[RADIOCARBON, VOL. 6, 1964, P. 37-76]

U. S. GEOLOGICAL SURVEY RADIOCARBON DATES VII*

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This date list contains the results of measurements made during 1961, 1962 and 1963. The method of counting, utilizing acetylene gas, remains essentially unchanged, except for the addition of some solid state electronics. The method of computation, using the Libby half-life of 5568 ± 30 yr, is continued. The error listed is always larger than the one-sigma statistical counting error commonly used, and takes into account known uncertainty laboratory factors, and does not include external (field or atmospheric) variations.

Unless otherwise stated, collectors of all samples are members of the U. S. Geological Survey.

SAMPLE DESCRIPTIONS

A. Eastern U. S.

W-1132. Copperas Gap, Arkansas **>38,000**

Fresh-water mussel shells from S side of road cut on State Highway 113, approx. 1 mi SW of Arkansas River, SE¼ NE¼ SE¼ sec. 24, T 5 N, R 16 W (35° 04′ N Lat, 92° 42′ W Long), Perry County, Arkansas. Most shells are complete, averaging 3 in. in size, and occur in small pockets about 2 ft in diam, indicating shells were not transported. Stratigraphic sequence of alluvial materials in Arkansas Valley is as follows: younger alluvium, (clay and sand in flood plain next to river); older alluvium (second bottom), (brown clay with limestone modules); lower terrace (higher than second bottom), the shell locality, consists of red silty clay with chert pebbles and limestone nodules; upper terrace, consisting of rounded sandstone and chert pebbles. Coll. 1961 by C. G. Stone; subm. by H. D. Miser. *Comment*: sample is sole organic material found in terraces of Arkansas Valley region. As lower terrace is widespread, age of sample will aid correlation.

W-945. New Haven, Connecticut **5900 ± 200**
3950 B.C.

Organic material from test boring for Connecticut Turnpike bridge over Quinnipiac River (41° 18′ 2″ N Lat, 72° 59′ 24″ W Long), New Haven, Connecticut, near base of estuarine deposits unconformable on glacial outwash, at 30 to 31.5 ft below mean sealevel. Stratigraphy, top to bottom: silt and clay with shell fragments, mainly estuarine but with lenses of peat and other plant material near base; outwash, 126 ft, which rests on bedrock. Sample contained pollen, mostly *Tsuga* (id. by E. B. Leopold). Subm. 1960 by J. E. Upson. *Comment*: sample represents a sealevel not lower than –35 to –40 ft, and therefore suggests average relative rise of sealevel since then of between 1.7 and ca. 2 mm/yr (Upson, Leopold, and Rubin, 1964). *Tsuga* is frequent

* Publication authorized by the Director, U. S. Geological Survey.

in early postglacial assemblages in Connecticut, is compatible with a postglacial age.

W-1229. Okefenokee Swamp, Georgia — **400 ± 200** / **A.D. 1550**

Brown peat (alt 114 ft) from peat deposit 3 ft below swamp water level, S of Okefenokee Canal, 100 yd from turnoff to Buzzard Roost Lake, W of boat landing at Camp Cornelia (30° 44′ N Lat, 82° 10′ W Long), Georgia. Coll. 1962 by J. T. Callahan and R. L. Wait; subm. by J. T. Callahan. *Comment* (J.T.C.): swamp is post-Pleistocene. Date indicates slow rate of accumulation.

Turtle River series, Georgia

Wood fragments from stumps, possibly cypress, in Recent sediments, from S bank of Turtle River, ca. 4 mi N NW of Brunswick (31° 11′ N Lat, 81° 32′ W Long), Georgia. Coll. 1962 by J. T. Callahan and R. L. Wait; subm. by J. T. Callahan. *Comment* (J.T.C.): dates indicate that relative sealevel rose about 12 ft in ca. 1000 yr.

W-1222. Wood, 17 ft — **3670 ± 300** / **1720 B.C.**

Wood from stumps in buried forest about 12 to 17 ft below sealevel.

W-1223. Wood, 1 ft — **2780 ± 250** / **830 B.C.**

Wood from stump in growth position ca. 1 ft above sealevel, overlain by ca. 3 ft of silt and clay.

W-961. Gulf of Mexico — **10,600 ± 500** / **8650 B.C.**

Calcite coll. from continental slope off W coast of Florida (25° 41′ N Lat, 84° 20′ W Long), by chain bag dredge across low elongate submerged rock ridge, by U. S. C. and G. S. No. 4 of *Explorer* expedition (H. B. Stewart, 1962) from 86 to 87 fathoms of water. Coll. 1960 by H. B. Stewart; subm. by P. Cloud, Univ. of Minnesota, Minneapolis. *Comment*: elongate ridge believed to be a spit formed at a lower sealevel. Algal growth recovered by dredge may veneer a ridge of older solid rock beneath. Date does not prove or disprove the spit hypothesis.

W-1011. Bangor, Maine — **12,800 ± 450** / **10,850 B.C.**

Shells, consisting of *Astarte subaequilatera* Soerby and *Mya arenaria* Linné, from topset and foreset beds of esker delta 10 mi WNW of Bangor (44° 49′ N Lat, 68° 58′ 10″ W Long), Maine. Coll. 1961 and subm. by H. W. Borns, Univ. of Maine, Orono. *Comment* (H.W.B.): glacier was present when delta was built into the sea. Other shell dates in area were from flanks of wave-washed eskers with no ice front significance (W-947, 11,950 ± 350, this date list; W-737, 11,800 ± 240, USGS V). Date indicates that an ice mass existed in central Maine at this time.

W-1082. Sixpenny Island, Connecticut — **2850 ± 260** / **900 B.C.**

Peat at NE edge of Sixpenny Island, Mystic Harbor (41° 20′ 6″ N Lat, 71° 58′ 43.5″ W Long), Connecticut, at base of estuarine deposits overlying

sequence of sand and gravel (glacial outwash?). Coll. at depth of 9.2 to 10.0 ft below mean sealevel. Coll. 1960 by Corps of Engineers; subm. by J. E. Upson. *Comment*: dates a lower sealevel and helps define curve of apparent sealevel rise along S New England coast (Upson, Leopold, and Rubin, 1964).

W-947. Norridgewock, Maine **11,950 ± 350**
10,000 B.C.

Mixed shell and shell fragments of *Mya arenaria*, *Macoma calcarea*, *Buccinum tenue*, *Saxicava arctica*, *Mytilis edulis*, *Panomya arctica*, and *Balanus balanoides*, from esker 1.2 mi W of Norridgewock (44° 43′ N Lat, 69° 48′ W Long), Maine. Top of esker was at 320 ft alt before overburden removed. Fossil marine clay stratum approx. 2 ft thick lies between sand (above) and gravel (below) and slopes from approx. 290 ft E to 240 ft. Sample is from 250 ft. This is highest fossil marine clay yet found in Maine. Coll. 1959 by D. W. Caldwell, R. Doyle, and R. L. Dow; subm. by R. L. Dow, Dept. of Sea and Shore Fisheries, Augusta, Maine. *Comment*: W-737 (USGS V), 11,800 ± 240 was from same marine clay exposed in Clinton gravel pit farther E.

Watts Branch series, Maryland

Peat and wood from floodplain alluvium, Watts Branch, 1 mi NW of Rockville (39° 05′ N Lat, 77° 09′ W Long), Maryland. Peat coll. downstream from wood, was from black organic peat in form of filled channel underlain by gravel on bedrock and overlain by silt. Wood coll. from layer of pebbles just below top of basal gravel; brown silt above showed no sign of disturbance. Coll. 1960 and subm. by G. Dury and L. B. Leopold. *Comment*: the wood was expected to be much older than the peat in floodplain silt, indicating that basal gravel is of different age and stream regimen. Dates do not show this difference.

W-1064. Peat **<250**

Black organic peat about ½ mi downstream from Highway 28 bridge over Watts Branch.

W-1065. Wood **<250**

Sticks of wood about 200 yd downstream from Highway 28 bridge over Watts Branch, 50 yd below gaging station.

W-992. Edgartown, Martha's Vineyard, Massachusetts **>38,000**

Pieces of charcoal scattered in sandy beds of outwash gravel, from sand pit 1 mi S of Edgartown, just W of Katama Road, Martha's Vineyard (41° 22′ N Lat, 70° 31′ W Long), Massachusetts. Coll. 1958 and subm. by C. A. Kaye. *Comment* (C.A.K.): charcoal probably dates the outwash, but outwash may not be equivalent of younger drift at Gay Head, as previously supposed.

Barnstable Marsh series, Massachusetts

Peat coll. from West Barnstable Great Marsh, Cape Cod, Massachusetts from various depths, to determine rate of vertical accretion of high marsh peat. Results were interpreted to indicate relative change of sealevel in Cape Cod region (Redfield and Rubin, 1962). Coll. 1958 to 1961 and subm. by A. C. Redfield, Woods Hole Oceanographic Inst.

General Comment: age of peat increases with depth below surface. Vertical accretion, controlled by rise of sealevel, has averaged 3.3 x 10^{-3}ft/yr since 2100 B.P., when surface was 7 ft lower than at present. Earlier, rate was 10 x 10^{-3} ft/yr for a period extending back to at least 3700 B.P. Depths are in ft below marsh surface, within 1 ft of mean high water.

W-970. Proctors Crossing, 7.6 ft depth **2420 ± 250**
470 B.C.

This sample, W-971, and W-973 consist of Spartina peat over clay and were cored from salt marsh 1000 ft NE of junction of railroad and Highway 6 at Proctors Crossing (41° 31′ N Lat, 70° 21′ W Long).

W-971. Proctors Crossing, 13.4 ft depth **2800 ± 250**
850 B.C.

W-973. Proctors Crossing, 22.8 ft depth **3660 ± 250**
1710 B.C.

W-1094. Navigation Rd, 4.5 ft depth **1040 ± 300**
A.D. 910

This and the following 4 samples consist of Spartina peat. W-1093 is oak wood. Samples, taken with piston corer and considered the most reliable of the series, come from salt marsh 800 ft E of Navigation Rd, leading to West Barnstable Landing on Spring Creek (42° 42′ 55″ N Lat, 70° 21′ 56″ W Long).

W-1095. Navigation Rd, 7.5 ft depth **1850 ± 300**
A.D. 100

W-1096. Navigation Rd, 10.8 ft depth **2240 ± 300**
290 B.C.

