17 **18,430 B.C.**
Coal contamination probable.

3080 ± 350
Y-1496. Tapenkeng 13 **1130 B.C.**
From bottom of Corded Ware phase.

Fantzuyüan, Taiwan (Formosa)

1100 ± 80
Y-1499. Fantzuyüan **A.D. 850**

Oyster shells from Fantzuyüan E of Tachia, Taichung (24° 21′ 35″ N Lat, 120° 39′ E Long). Coll. 1961 by W. H. Sung; subm. by K. C. Chang. Black Pottery culture.

Yingpu series, Taiwan (Formosa)

Charcoal from Yingpu, near Tatu, Taichung (24° 8′ 30″ N Lat, 120° 32′ 0″ E Long). Coll. 1964 by W. H. Sung and K. C. Chang; subm. by K. C. Chang. Black Pottery culture.

2970 ± 80
Y-1630. Yingpu 1 and 2 **1020 B.C.**
From 110 cm depth.

2810 ± 100
Y-1631. Yingpu 3 **860 B.C.**

2250 ± 60
Y-1632. Yingpu 4 **300 B.C.**

Fengpitou series, Taiwan (Formosa)

Fengpitou site is located 14 km SE of Kaohsiung, SW Taiwan (Formosa) (22° 31′ 45″ N Lat, 120° 21′ 38″ E Long). Coll. 1965 by and subm. by K. C. Chang. Two cultures, earlier Corded Ware culture, and upper layer Lungshanoid. Materials suitable for C^{14} measurements were available only from Lungshanoid layers.

2440 ± 100
Y-1577. Fengpitou 1 **490 B.C.**
Shells.

2780 ± 80
Y-1578. Fengpitou 2 **830 B.C.**
Shells.

3310 ± 80
Y-1580. Fengpitou 4 **1360 B.C.**
Shells from lower stratum of Sec. V.

2910 ± 80
Y-1581. Fengpitou 5 **960 B.C.**
Shells from upper stratum of Sec. V.

Y-1584. Fengpitou 8 **2670 ± 80**
720 B.C.

Shells from lower stratum in K area, below Y-1577.

Y-1600. Fengpitou **1380 ± 160**
A.D. 570

Charcoal from Black Pottery-Painted Pottery horizon.

Y-1601. Fengpitou 11 **Modern**

Wood, thought to be remains of house post.

Y-1648. Fengpitou 13 **2670 ± 60**
720 B.C.

Shells.

Y-1649. Fengpitou 14 **2900 ± 120**
950 B.C.

Shells.

Kiowa Rock Shelter series, New Guinea

Charcoal samples from Kiowa Rock Shelter, near Chuave, Chimbu dist., Territory of Papua and New Guinea (6° 6′ S Lat, 145° 9′ E Long). Coll. 1960 by S. E. Bulmer; subm. by H. M. Van Deusen, Am. Mus. of Nat. History (Bulmer, 1964).

Y-1366. Layer 12 442 cm **10,350 ± 140**
8400 B.C.

Charcoal from Layer 12, 442 cm below surface.

Y-1367. Layer 10 366 cm **9300 ± 200**
7350 B.C.

Ash and charcoal S face, Layer 10, 366 cm below surface.

Y-1368. Layer 10 305 cm **9920 ± 200**
7970 B.C.

Ash and charcoal from fireplace at top of Layer 10, E extension, 305 cm below surface.

Y-1370. Layer 6 152 cm **6100 ± 160**
4150 B.C.

Ash and charcoal from fireplace at top of Layer 6, 152 cm below surface.

Y-1371. Layer 3 91 cm **4840 ± 140**
2890 B.C.

Ash and charcoal from fireplace in Layer 3, 91 cm below surface.

F. Africa

Kom Ombo series, Egypt

Charcoal and shell from Kom Ombo Plain, ca. 10 km N of Kom Ombo, Upper Egypt (24° 35′ N Lat, 32° 58′ E Long). Coll. 1963 by M. A. Baumhoff, Univ. of California, Davis; subm. by C. A. Reed. (See Reed *et al.*, 1967 for details).

Y-1375. Unit J-11, Sebilian area **13,070 ± 160**
11,120 B.C.