W-1098. Navigation Rd, 18.3 ft depth **3060 ± 300**
1110 B.C.

W-1092. Navigation Rd, 21.3 ft depth **3400 ± 300**
1450 B.C.

W-1093. Wood, Navigation Rd, 22.8 ft depth **4860 ± 350**
2910 B.C.

W-1099. Fullers Point **3170 ± 300**
1220 B.C.

Fresh-water peat from 16.2 ft depth in salt marsh 205 ft N of Fullers Point at E extremity of Scorton Neck (41° 43′ 50″ N Lat, 70° 23′ 04″ W Long). Site is at junction of upland and sand spit (Sandy Neck) which shelters greater part of Barnstable marsh from Cape Cod Bay. Age indicates that sand spit was formed at least 3000 yr ago.

W-988. Boston Common, Massachusetts **1700 ± 300**
A.D. 250

Peat from S wall of excavation, Boston Common Garage, Boston (42° 22′ N Lat, 71° 04′ W Long), Massachusetts, from basal 1 in. of salt-marsh sandy peat lying on till. Base of peat is 1.7 ft below high tide and top of peat is at

high tide. Coll. 1961 and subm. by C. A. Kaye. *Comment* (C.A.K.): sample represents marsh grasses that began to grow when sealevel encroached to this altitude.

W-991. Boston Common Garage, Massachusetts **12,170 ± 300**
10,220 B.C.

Twigs from peat from SE part of excavation, Boston Common Garage, Boston (42° 22′ N Lat, 71° 04′ W Long), Massachusetts. About a ft of peat and wood fragments lies at contact of marine clay (below) and deeply oxidized drumlin till (above). Peat and wood are slightly carbonized and greatly compressed. Coll. 1960 and subm. by C. A. Kaye. *Comment* (C.A.K.): clay was believed identical to that at West Lynn (W-735, 14,250 ± 250, USGS V), but younger age shows that clay is more recent. Wood must be postglacial and the till is not in place.

W-1151. Florence, New Jersey **16,700 ± 420**
14,750 B.C.

Bog sample consisting mainly of silty quartz sand with abundant, dispersed comminuted organic matter, from 1.2 mi S of Florence (74° 52′ 30″ N Lat, 40° 06′ 00″ W Long), New Jersey. Coll. 1961 and subm. by J. P. Owens. *Comment*: sample directly overlies Trenton gravels, so that date gives minimum age for these gravels.

W-1038. Byron, New York **10,450 ± 400**
8500 B.C.

Twigs and plant material directly beneath a mastodon bone, ca. 2.4 ft below surface, from Byron mastodon excavation, Byron (43° 5′ 1½″ N Lat, 78° 4′ 57″ W Long), Genesee County, New York, N of Batavia moraine, but well above level of Lake Iroquois. Coll. 1959 by C. Heubusch and M. E. White; subm. by E. H. Muller, Syracuse Univ., New York.

W-1109. Lake Alice, New York **10,560 ± 350**
8610 B.C.

Shells from gravel pit on E side of ridge 8 mi long, known as Ingraham esker (Woodworth, 1905), 1000 ft N, 29° E of road corner about ½ mi NE of Lake Alice, 14 mi N of Plattsburg (45° 00′ N Lat, 73° 30′ W Long), New York. Shells consist of foraminifera (id. by R. Todd), a characteristically cold, shallow-water marine assemblage, the species widely known in the Arctic and S to Martha's Vineyard; molluscs and crustacea (id. by Rosewater), characteristic of a shallow marine environment, one species suggestive of lowered salinity; and ostracodes (id. by Sohn), characteristic of cold water environment and containing some of the same elements as in Pleistocene marine clays on Massachusetts and Maine coasts. Unit containing shells consists of coarse-grained, cross-bedded pebbly sand with pockets of almost pure shells in coarse sandy matrix. Coll. 1961 and subm. by C. S. Denny. *Comment*: dates Champlain Sea sediments; in same range as many other Champlain Sea dates.

Botany Bay Island series, South Carolina

Samples from Botany Bay Island, on Atlantic Coast ca. 1½ mi SW North Edisto River (32° 35′ N Lat, 80° 15′ W Long), South Carolina. Island is separated from mainland by 0.5 mi of marsh and is currently undergoing rapid

erosion (Neiheisel, 1958). Wave-cut foredunes, densely vegetated, contain layer of pelecypod shells (from which sample W-1041 was obtained) 5 to 7 in. thick, at ca. 5 ft above sealevel. A 3-in. layer of shell fragments (W-1042) occurs just above layer of pelecypod shells and may contain reworked older fragments. Mud flats, containing yellowish marsh grass (W-1044) occurs in littoral zone a few ft below. Coll. 1958 and subm. by James Neiheisel, Corps of Army Engineers, Marietta, Georgia. *Comment* (J.N.): shells appear to correlate with a cold phase at a time when sealevel was lower.

W-1041. Pelecypod shells **1550 ± 300**
A.D. 400

W-1042. Shell Fragments **2100 ± 300**
150 B.C.

W-1044. Marsh grass **<200**
Sample located about 1 mi NE of W-1041.

B. Central U. S.

W-1054. Danville, Illinois **>37,000**

Wood fragments from silt in drainage ditch for a strip mine in SE¼ NE¼ sec. 2, T 19 N, R 12 W (40° 09′ N Lat, 87° 40′ W Long), NW of Danville, Illinois. Section consists of tills interbedded with silt, sand, or gravel (Ekblaw and Willman, 1955). Sample comes from Unit XI of Ekblaw and Willman. Age of 40,000 was previously obtained on wood somewhat higher in the section, Unit IX of Ekblaw and Willman (W-917, USGS VI). Coll. 1959 and subm. by G. E. Ekblaw and H. B. Willman, Illinois Geol. Survey, Urbana. *Comment*: till was thought to be pre-Shelbyville or Farmdale age, but date places till in Altonian substage of Frye and Willman (1960), of Wisconsin age.

W-1144. McHenry County, Illinois **>38,000**

Peat from test boring along Northwest Illinois Toll Highway, SW¼ NE¼ NW¼ sec. 31, T 43 N, R 5 E (42° 10′ N Lat, 88° 42′ W Long), McHenry County, Illinois. Stratigraphy: 5½ ft of gravelly, sandy, yellowish brown, calcareous till; 11 ft of gravelly, sandy, brown, calcareous till; 6½ ft of sand, mostly very fine, with ½ in. beds of silt and clay; 5 ft of very silty, sandy, brown, calcareous till containing wood fragments; 4 ft of peat; 2 ft of sandy peat; 2¼ ft of peat (from which sample was taken); ½ ft of dark grayish brown till; 1 ft of calcareous till; and 1½ ft of greenish gray, calcareous sand. Coll. 1956 and subm. by J. P. Kempton, Illinois Geol. Survey, Urbana. *Comment* (J.P.K.): date eliminates possibility that peat might represent the Farmdale stade. Sample probably represents interstadial deposits between Winnebago till and older Altonian drifts of Frye and Willman (1960).

Collinsville series, Illinois

Wood from interstate highway cut through Mississippi bluffs, Collinsville, SE¼ NW¼ NE¼ sec. 29, T 3 N, R 8 W (38° 39′ N Lat, 89° 59′ W Long), Madison County, Illinois. Cut is ¼ mi S of W-729, snail shells dating 35,200 ± 1000, and a little further S along bluff line of W-730 (within the Peorian

Loess silt), snail shells dating 17,100 ± 300 (USGS V). Stratigraphy, a valley fill, consists of a basal zone of gray silt, in part calcareous, with snails, leaves, and wood fragments (W-1055), an overlying zone of loess with snails and wood fragments (W-1053), and a still-higher loess. Coll. 1960 by George Ekblaw; subm. by J. C. Frye. *Comment* (J.C.F.): lower wood zone was thought Farmdalean and upper zone possibly Two Creeks. However, mineralogy associated with W-1055 is typical of Peoria silt, and fauna immediately above is typical Peoria, agreeing with date of W-1055. Thick calcareous loess, eolian sand, and snail fauna indicate W-1053 must not have been in place.

W-1055. Wood, lower zone **17,950 ± 550**
16,000 B.C.

W-1053. Wood, upper zone **<200**

W-1048. Princeton Farms, Indiana **<200**

Wood from stream-cut bank in dissected outwash of Illinoian Glaciation 300 ft N of County road, near Princeton, SW¼ SW¼, sec. 29, T 2 S, R 10 W (38° 18′ 30″ N Lat, 87° 33′ W Long), Indiana. Stratigraphy: leached gray silt alluvium on calcareous gray silt alluvium on humic muck (wood, leaves, shells); stream surface. Coll. 1958 and subm. by L. L. Ray. *Comment*: anomalous date is unexplained.

W-1040. Switzerland County, Indiana **9140 ± 400**
7190 B.C.

Wood from W side of country road, S of bridge over creek, NE¼ SE¼, sec. 16, T 2 N, R 3 W (38° 44′ N Lat, 85° 6′ W Long), Switzerland County, Indiana, from near creek level under 14 ft of compact, leached oxidized alluvial silty clay of a valley fill younger than that exposed ¼ mi upstream and interpreted as fill of Tazewell Stade (Patton and others, 1953). Coll. 1960 and subm. by L. L. Ray. *Comment* (L.L.R.): dates alluviation in Ohio River Valley. Similar dates from related points are W-418, 9400 ± 250 (USGS IV) and I-420, 9250 ± 300.

White Pine Copper Mine series, Michigan

Wood and organic material from White Pine Copper Mine, N dam of S Tailings Pond, 500 ft E of former bed of Caribou Creek, near center NE¼ NE¼, sec. 2 T 50 N, R 42 W (46° 45′ N Lat, 89° 34′ W Long), Ontonagon County, Michigan. From fill in kettle in till. Fill is gyttja and peat (5 ft) on silt and clay on collapsed till and gravel. Coll. 1960 and subm. by F. J. Brandtner. *Comment* (F.J.B.): W-964 dates upper clayey till which represents a last minor readvance subsequent to main advance of Valders stade of Wisconsin Glaciation. W-965 and W-1150 date onset of reoccupation by forest after disappearance of dead ice. W-963 and W-962 date phases of postglacial vegetation development; W-963 is believed to date a short dry period.

W-964. Spruce log from till exposed in side of kettle **10,230 ± 280**
8280 B.C.

W-965. Spruce log from base of gyttja **9600 ± 280**
7650 B.C.

W-1150. Gyttja from horizon of W-965 — **9500 ± 350 / 7550 B.C.**

W-963. Oak log 60 m above base of gyttja — **4130 ± 250 / 2180 B.C.**

W-962. Cedar log from peat, 80 cm above base of gyttja — **1780 ± 250 / A.D. 170**

W-1141. Aitkin, Minnesota — **11,560 ± 400 / 9610 B.C.**

Wood from S wall of diversion canal of Mississippi River, 3 mi N of Aitkin, NW¼ NE¼ sec. 2, T 47 N, R 27 W (46° 34′ N Lat, 93° 41′ W Long), Minnesota. From top of noncalcareous sandy podzolic soil beneath 7 ft of marl and clay (Glacial Lake Aitkin), and peat. Pollen diagram shows soil and overlying 3 in. of marl are dominated by spruce and *Artemisia*. Coll. 1959 and subm. by H. E. Wright, Univ. of Minnesota, Minneapolis. *Comment*: date establishes that red and brown clayey till surrounding and antedating Glacial Lake Aitkin is pre-Two Creeks rather than post-Two Creeks as previously supposed. W-502 (11,710 ± 325) is from same horizon at same site and agrees with date of W-1141. But W-574, from buried peat at W end of same diversion canal, dates 10,620 (USGS V).

W-1059. Cloquet Lake, Minnesota — **11,500 ± 600 / 9550 B.C.**

Clay gyttja from Cloquet Lake, 6 mi W of Cloquet, sec. 23, T 49 N, R 18 W (46° 44′ N Lat, 92° 27′ W Long), Carlton County, Minnesota. Collected immediately above clay at depth of 9.25 m in lake sediments; from transition from spruce-parkland pollen zone (below) to spruce zone (above). Horizon is slightly above equivalent pollen horizon at Weber Lake (W-873, USGS V, 10,550 ± 300). Lake (and base of pollen-bearing sediments) overlies outwash from Superior Lobe representing a distinct stillstand. Coll. 1959 by S. Jelgersma; subm. by H. E. Wright.

W-1028. Lake Bronson, Minnesota — **>38,000**

Wood from Pleistocene sand and gravel, pumped from depth 137 ft in a well in Lake Agassiz Basin, NE¼ NW¼ SE¼, sec 33, T 161 N, R 46 W, ca. 3 mi SE of Lake Bronson, Kittson County (48° 43′ N Lat, 96° 37′ W Long), Minnesota. Coll. 1958 and subm. by G. R. Schiner. *Comment*: geologic age of sediments here is not known.

W-1057. Lake of the Woods, Minnesota — **9200 ± 600 / 7250 B.C.**

Piece of tamarack wood from Lake Agassiz beach ridge 4 mi S of Lake of the Woods, NW¼ SE¼ sec. 22, T 163 N, R 34 W (48° 53′ N Lat, 95° 03′ W Long), Lake of the Woods County, Minnesota. Stratigraphy top to bottom: sand and gravel, 20 ft; peat, (sample) 8 in; clay and sand, 2 in; till. Coll. 1960 by M. L. Heinselman; subm. by H. E. Wright. *Comment*: sample should date Lake Agassiz II (Elson, 1958; Wright and Rubin, 1956).

W-1058. Madelia, Minnesota **11,250 ± 400 9300 B.C.**

Clay gyttja from 2.5-ft organic layer at 8 ft depth, underlying clay and sand, in drained swamp 1¼ mi N of Madelia, sec. 14, T 107 N, R 30 W (44° 05′ N Lat, 94° 25′ W Long), Watonwan County, Minnesota, inside Marshall Moraine, formed by Des Moines Lobe when glacier stood at about Mankato, Minnesota. Coll. 1960 by H. E. Wright and M. Fries; subm. by H. E. Wright. *Comment* (H.E.W.): sample was chosen with reference to pollen diagram and two other dates from same sediment core (W-825, 9300 ± 350, top of organic layer; W-824, 12,650 ± 350, base of organic layer; USGS V). Pollen diagram begins with NAP zone marking tundra or park-tundra immediately following retreat of Mankato ice. Then a spruce zone (W-824) that marks first forestation, with maximum equivalent to Two Creeks, an *Artemisia* maximum (Valders) and a rise in birch and alder (W-1058 at base); then postglacial rapid rise of hardwoods fully developed at the time of W-825.

W-999. Plummer mine, Minnesota **>38,000**

Wood fragments from stratified sediments NE¼, SW¼ sec. 21, T 56 N, R 24 W, 4th P. M. (47° 18′ N Lat, 93° 24′ W Long), Itasca County, Minnesota. Stratigraphy, top to bottom: gray drift (Mankato); red drift; brownish gray drift; stratified dark brown or gray clay, silt, gravel (sample); yellow outwash; bedrock. Coll. 1959 and subm. by E. I. Roe and M. L. Heinselman, Lake States Forest Experiment Station, Grand Rapids, Minnesota. *Comment*: date substantiates estimate of age from the flora included in the fragments.

W-993. Fargo, North Dakota **9900 ± 400 7950 B.C.**

Wood from bottom of cut made across neck of meander loop of Red River, approx. same altitude as surrounding Lake Agassiz plain, N of Fargo, center sec. 20, T 140 N, R 48 W (46° 55′ N Lat, 96° 45′ W Long), North Dakota. Stratigraphy, top to bottom: clay and silt, 28 ft; wood and black silt, 6 in.; clay and silt, 13 ft. Coll. 1960 and subm. by J. A. Brophy, North Dakota Agricultural College, Fargo. *Comment*: dates a low-water phase of Lake Agassiz.

W-1021. Gackle, North Dakota **>38,000**

Peat from 4.5 ft below surface of gravel pit 0.1 mi N of SE corner of sec. 9, T 134 N, R 68 W (46° 26′ N Lat, 99° 16′ W Long), 14 mi S SW of Gackle Logan County, North Dakota. Peat occurs as blocks and fragments in thin beds within outwash gravel, contemporaneous with the Streeter end moraine. Coll. 1961 by L. Clayton; subm. by W. Laird, North Dakota Geol. Survey, Grand Forks. *Comment*: date indicates peat is secondary in the gravel.

W-1045. Logan County, North Dakota **28,700 ± 800 26,750 B.C.**

Peat and organic clay from exposure at NW¼ NW¼ sec. 24, T 134 N, R 72 W (46° 26′ N Lat, 99° 40′ W Long), Logan County, North Dakota. Stratigraphy, top to bottom: outwash gravel; iron-cemented till; dark gray to black organic clay with carbonized plant remains in small fragments; peat or

peaty, clayey silt with carbonized fragments; bedrock. Coll. 1960 by J. W. Bonneville; subm. by W. Laird. *Comment*: date does not support an early Wisconsin age for the till.

W-1019. Fredonia, North Dakota **9000 ± 300**
7050 B.C.

Clam fragments from 21 in. below ground surface of roadcut, 0.4 mi S of NW corner sec. 20, T 135 N, R 67 W (46° 30′ N Lat, 99° 08′ W Long), 9 mi S of Gackle and N of Fredonia, Logan County, North Dakota. Clams with both valves together, coll. from base of lacustrine silty sand, postdating Streeter moraine, part of "post-Cary No. 1" advance of Lemke and Colton (1958). Coll. by Lee Clayton; subm. by W. Laird. *Comment*: shells date lake deposits, not necessarily exact time when ice left area.

W-974. McIntosh County, North Dakota **11,650 ± 310**
9700 B.C.

Clam shells and shell fragments from 2 to 8 ft below surface of silty, clayey lake sediments W¼ corner sec. 20, T 132 N, R 68 W (46° 15′ N Lat, 99° 12′ W Long), McIntosh County, North Dakota. Sediments were deposited in a basin walled by stagnant ice and by Burnstad end moraine, called the A-1 advance by Flint (1955). Coll. 1961 by J. W. Bonneville; subm. by W. Laird. *Comment*: dates lake and end moraine.

W-990. Napoleon, North Dakota **>38,000**

Peat from gravel pit SW corner sec. 32, T 135 N, 72 W, (46° 28′ N Lat, 99° 46′ W Long) 3 mi S of Napoleon, Logan County, North Dakota, from 5 ft or more below surface of sandy outwash lenses of "peat," and clay. Coll. 1961 by Lee Clayton; subm. by W. M. Laird. *Comment*: sample dates "Napoleon drift" in this area which is part of "Tazewell" drift of Lemke and Colton (1958).

W-956. Cleveland, North Dakota **11,070 ± 300**
9120 B.C.

Clam shells from pit SE¼ SW¼ SE¼ sec. 17, T 139 N, R 67 W (46° 51′ N Lat, 99° 10′ W Long), near Cleveland, Stutsman County, North Dakota. In deltaic remnant (?) in outwash 20 mi E of Streeter moraine, correlative with distal edge of Mankato B-1 advance in South Dakota (Flint, 1955). Coll. 1960 by Charles Huxel and H. C. Winters; subm. by R. W. Lemke. *Comment*: sample postdates Streeter moraine.

W-954. Streeter, North Dakota **9870 ± 290**
7920 B.C.

Clam shells from upper part of sandy to silty clay over till, SE¼ SE¼ SE¼ sec. 29, T 137, R 69 W (46° 39′ N Lat, 99° 24′ W Long), near Streeter, Stutsman County, North Dakota, from stagnation moraine immediately behind proximal edge of Streeter moraine, the terminus of Flint's Mankato B-1 in South Dakota (Flint, 1955). Sample is from upper half of clay unit. Coll. 1960 by C. Huxel and H. C. Winters; subm. by R. W. Lemke. *Comment*: sample will aid in dating two significant stagnation units behind Mankato ice advance and in correlating W-542 (USGS V), from beyond distal edge of Streeter moraine.

W-1020. Stutsman County, North Dakota **>38,000**

Fragments of wood from glaciofluvial sediment underlying 50 ft of till, NE¼ NE¼ NE¼ NE¼ sec. 21, T 141 N, R 66 W (47° 01′ 22″ N Lat, 99° 02′ 16″ W Long), Stutsman County, North Dakota. Coll. 1961 by R. W. Schmitt; subm. by E. Bradley. *Comment*: age was thought to be between Valders and Cary, but date does not support that view.

W-1005. Thompson, North Dakota **10,050 ± 300**
8100 B.C.