Charcoal from 45 to 60 m depth, Unit J-11, Gebel Silsila 2B site. Gebel Silsila Formation. This sample dates layer assoc. with Sebilian cultural artifacts.

Y-1376. Microlithic area **15,310 ± 200**
13,360 B.C.

Charcoal from 30 cm depth, Microlithic Area, Gebel Silsila 2B site. Gebel Silsila Formation. Sample found together with Sebilian flint industry (Microliths).

Butzer and Hansen, 1968, p. 175, 177, believe that level and artifacts represented are younger, not older, than levels and artifacts representative of Y-1375 and Y-1447.

Y-1447. Unit K-9, Sebilian area **13,560 ± 120**
11,610 B.C.

Shells of fresh-water clam (*Unio willcocksii*) from 46 to 60 cm depth, Sq. K-9, Gebel Silsila 2B site. Gebel Silsila Formation. Sebilian type artifacts are assoc. with same layer.

Catfish Cave series, Egypt

Charcoal samples from sediment deposited by Nile R. and its tributary Khor el Aquiba in S Egypt (22° 43′ N Lat, 32° 07′ E Long). Coll. by W. E. Wendt and subm. by R. Giegengack, 1965 (Wendt, 1966).

Y-1646. Catfish Cave **7060 ± 120**
5110 B.C.

Charcoal from unit directly overlying deposit of Nile silt which contained several barbed bone points. Elev. +130.3 m.

Y-1680. Catfish Cave **4830 ± 80**
2880 B.C.

Charcoal and small twigs from sandy deposit directly overlying unit from which Y-1646 was coll. Elev. +130.8 m.

Arminna West series, United Arab Republic

Charcoal from village site excavated at Arminna W (22° 57′ N Lat, 31° 50′ E Long), in Egyptian Nubia, United Arab Republic. Subm. by W. Simpson, Yale Univ.

Y-1313. Room 36 **1700 ± 80**
A.D. 250

Sample consists of charcoal from small twigs of acacia of tamarisk taken from interior of pottery vessel in floor in NW corner of Room 36, House "X", at Arminna W. House was dated to Late Ballana period (ca. A.D. 500) (Trigger, 1966).

Y-1314. Room 1 **2020 ± 80**
70 B.C.

Assoc. with culture transitional between Merotic and Ballana phases, dating approx. to 3rd century A.D.

Natchabiet Cave series, Ethiopia

Charcoal from Natchabiet Cave located in escarpment near small locality known as Gubsiweit Mariam, province of Begemeder, Ethiopia (ca. 13° 45′ N Lat, 37° 40′ E Long). Cave site contains 2 major occupations separated by period of rock fall. Upper occupation is Iron age, and lower, Late Stone age. Coll. and subm. by Joanne Dombrowski, Boston Univ. (Dombrowski, Ph.D. Thesis in preparation: Boston Univ., Boston, Mass.).

550 ± 120
Y-2365. Natchabiet 23 cm A.D. 1400

Found in E face of Sq. Z-3, 25 to 30 cm from N face. Top of upper occupation.

660 ± 80
Y-2366. Natchabiet 22 cm A.D. 1290

Found 20 cm from N face of Sq. Z-4, 7 cm from W face, 8 cm above 2 iron blade fragments. Upper occupation.

840 ± 100
Y-2368. Natchabiet 55 to 59 cm A.D. 1110

Found 42 to 65 cm from E face of Sq. A-7, 10 to 30 cm from S face, 10 cm below iron point. Bottom of upper occupation.

2030 ± 80
Y-2367. Natchabiet 106 to 110 cm 80 B.C.

Found 25 to 28 cm from E face of Sq. Z-6, 23 to 29 cm from S face. Lower occupation, containing pottery and crude stone tools.

130 ± 80
Y-1394. Bweyorere site, Uganda A.D. 1820

Charcoal from old ground level beneath bank of superimposed village site, at Bweyorere site, Isingiro Co. of Ankole, Uganda (0° 44′ S Lat, 30° 47′ 30″ E Long). Sample assoc. in occupation layer with pottery and bones. Coll. 1958 and subm. by M. Posnansky as part of Uganda Iron age Project of the Uganda Mus. *Comment* (M.P.): site clearly ascribed by traditions to 17th/18th century, date acceptable. (For details, see Posnansky 1961, 1962, and 1967.)

"Sirikwa Holes" series, Muringa, Moiben, Kenya

Charcoal, perhaps burnt wall posts, from floor of houses attached to stone-lines "Sirikwa Holes" (0° 50′ N Lat, 35° 24′ E Long). Charcoal was between upper layer of brown loam and natural weathered lava. Samples should be contemporary. At Muringa and elsewhere in W highlands of Kenya, Sutton has obtained evidence of late Iron-age date for "Sirikwa holes" and oral and cultural information indicate that they were constructed by Kalenjin peoples in centuries preceding 19th. Questions of their makers, date, and purpose are discussed by Sutton (1965, 1966). Compare Y-570 from Lanet, Kenya, yielding date of 370 ± 100 B.P. for ground surface below earthwork assoc. with "Sirikwa holes."

Coll. and subm. 1964 by J. E. G. Sutton, formerly British Inst. of Hist. and Archaeol. in E Africa, now Univ. College, Dar-es-Salaam.

Y-1395. Muringa, Sirikwa Hole 1 **300 ± 80** **A.D. 1650**

Charcoal from 46 cm depth.

Y-1396. Muringa, Sirikwa Hole 2 **300 ± 60** **A.D. 1650**

Charcoal from 24 cm depth.

Tunnel rock-shelter series, Fort Ternan, Kenya

Cutting excavated in 1963 in this rock shelter (0° 14′ S Lat, 35° 21′ E Long) revealed layers of stony and ashy soil to total depth 1.6 m, containing fairly homogeneous Late Stone age industry of obsidian with both Wilton and derived Capsian features, cattle bones, and some Kenya Highlands Class A pottery (Sutton, 1966). Other dates in 1st millennium B.C. were obtained from Njoro R. Cave (Y-91) (Leaky, 1950), Prospect Farm, Elmenteita (UCLA-1234) and Ngorongoro (GX-1234) (Sassoon, 1968).

Y-1397. Tunnel rock shelter, Cutting 2, Layer 5 **2050 ± 60** **100 B.C.**

Charcoal from 51 cm depth.

Y-1398. Tunnel rock shelter, Cutting 2, Layer 10 (upper) **2730 ± 60** **780 B.C.**

Charcoal from 104 cm depth.

Castle Cavern series, Swaziland

Charcoal from Castle Cavern, Iron age site at Ngwenya, Swaziland (31° 2′ E Long, 26° 12′ 30″ S Lat). Coll. and subm. by P. B. Beaumont, Univ. of Witwatersrand. For discussion of sample results, see Dart (1967) and Dart and Bequmont (1968).

Y-1995. Castle Cavern 30 to 60 cm **1430 ± 100** **A.D. 520**

From well-defined hearths in upper levels of 150 cm thick Iron age deposit, overlying worked specularite-rich hematite bedrock.

Y-1712. Castle Cavern 120 to 132 cm **1550 ± 60** **A.D. 400**

From well-defined and undisturbed hearth in basal levels of deposit and overlying floor of quarry cut into hematite hillside along 30 m wide face. Assoc. are stone mining tools and sherds. *Comment* (P.B.B.): these are earliest known dates for Iron age S of Limpopo, predating Melville Koppies, Johannesburg (Y-1323B) by ca. 600 yr and Loolekop, Palabora by ca. 300 yr (Y-1636). They tend to favor hypothesis that 1st Iron age peoples in region were of Bush-Boskop type. They also indicate that Later Stone age and Iron age overlapped considerably. Very friable, course sherds occurred abundantly throughout deposit. Some show carinated profiles. Dominant decoration patterns are single and multiple channelled lines parallel to immediately below rim. Also present were stone mining tools of various types, rare, extremely rusted iron fragments, and few Later Stone age flakes and scrapers.