Wood from gravel pit 2.4 mi NW of N edge of Thompson, NE¼ SW¼, sec. 14, T 150 N, R 51 W (47° 46′ N Lat, 97° 07′ W Long), Grank Forks County, North Dakota, ca. 5.5 ft below soil. Stratigraphy, top to bottom: sand and gravel; gray clay containing abraded sticks, chips, and twigs (sample), gravel. Coll. 1960 by W. M. Laird and F. D. Holland; subm. by R. W. Lemke. *Comment*: sample was interpreted as driftwood on shore of Glacial Lake Agassiz. Compare date on wood near Grand Forks (W-723, USGS V, 10,960 ± 300).

W-1039. Katotawa Creek, Ohio **2600 ± 300**
650 B.C.

Part of log from base of gravel over silt, bank of Katotawa Creek, SE¼ NE¼ sec. 14, Montgomery Township, Ashland County (40° 52′ N Lat, 82° 15′ W Long), Ohio. Coll. 1960 and subm. by G. W. White, Univ. of Illinois, Urbana. *Comment*: it was thought that sample represented outwash from Wabash moraine, but date indicates gravel is alluvium.

W-1031. Seville, Ohio **5950 ± 300**
4000 B.C.

Wood from sewer trench 200 ft W of corner of Market and East Streets (41° 01′ N Lat, 81° 52′ W Long), Seville, Ohio. Sample is from unoxidized gravelly outwash from Wabash moraine, 0.25 mi N of the exposure. Calcareous till over gravel is late Cary of the last advance. Coll. 1961 by G. W. White and E. F. Bauer, Univ. of Illinois, Urbana. *Comment*: sample does not date Cary Stade.

W-957. London, Ohio **>38,000**

Part of tree branch, possibly cedar, in sand and gravel, at London water works, about 1/3 mi W of courthouse, Union Township, Madison County (39° 53′ N Lat, 83° 27′ W Long), Ohio. Sample taken at 93 ft lower Wisconsin(?) outwash, consisting of sand and gravel with clay balls, which underlies upper Wisconsin till and overlies lower Wisconsin till. Coll. 1960 by G. M. Baker and Sons (well drillers); subm. by S. E. Norris. *Comment*: sample indicates that buried outwash is probably associated with lower, rather than upper, Wisconsin till.

Alpena series, South Dakota

Pieces of wood from log ca. 16 in. in diam, penetrated at ca. 41 ft by boring in till, 1951, near Alpena, Jerauld County (44° 11′ N Lat, 98° 20′ W Long), South Dakota. Till from 16 to 47 ft is impervious, the well obtaining its water from glacial sand at depth of 53 ft. Log was in a soil zone that included

2 ft of black soil and 2 ft of oxidized till. W-987 coll. 1951 by property owner; subm. by L. W. Howells. W-983 coll. 1960 and subm. by L. W. Howells. *Comment*: till exposed at surface has been classified as Cary. No obvious explanation for age differences between freshly collected sample and stored one.

W-987. Farmer's wood — **12,530 ± 350 / 10,580 B.C.**

Pieces of log recovered when well was drilled, and stored in dry container by property owner.

W-983. Survey wood — **10,350 ± 350 / 8400 B.C.**

Pieces of log recovered by U. S. Geol. Survey in new hole, apparently from same log.

W-1189. Menno, South Dakota — **12,050 ± 400 / 10,100 B.C.**

Wood fragments from between gravel and overlying till at depth 192 ft, Menno, Hutchinson County, NW¼ sec. 9, T 97 N, R 57 W (43° 25′ N Lat, 97° 55′ W Long), South Dakota. Coll. 1961 by R. H. Schoon; subm. by A. F. Agnew, South Dakota Geol. Survey, Vermillion. *Comment* (R.H.S.): previous dates in area are W-801, 12,200 ± 400, 60 mi N (USGS V); W-987, 12,530 ± 350, 70 mi NNW (this date list); Y-452, 12,330 ± 180, 25 mi NE (Yale III); and Y-595, 12,760 ± 120, 30 mi E (Yale IV). Samples W-801 and W-987 are from drift mapped as Mankato, Y-452 and Y-595 from drift mapped as Cary (Flint, 1955).

W-1033. Sanborn County, South Dakota — **10,060 ± 300 / 8110 B.C.**

Shells from clay in cattle dugout, SW¼ SE¼ sec. 3, T 107 N, R 62 W (44° 06′ N Lat, 98° 15′ W Long), Sanborn County, South Dakota. Coll. 1959 and subm. by F. V. Steece, South Dakota State Geol. Survey, Vermillion. *Comment*: sample comes from area mapped by Flint (1955) as Mankato, on W side of James R. Valley. Age was thought to be Cary, but date is too young.

W-1110. De Pere, Wisconsin — **11,640 ± 350 / 9690 B.C.**

Tamarack log from gravel pit 8 mi W of De Pere, SW¼ SE¼ sec. 19, T 23 N, R 19 E (44° 27′ N Lat, 88° 14′ W Long), Wisconsin, from 8 to 12 ft below surface in organic layer at ca. 710 ft alt. Sample is from sand and silt with tamarack needles, beneath till and kame gravel. Coll. 1961 and subm. by R. F. Black, Univ. of Wisconsin, Madison. *Comment* (R.F.B.): date helps to establish site as of Two Creeks age, lying beneath Valders Till and upon a Cary kame.

W-1017. Kenosha, Wisconsin — **6340 ± 300 / 4390 B.C.**

Wood from log lying in pond silt and sands above soil developed in till, 100 yd S of city limits of Kenosha, on shore of Lake Michigan, NW¼ SW¼ sec. 8, T 1 N, R 23 E (42° 33′ N Lat, 87° 49′ W Long), Wisconsin. Coll. 1961 and subm. by R. B. Black. *Comment*: dates the buried soil.

Portage series, Wisconsin

Wood from NW corner of borrow pit ¼ mi E of junction of Highway 33 and 78, 1 mi S of Portage, SW¼ SW¼ sec. 7, T 12 N, R 8 E (43° 31′ N Lat, 89° 29′ W Long), Wisconsin, from alluvium. Coll. 1962 by R. F. Black and T. E. Berg; subm. by R. F. Black. *Comment*: spruce needles, cones, and mosses imply colder climate than today's. Dates alluviation of Wisconsin River Valley.

W-1138. Stump **6070 ± 320**
4120 B.C.

Base of stump, depth 20 ft, undercut by lateral migration of Wisconsin River and immediately covered during aggradation.

W-1139. Log of driftwood **6040 ± 350**
4090 B.C.

Log, depth 7 ft, deposited in backwater swamp with other organic material during aggradation.

W-1183. Winnebago County, Wisconsin **12,060 ± 700**
10,110 B.C.

Black clayey peat with well-preserved remains of spruce trees about 2000 ft W of Highway 47 and 200 ft N of Airport Road, SE¼ SW¼ NE¼, sec. 11, T 20 N, R 17 E (44° 13′ 05″ N Lat, 88° 25′ 47″ W Long), Winnebago County, Wisconsin. Sample from a 3- to 6-in. layer overlain by ca. 10 ft of till. Coll. 1962 by P. G. Olcott; subm. by C. L. R. Holt, Jr. *Comment* (C.L.R.H.): date compares with dates of wood from Two Creeks Interstade at Two Creeks, Wisconsin, 60 mi E. Sample probably represents end of Two Creeks Interstade and advance of Valders ice. Lake clays overlying sampled material are therefore younger than Two Creeks Interstade and are probably Valders.

C. Western U. S.

W-939. Meteor Crater, Arizona **24,000 ± 2000**
22,000 B.C.

Snail shells from marl on dump of main shaft in Meteor Crater (35° 0′ N Lat, 111° 0′ W Long), Coconino County, Arizona. Coll. 1960 by E. E. T. Chao. *Comment*: sample was diluted with dead carbonate to obtain sufficient carbon for a run. Shells believed to come from basal part of lake sediments filling crater, thus approximating minimum age of crater.

W-1069. Antelope Springs, California **1380 ± 250**
A.D. 570

Charcoal from Antelope Springs channel bank, SW¼ sec. 20, T 8 S, R 35 E (37° 17′ N Lat, 118° 16′ W Long), Deep Springs Valley, California, from charcoal pod 2 ft wide and 8 in. thick in 12-ft deep channel bank consisting of stream alluvium, from 6 ft below surface of valley floor. Fire-blackened stones rested upon pod, indicating a fire hearth. Coll. 1961 and subm. by J. P. Miller and L. K. Lustig, Harvard Univ., Cambridge, Massachusetts. *Comment*: date marks upper limit for beginning trenching in basin.

Burnt Lava Flow series, California

Charcoal from trees within Burnt Lava Flow, S of Medicine Lake T 42 N, R 11 E (41° 32′ N Lat, 121° 24′ W Long), California (Anderson, 1941).

Sample flow is youngest stratigraphic unit in area. W-936 is from standing pine tree with base immersed in thin part of flow at edge of a kipuka. W-934 is from cedar tree burned off at base by flow, and then fallen onto flow. Coll. 1957 by G. A. MacDonald.

W-936. Pine tree charcoal **200 ± 200**
A.D. 1750

Charcoal coll. ca. 500 ft W of E edge of flow, E-SE of High Hole Crater.

W-933. Cedar log charcoal **220 ± 200**
A.D. 1730

Charcoal coll. 30 ft from NE edge of flow, NE of High Hole Crater.

W-935. Cedar tree charcoal **320 ± 200**
A.D. 1630

Charcoal from surface of flow, 15 ft from edge, E of High Hole Crater.

W-934. Cedar tree charcoal **200 ± 200**
A.D. 1750

Charcoal coll. 10 ft from NE edge of flow, NE of High Hole Crater.

W-1034. Potrero Canyon, California **>35,000**

Small charcoal fragments (carbonized plant material) from sand of upper Pleistocene marine terrace deposits, from cut bank 20 ft W of Flagg's Restaurant and ca. 200 ft W of mouth of Potrero Canyon, Pacific Palisades area (34° 01′ 55″ N Lat, 118° 31′ 33″ W Long), Los Angeles, California. Sample is from ½-in. layer of charcoal fragments ca. 13 ft above base of sand which underlies gravel and overlies marine Pliocene. Coll. 1960 and subm. by J. T. McGill, Univ. of California, Los Angeles. *Comment*: it was hoped date would correlate sand with nearby marine upper Pleistocene terrace deposits in contrast to theory that it is upper Pliocene or lower Pleistocene.