Y-1829. Castle Quarry, Swaziland **3970 ± 120** **2020 B.C.**

Charcoal from infilled hematite quarry on N face of Castle Peak, Ngwenya, Swaziland (31° 2′ E Long, 26° 12′ 30″ S Lat). Up to 180 cm of deposit overlay bedrock. Assemblage consisted mainly of stone mining tools. Also recovered were typical Later Stone age cores and flakes and some ground stone objects including armband fragments, spearhead and chopper, bead, bored-stone, various fragments of unknown function, and upper and lower grindstones for reducing hematite to powder. Depth of sample, 91 to 152 cm. Coll. and subm. by P. B. Beaumont. For discussion of sample results, see Dart and Beaumont (1968).

Lion Cavern series, Swaziland

Charcoal from Lion Cavern, stratified ancient working at Ngwenya, Swaziland (31° 2′ E Long, 26° 12′ S Lat). Coll. and subm. by P. B. Beaumont. For discussion of sample results see Dart (1967), Dart and Beaumont (1967), and Boshier (1965).

Y-1713. Lion Cavern 213 to 244 cm **9640 ± 80** **7690 B.C.**

From ash zones immediately overlying worked bedrock of hematite in Strip E and F. Assoc. with small number of indeterminate stone artifacts.

Y-1827. Lion Cavern 250 to 295 cm **22,280 ± 400** **20,330 B.C.**

From hearth levels 25 cm above worked specularite-rich hematite bedrock in Strips B and C. Some stone mining tools assoc. and many thousands of implements belonging to middle stage of Middle Stone age. *Comment* (P.B.B.): evidence indicates mining with specific tools was in progress at Lion Cavern over 20 millennia ago, making site oldest known carbon dated working in world.

Y-1714. Banda Cave, Swaziland **5890 ± 80** **3940 B.C.**

Charcoal from thin ash lenses in Stratum 2, Banda Cave, Nqwenya, Swaziland (31° 2′ E Long, 26° 12′ S Lat). Depth of sample, 20 to 30 cm. Level yielded very fragmented bone and rich early Later Stone age assemblage. Coll. and subm. by P. B. Beaumont. For discussion of sample results, see Dart and Beaumont (1968).

Welgelegen Cave series, Eastern Transvaal

Charcoal and bone from Welgelegen Cave, near Ermelo, Transvaal (30° 6′ E Long, 26° 22′ S Lat). Coll. and subm. by P. B. Beaumont.

Y-1997. Welgelegen 15 to 30 cm **Recent**

Bone fragments assoc. with rich Iron age assemblage. Pottery is similar to that from vast stone-walled settlement sites near Ngwenya. Swazi ascribe them to people they displaced, Sotho.

740 ± 80
Y-1828. Welgelegen 23 to 46 cm A.D. 1210

Charcoal from thin hearth levels. Assoc. are potsherds, various iron tools, copper hairpin, and ostrich egg shell beads. Few of sherds show bichrome burnishing and or incised decoration. Truncated cowry shells indicate trade links with Indian Ocean, over 150 mi away. Abundant animal remains consist preponderantly of many antelope species and freshwater mussels; birds and fish also occur. Domesticated animals are represented by ox.

9370 ± 160
Y-1996. Mlaula shelter, Swaziland 7420 B.C.

Bone fragments from lower levels of 90 cm thick Stone age stratum which overlies bedrock and underlies 30 cm thick normal Later Stone age stratum, at Mlaula shelter, ca. 4 mi SW of Mlaula, in Lebombo Mts., Swaziland (32° 2′ E Long, 26° 12′ 30″ S Lat). Depth of sample, 81 to 102 cm. Assoc. is assemblage consisting almost entirely of unfaceted irregular flakes and large ostrich eggshell beads. Coll. and subm. by P. B. Beaumont.

3590 ± 120
Y-1998. Emambent shelter, Swaziland 1640 B.C.

Bone fragments from middle-lower levels of 75 cm thick stratum in small shelter ca. 9 mi SW of Mbabane, Swaziland (31° 3′ E Long, 26° 26′ S Lat). Assoc. is rich assemblage ascribed to middle stage of Later Stone age and much fragmented bone.

Palabora series, South Africa

Palabora (23° 55′ S Lat, 31° 10′ E Long), ca. 100 km E of Tzaneen, NE Transvaal, was large center of metal production of Iron age in S Africa. Archaeologic features include extensive mine shafts and galleries at Loolekop (iron and copper ore), habitation sites on hillside terraces, and several hundred smelting sites. Excavations were carried out by R. J. Mason in 1964 (Mason, 1965; also see Radiocarbon, 1967, v. 9, p. 107-155) and by N. J. van der Merwe in 1965 (Stuiver and van der Merwe, 1968). Y-1766, Y-1767, and Y-1769 coll. and subm. by R. J. Mason, Univ. of Witwatersrand; rest by N. J. van der Merwe and M. Stuiver.

950 ± 60
Y-1635. Loolekop Mine Shaft 1 A.D. 1000

Charcoal from mine shaft, 21.4 m deep, at Loolekop, ca. 4 km SW of Palabora. *Comment*: shaft, narrow trench ca. 15.3 m long at top and 21.4 m deep in middle, was completely revealed in cross section as result of blasting in course of modern mining activities. Sample from deepest part of shaft within hrs after blasting took place. C^{14} age agrees well with ages of Y-1636-1639 and Y-1662; these measurements are oldest known dates for Iron age in S Africa.

1180 ± 80
Y-1636. Loolekop Mine Shaft 2 **A.D. 770**

Charcoal from gallery at bottom of mine shaft, 6.1 m deep, at Loolekop, Palabora. *Comment*: charcoal came from extensive charcoal deposit (probably result of fire setting) on floor of horizontal gallery, some 6.1 m long at bottom of shaft; coll. was accomplished in same manner as for Y-1635. Oldest known date for Iron age in S Africa.

910 ± 60
Y-1637. Kgopolwe III, Lower Floor 1 **A.D. 1040**

Charcoal from surface of clay floor of earlier occupation at Kgopolwe, ca. 3 km N of Palabora, Site SPK-III (SPK-III/A: 52.5 to 60 cm below datum). *Comment*: clay floor, part of hut and living area, was stratified below floor of later occupation (Y-1639, Y-1662). Date is consistent with Y-1638, from same floor, and with dates for upper floor.

990 ± 80
Y-1638. Kgopolwe III, Lower Floor 2 **A.D. 960**

Charcoal from surface of clay floor of earlier occupation at Kgopolwe, Palabora, Site SPK-III (SPK-III/C:60 to 67.5 cm below datum). *Comment*: sample was taken from same floor as Y-1637, from different part of site. Consistent with Y-1637, Y-1639, and Y-1662.

850 ± 60
Y-1639. Kgopolwe III, Upper Floor 1 **A.D. 1100**

Charcoal from immediately below clay hut floor of later occupation at Kgopolwe, Palabora, Site SPK-III (SPK-III/D:53.7 cm below datum). *Comment*: clay floor beneath sample is of same type as for Y-1637 and Y-1638, and was stratified ca. 15 cm above it. Consistent with Y-1637, Y-1638, and Y-1662.

820 ± 80
Y-1662. Kgopolwe III, Upper Floor 2 **A.D. 1130**

Charcoal from surface of clay hut floor of later occupation at Kgopolwe, Palabora, Site SPK-III (SPK-III/CD:45 cm below datum). *Comment*: charcoal from surface of floor, beneath collapsed walls of hut, and dates end of later occupation at SPK-III. Consistent with Y-1637, Y-1638, and Y-1639.

280 ± 60
Y-1658. Kgopolwe IV, Iron Furnace 1 **A.D. 1670**

Charcoal from floor of iron furnace at Kgopolwe, Palabora, Site SPK-IV. *Comment*: sample represents last time iron was smelted in furnace.

520 ± 60
Y-1657. Kgopolwe IV, Iron Furnace 2 **A.D. 1430**

Charcoal in iron cinder slag, from slag heap surrounding furnace at Kgopolwe, Palabora, Site SPK-IV. *Comment*: slag sample, taken from deposit of some 50 tons, represents date during period of smelting operations at site. Consistent with Y-1658.

80 ± 60
Y-1660. Matsepe iron furnace **A.D. 1870**

Charcoal in iron cinder slag, from small deposit around iron bloom furnace at Matsepe, ca. 5 km W of Palabora. *Comment*: furnace was still standing on surface, one of a number of similar sites.