W-1201. Salt Wells Canyon, California **13,300 ± 500**
11,350 B.C.

Lacustrine tufa from S side of wash issuing from Salt Wells Canyon, Searles Valley, San Bernardino County (35° 40′ N Lat, 117° 24′ 50″ W Long), California. Sample coll. 3 ft above base of white marly silt, which is basal member of sequence correlated with upper Wisconsin parting mud in subsurface section of Searles Lake. Upper Wisconsin sequence consists of greenish micaceous sand 0 to 30 ft thick, overlain by this sequence of silt and sand beds, in this area ca. 50 ft thick (Flint and Gale, 1958; Smith, 1962). Coll. 1962 and subm. by G. I. Smith. *Comment* (G.I.S.): sample probably formed in shallow water which should have been as near equilibrium with atmospheric CO_2 as any in the lake. Date is ca. 6000 to 8000 yr younger than expected, but is not in conflict with field evidence. Parting mud has dates ranging from ca. 10,000 at top to 23,000 at base.

W-942. Searles Lake, California **11,800 ± 1000**
9850 B.C.

Core from Searles Lake, ¼ mi W of NE corner of sec. 2, T 26 S, R 43 E (35° 42′ 30″ N Lat, 117° 19′ 00″ W Long), California, from material between depths of 22.0 ft to 22.7 ft. Core represents base of "Overburden Mud" de-

posited after earlier lake had desiccated to form "Upper Salt." Interval sampled consists of carbonaceous mud and pirssonite crystals in upper half, and mud and rounded halite crystals in lower half. Coll. 1958 by F. J. Dluzak, American Potash and Chemical Corp., Trona, California; subm. by G. I. Smith. *Comment*: sample repeats W-892, USGS VI, 12,390 ± 400 and confirms suspicion that overburden mud here contains reworked carbonaceous matter from older lake sediments exposed around the edges.

W-981. San Nicolas Island, California **5070 ± 250**
3120 B.C.

Abalone shells (*Haliotis rufescens* Swainson) from oldest occupation layer in extensive kitchen midden on high point near NW end of San Nicolas Island (33° 16′ N Lat, 119° 32′ W Long), California. About 4 ft of barren eolian sand immediately overlies occupation layer, and a much younger occupation layer caps the hill. Coll. 1957 and subm. by J. G. Vedder. *Comment* (J.G.V.): this species of abalone is abundant only in older, partially lime-cemented occupation layers. Other marine invertebrate species in this layer suggest that water temperatures were approx. the same as now, but abundant large rhizomorphs (root casts) and numerous terrestrial snail shells in middens of similar aspect presumably indicate relatively dense vegetation and higher humidity at time of occupation. Seasonal habitation of island at this time may be indicated by scarcity of artifacts and burials associated with these mounds.

San Joaquin Valley series, California

Peat from cores drilled by U. S. Bureau of Reclamation in San Joaquin Valley, California in lacustrine diatomaceous Corcoran Clay Member of Tulare Formation. Coll. 1952, 1960 by I. E. Klein; subm. by J. F. Poland. *Comment* (J.F.P.): dates are minimum for disappearance of lake. Compare date of >17,800 yr for same peat as W-1192 (Libby, 1955).

W-1192. San Joaquin **>38,0000**

Sample from peat bed from central part of San Joaquin Valley, 22 mi SW of Fresno and 2 mi N of San Joaquin, NE¼ NW¼ sec. 12, T 15 S, R 16 E (36° 38′ N Lat, 120° 10′ W Long).

W-1200. Shafter **>38,000**

Sample from peat interbed, associated with volcanic ash, at depth 449.5 to 450.0 ft in S part of San Joaquin Valley, 19 mi W of Shafter, NE¼ NW¼ sec. 9, T 28 S, R 22 E (35° 31′ N Lat, 119° 37′ W Long).

W-1129. Gypsum, Colorado **4150 ± 300**
2200 B.C.

Charcoal from East Rim Blowout, Eagle River near Gypsum (39° 38′ N Lat, 107° 02′ W Long), Colorado, from small juniper or pinon tree (basal trunk diam 3 to 4 in.), burned and buried by volcanic ash, overlying alluvial fans. Coll. 1961 by R. F. Giegengack; subm. by W. C. Bradley, Univ. of Colorado, Boulder. *Comment*: volcanic eruption consisted in part of basalt flow which reached floor of Eagle River and deflected river but did not dam it. Other phase of eruption is explosion crater with ash at same vent from which basalt was erupted. Sample represents most recent volcanism dated in Colorado.

W-1133. Horse Creek, Colorado **1500 ± 250**
A.D. 450

Fragments of partially rotted log from bank of Horse Creek, approx. halfway between Horse Park and confluence of Horse Creek and Illinois Creek (40° 24′ N Lat, 106° 01′ W Long), Colorado, probably emplaced when drainage was blocked by recessional moraine. Coll. 1960 and subm. by K. L. Pierce, Yale Univ., New Haven, Connecticut. *Comment*: wood was expected to correlate with Silver Creek glaciation of Eschman (1955), but date contradicts this.

W-1135. Jack Creek, Colorado **7830 ± 350**
5880 B.C.

Wood from near head of tributary to Jack Creek, ½ mi S of Jack Creek and just below three cirque lakes, SE North Park (40° 24′ N Lat, 105° 56′ W Long), Jackson County, Colorado, from clay of 10-ft stream bank, underlain by gravel and sand, cut by stream alpine meadow, alt 11,320. Coll. 1960 and subm. by K. L. Pierce. *Comment*: deposit probably formed when ice extended into lower parts of cirques.

W-1018. Jarre Creek, Colorado **900 ± 250**
A.D. 1050

Charcoal from top of pediment, NW¼ NW¼ sec. 4, T 8 S, R 68 W (39° 22′ N Lat, 105° 00′ W Long), Douglas County, Colorado, from 10-in. thick deposit of Recent loess overlying Rocky Flats alluvium (Nebraskan?). Coll. 1961 and subm. by G. R. Scott. *Comment* (G.R.S.): pottery associated with charcoal is referred to the Franktown Focus, which A. M. Withers considers transitional between Woodland and Upper Republican cultures. Two types of pottery are found in area. Older sites have strongly corrugated pottery. Charcoal from an older site referred to Parker Focus of Woodland culture was dated at 1360 ± 200 yr. Younger sites have weakly corrugated pottery. Date obtained on charcoal from younger site establishes chronology of Woodland and post-Woodland cultures.

W-989. Salida, Colorado **<200**

Carbonized wood fragments from Gas Creek, N of Salida, sec. 27, T 15 S, R 78 W (38° 32′ N Lat, 106° 00′ W Long), Colorado, from peat, underlain by outwash. Coll. 1958 and subm. by R. E. Van Alstine. *Comment*: it was hoped that sample could be correlated with associated vertebrate bones and fossil plant material, but age suggests intrusion.

W-932. American Falls, Idaho **>38,000**

Well-bedded fine peat from large chunk of peat ca. 3 by 4 ft incorporated in coarse Michaud Gravel, near top of bluff overlooking American Falls Reservoir, SE¼ SW¼ sec. 29, T 5 S, R 33 E (42° 57′ N Lat, 112° 37′ 30″ W Long), Idaho. Coll. 1960 by D. E. Trimble and W. J. Carr; subm. by W. J. Carr. *Comment*: peat was probably ripped out of underlying American Falls Lake Beds by Lake Bonneville overflow waters and deposited in Michaud Gravel. W-358, >32,000 (USGS IV) is from gravel at base of lake beds from which present sample comes; W-731, 29,700 ± 1000 (USGS V) is from terrace deposits somewhat younger than Michaud Gravel.

W-1221. Bannock City, Idaho **32,500 ± 1500**
30,550 B.C.

Shells of freshwater mollusks from possible lake sediments consisting of marl and marly clay and silt, ca. 75 yds W of Arimo gas station of highway over Marsh Creek, E½ SW¼ sec. 12, T 10 S, R 37 E (42° 33′ N Lat, 112° 05′ W Long), Bannock County, Idaho. Coll. 1962 by R. C. Bright, M. Rubin and R. Rubin; subm. by M. Rubin. *Comment* (R.C.B.): sediments containing shells underlie a terrace that might represent Provo overflow of Lake Bonneville. Date would then be maximum for Provo Formation.

Bear River series, Idaho

Travertine-coated twigs from culvert from a hot spring just W of large meander of Bear River ca. 3 mi NW of Preston, SW¼ NW¼ sec. 17, T 15 S, R 39 E (42° 07′ N Lat, 112° 56′ W Long), SE Idaho. Coll. 1962 by R. C. Bright, M. Rubin and R. Rubin; subm. by M. Rubin. *Comment* (R.C.B.): twigs are probably less than 10 yr old. Sample was coll. to compare age of wood with that of travertine to test possibility of using travertine to date older sediments.

W-1226. Twigs **<200**

W-1225. Travertine **>39,000**

W-1128. Bitten's Ranch, Idaho **34,000 ± 1600**
32,050 B.C.

Mollusk shells from road cut ca. 1/5 mi W of Bitten's Ranch, on divide separating E fork of Whisky Creek and W fork of Trout Creek, SW¼ SW¼ SW¼, sec. 8, T 11 S, R 41 E (42° 29′ 30″ N Lat, 111° 41′ 30″ W Long), SE Idaho. Sample from near shore, cross-bedded sand of extinct Lake Thatcher, alt ca. 5270 ft. Coll. 1961 and subm. by R. C. Bright, Univ. of Minnesota, Minneapolis. *Comment*: date is minimum for Lake Thatcher.

W-1125. Harris Ranch, Idaho **27,000 ± 900**
25,000 B.C.

Snail shells (*Fluminicola*, id. by R. C. Bright) from beach sands of highest beach formed by Pleistocene Lake Thatcher, from 5425 ft alt, ca. 1/5 mi NW of Harris Ranch, C NW¼ NE¼ NW¼ NW¼ sec. 32, T 10 S, R 40 E (42° 31′ N Lat, 111° 49′ W Long), SE Idaho. Coll. 1961 and subm. by R. C. Bright. *Comment*: date is minimum for high stand of Lake Thatcher and approximates date of spillover into Bonneville Basin. Three related samples previously run were: W-898 (USGS VI), 33,700 ± 1000 yr from 4935 ± 5 ft alt; W-855 (USGS V), 27,500 ± 1000 yr from 5170 ± 5 ft alt; and W-704 (USGS V), 32,500 ± 1000 yr from 5290 ± 5 ft alt.

W-1191. Cottonwood Creek, Idaho **2050 ± 300**
100 B.C.

Tufa from deposit on E side of valley at head of Cottonwood Creek, NE¼, sec. 7, T 11 S, R 39 E (42° 29′ 20″ N Lat, 111° 56′ 45″ W Long), Idaho. Coll. 1962 and subm. by S. S. Oriel. *Comment* (S.S.O.): fossil leaf impressions of willow and aspen in the tufa are indistinguishable from living plants in area now. This and similar pollen data confirm the date as modern.

McCammon series, Idaho

"Baked" organic soil exposed in bluff adjacent to Marsh Creek, 3 mi S SW of McCammon, NW¼ SW¼ sec. 26, T 9 S, R 36 E (42° 36′ N Lat, 112° 14′ W Long), Idaho, from black "baked" horizon, beneath basalt flow, believed to be organic debris cooked by lava. Alluvium underlies the flow. Coll. 1961 and 1962 and subm. by R. C. Bright, M. Rubin and R. M. Rubin. *Comment*: these basalts are thought to be of same sequence as basalts in Gem and Gentile Valleys which flowed down Portneuf and into Marsh Valley. Date should be maximum for flows of Marsh Valley and aid in correlating extrusions, Lake Thatcher, and overflow of Lake Bonneville. Sediments of Lake Bonneville overflow overlie this flow. Importance of date made it advisable to re-collect sample and make completely new run.

W-1121. McCammon flow, slide area **33,000 ± 1600**
31,050 B.C.

Organic material from beneath flow, exposed by recent landslide.

W-1177. McCammon flow, gravel pit **35,000 ± 3000**
33,050 B.C.

Organic material from beneath flow, exposed in gravel pit few hundred ft N of W-1121. Although a few rootlets in the low-C sample horizon were avoided, contamination by modern C is possible. Samples may be much older than dates given.

W-929. Portneuf pumping station, Idaho **>42,000**

Peat from near bottom of trench for Portneuf pumping station pipeline, SE¼ SW¼ sec. 36, T 5 S, R 33 E (42° 56′ N Lat, 112° 33′ W Long), Idaho. Sample from layer of peat ca. 1 ft thick in upper part of American Falls Lake Beds, is overlain conformably by ca. 13 ft of silty clay and then by Michaud Gravel deposited during spillover of Lake Bonneville. *Comment*: layer is probably source for W-932 (this date list).

W-982. Ramsbottom Ranch, Idaho **18,900 ± 500**
16,950 B.C.

Shells of fresh-water gastropod *Stagnicola* from pit on Ramsbottom Ranch, sec. 5, T 16 S, R 40 E (42° 4′ N Lat, 111° 59′ W Long), ca. 4.5 mi SE of Preston, Franklin County, Idaho. Coll. 1960 and subm. by R. C. Bright. *Comment* (R.C.B.): date is highest (Bonneville) stillstand and spillover of Lake Bonneville.

W-1160. Trout Creek, Idaho **33,000 ± 1500**
31,050 B.C.

Snail shells from sandy, near-shore facies of Pleistocene Lake Thatcher, alt 5340 ft ca. 100 ft below well-developed beach, S side of mouth of main fork of Trout Creek Canyon, SW¼ NW¼ SE¼, sec. 16, T 11 S, R 41 E (42° 28′ N Lat, 111° 40′ W Long), Preston quadrangle, Idaho. Coll. 1961 and subm. by R. C. Bright. *Comment* (R.C.B.): clam shells (*Gonidea angulata*) associated with sample suggest connection with Snake River; sample should date connection.

W-1112. Boomerang Gulch, Montana **5020 ± 260**
3070 B.C.

Plant stems and fragments, partly charcoal, from valley wall of upper part of Boomerang Gulch, SE of Sugarloaf Mountain, SE¼ NW¼ sec. 18, T 6 N, R 4 W (46° 16′ 34″ N Lat, 112° 9′ 24″ W Long), Jefferson County, Montana. From section of silt with sandstone and tuffaceous silt, directly overlain by 2 in. of clean ash and then more silt. Coll. 1961 and subm. by H. W. Smedes. *Comment*: dates overlying ash layer. Ash in similar geomorphic setting is common throughout Boulder batholith region.

W-1135. Rigler Bluffs, Montana **4900 ± 300**
2950 B.C.

Charcoal from rock-lined, prehistoric Indian hearth exposed by collapse of a gully wall, Rigler Bluffs, SW¼, NW¼, sec. 19, T 8 S, R 8 E (45° 08′ N Lat, 110° 43′ W Long), Montana. 25 ft above low-water stage of Yellowstone River at 5095.5 ft, 6 ft above drain bottom of gully and 22 ft below level of alluvial fan in which gully is incised. Coll. 1962 by A. L. Haines; subm. by J. M. Good, Yellowstone Nat. Park, Yellowstone Park, Wyoming. *Comment* (J.M.G.): date falls near center of little-known "Middle Prehistoric" period. Dated sites of occupation by Forager peoples are very rare. This one appears to have been established as a camp on silt margin of landslide-created lake, afterwards engulfed by continued deposition of silt. Similar sample run by D. Frey, Sheridan College, Sheridan, Wyoming, gave age of 5040 ± 150, which is oldest date for occupation of upper Yellowstone Valley by man.

Little Valley series, Utah

Wood and shells from Promontory Point, sec. 1, T 6 N, R 6 W (41° 14′ N Lat, 112° 29′ W Long), Little Valley, Utah. From silt and marl overlying recessional lake gravel on clay. Coll. 1960 by R. C. Bright, M. Rubin, W. Carr, and H. D. Goode; subm. by H. D. Goode, Univ. of Utah, Salt Lake City. *Comment*: recessional lake gravel is bracketed by the two dates.

W-941. Wood from clay at base of section **20,300 ± 500**
18,350 B.C.

(See W-876, USGS V).

W-943. Mollusks from silt near top of section **12,780 ± 350**
10,830 B.C.

(See W-875, USGS V), alt 4725 ft.

W-1037. Promontory Point, Utah **11,600 ± 400**
9650 B.C.

Carbonate carbon from calcareous clay from Southern Pacific R. R. fill project across Great Salt Lake between Promontory Point and Lakeside (41° 14′ N Lat, 112° 26′ W Long), Utah, at milepost 745, from just below top of salt bed with thin clay layers underlying lake clay. Salt bed (mainly $Na_2SO_4 \cdot 10\ H_2O$) is ca. 25 ft below bottom of G. S. Lake (Eardley, 1962). Coll. 1958 by E. S. Smith; subm. by A. J. Eardley, Univ. of Utah, Salt Lake City. *Comment*: salt bed was believed to be Hypsithermal but date is that of Two Creeks Interstade.

W-996. Bellingham, Washington **11,660 ± 350**
9710 B.C.

Marine shells from sea cliff at Cement Plant, Bellingham, sec. 44, T 38 N, R 2 E (48° 45′ N Lat, 122° 28′ W Long), Whatcom County, Washington, from pebbly blue-clay till underlying sand and gravel, overlain by clay. Coll. 1960 by D. J. Easterbrook; subm. by D. R. Crandell. *Comment*: till was thought to correlate with till at North Bellingham dated 12,090 ± 350 (this report, W-984). Dates a glacial advance that reached Georgia Strait.

W-940. Cedarville, Washington **11,640 ± 275**

Wood from logs embedded in peat and clay at base of lacustrine sediments, between two marine tills, from stream-bank exposure along Nooksack River, SW¼ NE¼ NE¼ sec. 34, T 39 N, R 4 E (46° 52′ N Lat, 123° 17′ W Long), Whatcom County, Washington. Coll. 1960 and subm. by D. R. Crandell. *Comment* (D.R.C.): date indicates that underlying glacio-marine drift is Vashon in age, and overlying drift is equivalent to Sumas drift of Armstrong (1960) which according to him is post-Two Creeks in age.

W-1118. Kautz Creek, Washington **2980 ± 250**
1030 B.C.

Carbon from duff layer in W bank of Kautz Creek, Mount Rainier National Park, SE¼ NW¼ NE¼ sec. 16, T 15 N, R 8 E (46° 46′ N Lat, 121° 49′ W Long), Washington. Stratigraphy, top to bottom: debris flow; gravel; debris flow; gravel; debris flow; pumice; duff layer (sample); coarse sand-size pumice Y; debris flow. Coll. 1961 by D. R. Crandell and R. D. Miller; subm. by D. R. Crandell. *Comment*: date is minimum for Y pumice in Kautz valley and agrees with age of W-930 (2550 ± 200), from above Y pumice in White River valley (Crandell and others, 1962).

W-1103. Lake City, Washington **>38,000**

Silty peat from layer interbedded with silt, clay, and pumiceous sand, on cutbank of Lake Washington, 12 ft above railroad track, Lake City district, SE¼ SW¼ sec. 15, T 26 N, R 4 E (47° 42′ N Lat, 122° 19′ W Long), Seattle, Washington. Coll. 1962 and subm. by D. R. Mullineaux. *Comment*: age is too great to permit correlation with similar sequence in W Seattle (W-1091, this date list).

Mount Rainier series, Washington

Wood from duff layer on E bank of Kautz Creek, Mount Ranier National Park, NE¼ NW¼ sec. 21, T 15 N, R 8 E (46° 47′ N Lat, 121° 48′ W Long), Washington. Stratigraphy, top to bottom: debris flow (A.D. 1947); duff; debris flow; sand and silt; duff (W-1120); sand; ash W (Crandell and others, 1962); sand; duff (W-1119); sand; debris flow; sand containing balls of pumice Y. Coll. 1961 by D. R. Crandell and R. D. Miller; subm. by D. R. Crandell. *Comment*: dates bracket ash layer W, and substantially agree with W-925 and W-926 (USGS VI; also Hopson and others, 1962).

W-1120. Wood, upper duff layer **290 ± 200**
A.D. 1660

https://doi.org/10.1017/S0033822200010547 Published online by Cambridge University Press

W-1119. Wood, lower duff layer **320 ± 200**
A.D. 1630

W-1116. Nisqually River, Washington **4000 ± 250**
2050 B.C.