60 ± 120
Y-1661. Molotho copper furnace **A.D. 1890**

Charcoal in copper cinder slag, from small deposit around copper smelting furnace at Molotho, ca. 4 km S of Palabora. *Comment*: furnace was still standing on surface, as furnace at Matsepe.

290 ± 80
Y-1766. Shankare **A.D. 1660**

Charcoal from floor around base of large anvil stone within shelter of stone windbreak protecting iron-working site at Shankare (superseded name for Shangaankop), ca. 3 km NE of Palabora. *Comment*: charcoal was mixed with iron chips from manufacture of artifacts on anvil; date probably refers to metal-working activity at site. Compare also GrN-4929 at 110 ± 40 for assoc. smelting furnace (Radiocarbon, 1967, v. 9, p. 148).

90 ± 60
Y-1769. Shankare terrace **A.D. 1860**

Charcoal from domestic refuse accumulated on terrace ⅓ of way up N slope of Shankare. *Comment*: probably terminal Iron age occupation. Compare Y-1766 and GrN-4929 at 110 ± 40.

160 ± 60
Y-1767. Nareng furnace **A.D. 1790**

Charcoal from 23 to 38 cm below psl around 3-vent smelting furnace at Nareng, ca. 1.5 km E of Palabora. *Comment*: compare also GrN-4928 at 110 ± 25 for same furnace; probably 19th century.
General Comment: (N.vdM.): C^{14}, archaeologic, and ethnohistoric evidence indicates that Iron age peoples occupied Palabora area more or less continuously from 8th century until 1904. Little change in ceramic styles (incised designs) can be observed. Y-1636 at 1180 ± 80 is earliest known date for Iron age in S Africa.

Melville Koppies series, South Africa

Two Iron age smelting furnaces were excavated by R. J. Mason in 1963 at Melville Koppies (26° 5′ S Lat, 28° 01′ E Long), nature preserve in Johannesburg. Coll. and subm. by R. J. Mason.

890 ± 60
Y-1338. Melville Koppies, Furnace 1 **A.D. 1060**

Charcoal from floor around 2-vent smelting furnace at Melville Koppies, 28 to 30 cm below surface. *Comment*: furnace, used for iron smelting, probably dates earlier part of Iron age occupation of Johannesburg area. Single stamp decorated sherd characteristic of Uitkomst culture assemblage is assoc.

90 ± 60
Y-1768. Melville Koppies, Furnace 2 **A.D. 1860**

Charcoal from 20 to 25 cm below rim inside 2-vent smelting furnace. *Comment*: furnace, also used for iron smelting, is several 106 N of furnace dated by Y-1338 and resembles it in construction; no pottery occurred with Furnace 2.

Uitkomst Cave series, South Africa

Uitkomst Cave (25° 55′ S Lat, 27° 40′ E Long), near Hekpoort, Transvaal, ca. 40 km NW of Melville Koppies, is type site of Uitkomst culture (Iron age) and was excavated between 1950 and 1958 by R. J. Mason (Mason and van der Merwe, 1964; Mason, 1962). Coll. and subm. by R. J. Mason.

9630 ± 200
Y-1323A. Uitkomst Cave, Bed 2 **7680 B.C.**

Charcoal from foot of iron smelting furnace, Uitkomst Cave, Bed 2, 55 to 65 cm. *Comment*: date probably refers to underlying Late Stone age deposit into which Bed 2 furnace is intrusive and not to furnace itself. Compare Y-1323B and Y-1324 for ages of over- and underlying deposits. Charcoal layer in Bed 2 was dated by British Mus. Lab. at 9844 ± 200.

300 ± 80
Y-1323B. Uitkomst Cave, Bed furnace **A.D. 1650**

Sharpened wooden stick from floor of iron melting furnace, Uitkomst Cave, Bed 3. *Comment*: Bed 3 furnace overlies Bed 2 (referred to by Y-1323A), 17th century date fits within Iron age chronology for area.

11,250 ± 200
Y-1324. Uitkomst Cave Bed 1 **9300 B.C.**

Charcoal from Later Stone age deposit at Uitkomst Cave Bed 1, 105 cm. *Comment*: Bed 1 underlies Bed 2 furnace and is presumably responsible for anomalous date of Y-1323A.

360 ± 80
Y-1425. Scott's Cave, South Africa **A.D. 1590**

Charcoal from Scott's Cave, on farm Scothurst, 6 mi N of Patensie in Gamtoos Valley, Cape Province (33° 44′ S Lat, 25° 43′ E Long), S Africa. Coll. and subm. by H. J. Deacon, Albany Mus., S Africa. Sample from top spit level of Sq. J 4, sealed from present day floor of cave by overburden of roof infall. Occupation deposit is 30 cm thick and composed of white ash with minor intercalations of comminuted vegetable material. Sample selected to date terminal stage of occupation, which has been recognized as single late phase of Late Stone age characterized by large number of crude quartzite flakes, pottery, and a number of bone and wooden tools. *Comment* (H.J.D.). date agrees well with estimated dating for terminal Late Stone age, and together with SR-82 (1190 ± 100) (Radiocarbon, 1967, v. 9, p. 384) offers indication of time range of occupation (Deacon and Deacon, 1963).

VI. OCEANOGRAPHY

North Atlantic Ocean series

Various organic and carbonate samples taken from 3 stations in N Atlantic: Sta. KK (36° 20′ N Lat, 67° 56′ W Long), Sta. MM (34° 33′ N Lat, 66° 56′ W Long), and Sta. II (38° 33′ N Lat, 68° 32′ W Long). Coll. 1965 and subm. by J. H. Ryther, Woods Hole Oceanog. Inst.

Y-1706. Atlantic, Sta. KK, Sample 1 $\delta C^{14} = 1.7 \pm 0.7\%$

Bottom-living fish (ca. 10 cm) at depth 4964 m in N Atlantic, N of Bermuda, at Sta. KK.

Y-1707. Atlantic, Sta. MM, Samples 2, 3 $\delta C^{14} = 22.6 \pm 1.5\%$

Sample 2: several small (2 to 3 cm) mid-water fishes. Sample 3: general mid-water red shrimps (2 to 3 cm). Both samples were caught in an oblique plankton tow 4000-0 m depth at Sta. MM in N Atlantic.

Y-1708. Atlantic, Sta. KK, Samples 5, 7 Sta. MM, Sample 6, Sta. II, Sample 9 $\delta C^{14} = 20.7 \pm 1.5\%$

Sample 5 consisted of several small brittle stars at Sta. KK. Sample 7 consisted of ca. 40 to 50 small anemones also from Sta. KK. Sample 6 consisted of mixed sample of brittle stars and bivalve mollusks from Sta. MM. And Sample 9 consisted of few bottom anemones from Sta. II.

Y-1709. Atlantic, Sta. KK, Sample 8 $\delta C^{14} = -34.0 \pm 1.0\%$

Carbonate fraction of ca. 100 to 200 ml of foraminiferal ooze from surface of sediment which was mostly carbonate, ca. 0.2 to 0.3% organic used in Y-1711, from Sta. KK.

Y-1710. Atlantic, Sta. MM, Sample 10 $\delta C^{14} = -19.4 \pm 1.0\%$

Same type of sample as Y-1709, from Sta. MM.

Y-1711. Atlantic, Sta. KK, Sample 8 Sta. MM, Sample 10 $\delta C^{14} = -37.7 \pm 2.0\%$

Organic fraction of Y-1709 and Y-1710.

Y-1867. Atlantic Carbonate

$\delta C^{14} = -2.3 \pm 0.7\%$ $\delta C^{13} = -0.7‰$

Organic

$\delta C^{14} = +0.8 \pm 1.0\%$ $\delta C^{13} = -18.6‰$

Sea urchins from ocean floor at depth 2178 m in N Atlantic (36° 29′ N Lat, 67° 58′ W Long). Coll. 1966. Organic fraction appears enriched in C^{14} by ca. 6% when compared with carbonate fraction.