Carbon from duff layer from highway cut at W end of bridge over Nisqually River between Longmire and Paradise, Mount Rainier National Park (46° 47′ N Lat, 121° 45′ W Long), Washington. Stratigraphy, top to bottom: till of 1840 moraine of Sigafoos and Hendricks (1961); sand, silt, and charcoal (W-922, USGS VI); mixed sand, silt, pumice Y (W-930 and W-1115, this date list); duff containing charcoal (sample) mudflow, possibly equivalent to Osceola; duff; till; bedrock. Coll. 1961 by D. R. Crandell and R. D. Miller; subm. by D. R. Crandell. *Comment*: age is maximum for pumice Y (Crandell and others, 1962) and minimum for underlying mudflow, which may be equivalent of Osceola mudflow.

W-984. North Bellingham, Washington **12,090 ± 350**
10,140 B.C.

Fibrous peat from highway cut, center of W½ sec. 13, T 38 N, R 2 E (48° 48′ N Lat, 122° 29′ W Long), Whatcom County, Washington. Peat occurs in lenticle between two tills, the upper one marine. Lower till, exposed nearby, is fossiliferous. Coll. 1960 by D. J. Easterbrook, Western Washington College, Bellingham, Washington; subm. by D. R. Crandell. *Comment* (D.J.E.): dates minimum extent of younger marine drift and is minimum for a still younger outwash postdating emergence.

W-1029. Renton, Washington **>38,000**

Compressed wood fragments from peaty clay exposed at top of scarp of Gladding McBean clay pit, SW½ SE½ sec. 17, T 23 N, R 5 E, on S side of Cedar River, Renton (47° 28′ N Lat, 122° 12′ W Long), Washington. Peaty clay underlies Vashon Drift and overlies unoxidized silty till that forms part of a complex of lactustrine deposits and till. Coll. 1960 and subm. by D. R. Mullineaux. *Comment*: this was an attempt to date beginning of Vashon glaciation.

W-1030. South Cascade Glacier, Washington **4700 ± 300**
2750 B.C.

Stem of tree, probably alpine fir, with roots extending into a weathered zone in bedrock, adjacent to S margin of South Cascade Glacier (48° 22′ 13″ N Lat, 121° 04′ 04″ W Long), Washington, ca. 100 ft above terminus. Tree became exposed below melting ice surface in summer 1958. Coll. 1958 and subm. by M. F. Meier. *Comment* (M.F.M.): as site is completely inhospitable to plant life now, South Cascade Glacier was probably much smaller when tree was alive. The glacier then advanced, striated the bedrock, and broke off the tree.

W-1114. Tipsoo Lake, Washington **2660 ± 250**
710 B.C.

Peat from near base of ash sequence, from roadcut S side of Highway 410, 150 yd E of first switchback W of Tipsoo Lake, Mount Rainier National Park (46° 52′ N Lat, 121° 31′ W Long), Washington. Coll. 1961 by D. R.

Crandell and R. D. Miller; subm. by D. R. Crandell. *Comment*: sample higher in sequence gives a conflicting date of 8750 ± 280 (W-950, this date list; also Crandell and others, 1962); the problem is not resolved.

West Point Light series, Washington

Wood and plant fragments from sea cliff 3000 ft SE of West Point Light, Seattle, sec. 16, T 25 N, R 3 E (47° 38′ N Lat, 122° 25′ W Long), Washington. Samples are from sequence known locally as Lawton formation, overlain by Vashon Till. Coll. 1961, 1962 and subm. by D. R. Mullineaux. *Comment* (D.R.M.): sampled sequence was deposited late in nonglacial interval (other dates ca. 28,000 to 35,000 yr, Dorn and others, 1962) that preceded Vashon glaciation. W-1186 is minimum for advance of Vashon Puget lobe to Seattle. Lacustrine silt and clay above sample horizon relate to a lake formed as Puget Lobe blocked Strait of Juan de Fuca.

W-1091. Wood fragments 1 — **20,350 ± 600**
18,400 B.C.

Sample coll. 3 ft above beach of Puget Sound, from lacustrine sand with organic fragments and overlain by silt and clay (horizon of W-1186).

W-1181. Wood fragments 2 — **22,400 ± 800**
20,450 B.C.

Sample W-1091, re-collected and re-run because of importance of date.

W-1186. Plant fragments — **18,100 ± 700**
16,150 B.C.

Sample coll. from lacustrine silt and clay 16,150 B.C., ca. 20 ft above beach, overlain by silt and sand, lacustrine silt and clay, sand, and Vashon Till.

W-1182. West Seattle, Washington — **24,100 ± 900**
22,150 B.C.

Peat from beach about 100 ft W of intersection of Beach Drive and Oregon Streets (47° 34′ N Lat, 122° 24′ W Long), West Seattle, interbedded with clay, silt, and sand that underlie Lawton formation of local usage. Coll. 1962 and subm. by D. R. Mullineaux. *Comment* (D.R.M.): peat dates nonglacial interval (elsewhere preceding ca. 28,000 to 35,000 yr, Dorn and others, 1962). Overlying sediments make up W flank of hill under West Seattle, and are banked against older Pleistocene sediments to E. Peat is slightly older than W-1091 and W-1186 from farther N in Seattle (this date list).

W-997. Whatcom County, Washington — **>38,000**

Shells from seacliff in middle of SW¼ sec. 20, T 39 N, R 1 W (48° 52′ N Lat, 122° 45′ W Long), Whatcom County, Washington, from silty clay, about 20 ft below base of marine till that forms present upland topography. Coll. 1960 by D. J. Easterbrook; subm. by D. R. Crandell. *Comment*: date is maximum for Wisconsin glacial advance that terminated in Georgia Strait.

White River series, Washington

Samples from cut in S valley wall of White River at mouth of Fryingpan Creek, Mount Ranier National Park (46° 54′ N Lat, 121° 36′ W Long),

Washington. W-930, from clay with logs, overlies pumice Y (Crandell and others, 1962). W-1115, from bed of peat and clay, underlies this pumice. Coll. 1960 and 1961 by D. R. Crandell and R. D. Miller; subm. by D. R. Crandell. *Comment*: dates brackets layer Y, which postdates Osceola mudflow.

W-930. Wood from log **2550 ± 200**
600 B.C.

W-1115. Carbon from peaty clay **3500 ± 250**
1550 B.C.

W-950. Yakima Park, Washington **>38,000**

Carbonized wood fragments from cut adjacent to highway between White River entrance and Yakima Park 200 yd W of exposure of columnar andesite (46° 55′ N Lat, 121° 36′ W Long), Mount Rainier National Park, Washington. Sample is from volcanic ash layer overlying till of older valley glacier and underlying till of youngest valley galcier. Coll. 1960 by D. R. Crandell and R. D. Miller; subm. by D. R. Crandell. *Comment* (D.R.C.): date shows older drift is not middle Wisconsin. Late Wisconsin here apparently is represented by short glacial advances.

W-1000. Beartooth Mountains, Wyoming **8600 ± 300**
6650 B.C.

Peat from just above base of peat deposit overlying granitic wash, 1 mi SE of Sawtooth Lake, at top of Beartooth Mountains at alt 9700 ft (44° 54′ N Lat, 109° 27′ W Long), Deep Lake quadrangle, Wyoming. Deposit is within a permafrost zone; "fossil" ice is found 18 in. below surface of peat. Coll. 1957 and subm. by W. G. Pierce. *Comment*: dates beginning of peat deposition; together with sample (W-459, USGS IV) from top of deposit, can be used to determine rate of accumulation.

Bill Dew Ranch series, Wyoming

Calcareous clay cores from Lake 5923, Wind River Mountains, 1 mi N of Bill Dew Ranch, ca. 21 mi NNW Pinedale, Sublette County, sec. 26, T 37 N, R 110 W (43° 31′ N Lat, 110° 01′ W Long), Wyoming. Sediment consists of calcareous and organic clay. Coll. 1959 and subm. by R. C. Bright and H. E. Wright. *Comment*: samples bracket a pronounced climate fluctuation, seen in a pollen diagram by Bright (unpub.). Bottom sample comes from base of a pine minimum, the beginning of the last glaciation of Wind River Mountains. Lower sample was diluted with dead acetylene. Upper sample dates top of pine minimum. See W-914 (USGS VI).

W-998. Core at 808 to 838 cm **20,800 ± 1200**
18,850 B.C.

W-995. Core at 558 to 578 cm **10,230 ± 600**
8280 B.C.

W-1290. Fremont County, Wyoming **>40,000**

Travertine overlying terrace gravel with layers of ash in Wind River Basin, Fremont County CSL sec. 13, T 5 N, R 6 W (43° 34′ N Lat, 109° 25′ W Long), Wyoming. Gravel, on a surface slightly older than Blackwelder's

(1915) Circle surface, is truncated by Bull Lake Moraine. Coll. 1957 and subm. by J. F. Murphy. *Comment* (J.F.M.): date gives limiting age of terrace cutting, ash falls, Bull Lake Glaciation and hot-spring activity.

W-1199. Grass Creek, Wyoming **2080 ± 300**
130 B.C.

Charcoal from fire pit banked by rock, Grass Creek, NE¼ SW¼ SE¼, sec. 29, T 46 N, R 98 W, 6th P.M. (43° 55′ N Lat, 108° 38′ W Long), Hot Springs County, Wyoming. Pit exposed 6 ft below surface by bulldozer trench cut in a fan. Coll. 1962 and subm. by W. L. Rohrer. *Comment*: sample was thought to represent a site of early man, but date is contradictory.

W-1070. Johnny Counts Flat, Wyoming **11,940 ± 500**
9990 B.C.

Molusk shells from fresh-cut trench intersecting 2-ft shell bed at depth 3 ft on Johnny Counts Flat, NW¼ NE¼ SE¼ sec. 32, T 39 N, R 116 W (43° 19′ N Lat, 110° 46′ W Long), Teton County, Wyoming. Coll. 1959 and subm. by J. D. Love. *Comment*: date is minimum for development of flat and maximum for downcutting of Snake River from flat to present river level.

W-1060. Wheatland, Wyoming **9500 ± 400**
7550 B.C.

Snail shells (*Oreohelix subrudis*) in bank of Brush Creek, SW of Wheatland, NE¼ NE¼ SE¼ sec. 22, T 22 N, R 69 W (41° 51′ N Lat, 105° 06′ W Long), Wyoming. Shells in a layer of dark alluvium overlain by alluvium and gravel, and underlain by coarse gravel, sand, and silt. Alluvium in stream bottom is coarse gravel, sand, and silt. Coll. 1958 and subm. by L. W. McGrew. *Comment*: dates downcutting by present drainage system and, as sequence appears to be faulted, age of the fault.