South Atlantic Deep-Sea Cores series

$CaCO_3$ and organic carbon from 3 S Atlantic deep-sea cores taken in Argentine Basin (44° 33.7′ S Lat, 51° 32′ W Long); Mid-Atlantic Ridge (19° 22.5′ S Lat, 11° 26.5′ W Long); and Walvis Ridge (22° 59′ S Lat, 7° 1′ E Long). Coll. by Lamont Geol. Observatory and subm. by K. K. Turekian with objective of establishing rates of accumulation of clay and calcium-carbonate components of deep-sea sediments in S Atlantic. *Comment*: highest eupelagic clay rates for Atlantic are in Argentine Basin, and lowest are in Mid-Atlantic Ridge (Turekian and Stuiver, 1964).

Y-1341. Walvis Ridge, Core V12-66, 0 to 5 cm **4320 ± 160**
2370 B.C.

Y-1342. Walvis Ridge, Core V12-66, 20 to 27 cm **10,310 ± 100**
8360 B.C.

Y-1343. Walvis Ridge, Core V12-66, 100 to 107 cm **37,000 ± 2000**
35,050 B.C.

Y-1344. Argentine Basin, Core V15-142, 23 to 35 cm **10,200 ± 400**
8250 B.C.

Y-1345. Argentine Basin, Core V15-142, 35 to 50 cm **12,200 ± 300**
10,250 B.C.

Y-1346. Mid-Atlantic Ridge, Core V16-36, 2 to 8 cm **5940 ± 120**
3990 B.C.

Y-1656. Mid-Atlantic Ridge, Core V16-36, 16 to 20 cm **12,960 ± 160**
11,010 B.C.

Y-1347. Mid-Atlantic Ridge, Core V16-36, 23 to 29 cm **19,700 ± 350**
17,750 B.C.

Y-1348. Mid-Atlantic Ridge, Core V16-36, 61 to 71 cm **30,100 ± 800**
28,150 B.C.

Antarctic Core series

Three diatomaceous cores coll. by USNS "Eltanin" and subm. by D. Kharkar, Yale Univ.

Core E 11-11-1 (64° 50.6′ S Lat, 114° 20.3′ W Long) 2660 fathoms water
Core E 11-8-1 (61° 56.7 S Lat, 115° 09.5′ W Long) 2750 fathoms water
Core E 11-5-1 (58° 56.6′ S Lat, 114° 43.2′ W Long) 2770 fathoms water

Y-1898. E 11-11-1 0 to 45 cm **8730 ± 600**
168 mg Carbon 0.23% C. **6780 B.C.**

Y-1899. E 11-11-1 60 to 110 cm **8460 ± 600**
168 mg Carbon 0.16% C. **6510 B.C.**

Y-1900. E 11-11-1 140 to 190 cm **8000 ± 600**
179 mg Carbon 0.13% C. **6050 B.C.**

Y-1901. E 11-8-1 0 to 50 cm **9820 ± 800**
161 mg Carbon 0.22% C. **7870 B.C.**

Y-1903. E 11-8-1 140 to 190 cm **10,430 ± 600**
157 mg Carbon 0.19% C. **8480 B.C.**

Y-1904. E 11-5-1 0 to 50 cm **7730 ± 500**
263 mg Carbon 0.39% C. **5780 B.C.**

Y-1905. E 11-5-1 60 to 110 cm **7960 ± 600**
161 mg Carbon 0.21% C. **6050 B.C.**

Y-1906. E 11-5-1 140 to 190 cm **7960 ± 600**
154 mg Carbon 0.21% C. **6010 B.C.**

All sample ages are uncorrected for isotope fractionation. No C^{13} ratios were available because complete sample was needed for C^{14} measurements. Measured samples are combination of organic and inorganic fractions. Dates do not extrapolate to zero age at surface and give sedimentation rates that are too fast. Sample ages of 8 to 10,000 yr correspond with C^{14} activities of 37 to 29% of modern standard. Atmospheric $C^{14}O_2$ activity is presently close to 200%. Adsorption of ca. 25 mg C atmospheric CO_2 can therefore produce same "ages" and may be cause of age discrepancies. This effect would be barely noticeable for standard ocean core material containing 100 times (or more) carbon. Si^{32} and Th^{230} sedimentation rates for same core are discussed by Kharkar and Turekian (1969, Earth and planetary sciences: Elsevier Publishing Co., in press).

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Yale VI	Stuiver and Deevey, 1961
Yale VII	Stuiver and Deevey, 1962
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