D. Alaska

W-1180. Anangula Island, Alaska **7660 ± 300**
5710 B.C.

Charcoal from Anangula Island, Aleutian Islands (52° 55′ N Lat, 168° 55′ W Long), Alaska, at depth 213 cm in ash with charcoal and obsidian flakes overlying till(?). Coll. 1963 and subm. by R. F. Black, Univ. of Wisconsin, Madison. *Comment* (R.F.B.): date is considered too young; charcoal from same locality dated 8425 ± 275 (I-715). Upper portion of ash was estimated ca. 5000 yr old at Nikolski by a variety of evidence, implying that 125 cm of ash with several paleosols would have had to form on this 5000-yr ash in about 3000 yr. Site is oldest paleo-Aleut site known in Alaska or North American Arctic.

W-1287. Bethel, Alaska **>34,000**

Wood from well No. 2, U. S. Air Force Station 5 mi W of Bethel (60° 50′ N Lat, 161° 55′ W Long), Alaska, from sand that heaved up hole under pressure when drilling reached base of permafrost at 603 ft. Presumably from depth of 603 to 605 ft in deposits of Kuskokwim delta, approx. 430 ft below modern sealevel. Coll. by Alaska District, Corps of Engineers, U. S. Army 1962; subm. by A. J. Feulner. *Comment* (A.J.F.): this is first date obtained from sediments of Yukon-Kuskokwim delta, about 1000 ft thick W of Bethel.

W-1175. Bitters Creek, Alaska **1650 ± 300**
A.D. 260

Peat from middle section of high bluff along Tanana River near Bitters Creek, ¼ mi back from face of bluff along deeply eroded creek valley (63° 10′ N Lat, 142° 07′ W Long), Alaska. Bluff exposes dune sand on alluvial and lacustrine sediments on muck. Coll. 1961 and subm. by A. T. Fernald. *Comment* (A.T.F.): date indicates sample was taken from slumped material probably from near top of bluff.

W-978. Bitters Creek junction, Alaska **2000 ± 250**
50 B.C.

Layered peat from low cutbank of Tanana River floodplain, 1.5 mi above its junction with Bitters Creek (63° 08′ N Lat, 142° 06′ W Long), Alaska, from 7 ft down from top, from 6-in. peat bed underlying volcanic ash and gray silt. Coll. 1959 and subm. by A. T. Fernald. *Comment* (A.T.F.): dates floodplain and antedates widespread ash in E Alaska (Fernald, 1962).

W-1089. Copper Center area, Alaska **4170 ± 250**
2220 B.C.

Decomposed and iron-stained log from gravel pit in intermediate terrace of Copper River at Milepost 103.9, Richardson Highway, 3 mi N of Copper Center (61° 55′ 30″ N Lat, 145° 20′ 00″ W Long), Alaska. Sample coll. 3.5 ft below terrace surface in 5-ft sand and gravel overlying older sand and gravel dated at >38,000 (W-969, this date list). Coll. 1958, subm. and interpreted by D. R. Nichols. *Comment*: sample postdates period of downcutting and indicates slightly more recent age of alluviation, possibly result of a postglacial climatic fluctuation.

W-1155. Copper River, Alaska **3500 ± 300**
1550 B.C.

Log from 50-ft gravel terrace on S side of Copper River, ca. 11 mi SW of Chistochina (62° 27′ N Lat, 145° 50′ W Long), Gulkana B-2 quadrangle, Alaska. Coll. 4 ft below top of gravel unit overlain by gravel and then alluvium with organic material. Coll. 1955 and subm. by O. J. Ferrians, Jr. and H. R. Schmoll. *Comment* (O.J.F.): sample dates an aggradation by Copper River.

W-1163. Gakona River, Alaska **7450 ± 400**
5500 B.C.

Peat from base of surface peat unit at top of bluff on E side of Gakona River about 26 mi from its mouth (62° 37′ 43″ N Lat, 144° 40′ 00″ W Long), Alaska. Surface peat unit, 3 ft thick, overlies unsorted sandy silt with numerous scattered pebbles, cobbles, and boulders (lacustrine diamicton). Coll. 1955, subm., and interpreted by O. J. Ferrians, Jr., and H. R. Schmoll. *Comment*: date is minimum for regression of lake water that covered site during last major glaciation.

W-967. Gulkana Hills area, Alaska **4960 ± 300**
3010 B.C.

Compressed woody particles (cedar?) from W bank of unnamed stream that drains S and is E of Keg Creek, Gulkana Hills area (62° 47′ 10″ N Lat, 146° 04′ 00″ W Long), Alaska. Sample coll. from fine sandy silt with pebbles

and scattered wood fragments, overlain by gravelly sand and underlain by oxidized gravel on till. Coll. 1960 and subm. by D. R. Nichols. *Comment* (D.R.N.): it was expected that date would be minimum for a supposed outwash. Young date, however, suggests that organic material probably was incorporated with gravelly silt by colluvial activity.

W-1213. Imuruk Lake, Alaska **9990 ± 400**
7950 B.C.

Wood from N shore of Granite Bay, Imuruk Lake, Seward Peninsula (65° 37′ N Lat, 163° 07′ W Long), Alaska, from intermediate terrace of Imuruk Lake terrace sequence (Hopkins, 1960), consisting of driftwood in lacustrine peat covered by colluvial(?) sand, silt, and roots. Base of lacustrine peat is 1 to 2 ft above present lake level. Coll. 1961 and subm. by D. M. Hopkins. *Comment* (D.M.H.): intermediate terrace at Imuruk Lake was thought to have been deposited during last (presumably Wisconsin) glaciation (Hopkins, 1960); a beach deposit and wave-cut scarp found higher on slopes was thought to have been covered during a presumably Illinoian glaciation. Both wave-cut scarp and terrace are warped, and outlet of Imuruk Lake was shifted by crustal warping. C^{14} date indicates that faulting that warped terrace and that shifted outlet of Imuruk Lake took place less than 10,000 yr ago.

W-1154. Itivlik Lake, Alaska **4470 ± 300**
2520 B.C.

Wood from north-central Brooks Range, Itivlik Lake (68° 07′ N Lat, 156° 05′ W Long), N Alaska, clayey peat 6 ft below surface of a fan. Fan underlies an important archaeologic site along N shore of Itivlik Lake. Coll. 1961 and subm. by T. D. Hamilton, Univ. of Wisconsin, Madison. *Comment* (T.D.H.): date is maximum for North Point archaeologic site (Irving, 1962) and minimum for Eschooka glaciation—considerably younger than 8000 minimum date cited by Detterman and others (1958). Date supports hypothesis that fan development is related to Hypsithermal recession of permafrost.

W-1157. Kotsina River, Alaska **<200**

Wood from log in clayey silt in low bank E side Kotsina River, 1.2 mi W SW of mouth of Long Glacier River (61° 42′ 45″ N Lat, 144° 17′ 16″ W Long), Alaska. Coll. 1961, subm. and interpreted by L. A. Yehle. *Comment*: mass of silt presumably slid over river bank from adjacent upstream bluff, and incorporated woody material in its basal part.

W-977. Lower Chitina Valley, Alaska **>40,000**

Wood fragments from "massive till" overlain by eolian silt and sand, E side Copper River, 0.3 mi N of mouth of Chitina River, (61° 31′ 10″ N Lat, 144° 23′ 30″ W Long), near Chitina, Alaska. Fragments are predominately lignitized, surrounded to well-rounded, and liberally scattered through the "massive till", which is that described as underlying woody material dating 6330 ± 240 yr (W-844, USGS V). Coll. 1960, subm., and interpreted by L. A. Yehle. *Comment*: date is minimum age from drift at topographically lowest part of Copper River Basin.

W-1159. Lower Chitina Valley, Alaska **4300 ± 300**
2350 B.C.

Wood fragments from near top of 525-ft bluff on N side of Chitina River 1 mi E of mouth of Tebay River (61° 23′ 37″ N Lat, 143° 57′ 36″ W Long), Alaska, alt ca. 1200 ft. Sample is from eolian silt with logs, branches, and various woody fragments, overlying thick section of till, gravel, and sand. Coll. 1961, subm., and interpreted by L. A. Yehle. *Comment*: date is minimum for retreat of Chitina Valley trunk glacier and cessation of local alluviation.

W-1161. Mentasta Basin, Alaska **9650 ± 370**
7700 B.C.

Wood fragments from gravel pit, Mile 76.4 Tok Cutoff section of Glenn Highway, just S of Slana River bridge (62° 51′ N Lat, 143° 42′ W Long), Alaska. Sample is from peat and silt on fine sand on sand and gravel. Coll. 1961, subm., and interpreted by H. R. Schmoll. *Comment*: date is minimum for glacio-alluvial and/or glacio-lacustrine environment in Mentasta Basin. Age is consistent with minimum dates previously obtained in adjoining Copper River Basin, and indicates at least partial contemporaneity of peat deposition here and at Ahtell Creek 12 mi SW.

W-1202. Middleton Island, Alaska **700 ± 250**
A.D. 1250

Peat from beach cliff at 15 ft alt on NW shore of Middleton Island (59° 28′ N Lat, 146° 19′ W Long), Alaska, from thin peat bed about 2 ft below surface of Stage V terrace deposit (Miller, 1953), underlain and overlain by beach gravel and sand. Coll. 1956 by N. J. Willimovsky; subm. by D. J. Miller; interpreted by George Plafker. *Comment*: date is minimum for Stage V terrace deposits on Middleton Island. Based on date, average rate of uplift in past 700 yr is ca. 0.021 ft/yr, comparing with ca. 0.04 ft/yr calculated from C^{14} dates of marine terrace deposits on tectonically active mainland (W-369 and W-405, USGS IV). If rate of uplift was uniform, Middleton Island cannot have emerged less than 5000 yr ago.

W-1205. Middleton Island landing field, Alaska **600 ± 250**
A.D. 1350

Peat from NW end of landing field at alt ca. 65 ft (59° 27′ N Lat, 146° 18′ W Long), Middleton Island, Alaska, from 14-in. peat bed in Stage III terrace deposits (Miller, 1953), overlain by gravel and underlain by gravel and sand. Coll. 1956 by N. J. Willimovsky; subm. by D. J. Miller; interpreted by George Plafker. *Comment*: sample was expected to date Stage III terrace on Middleton Island, at alt 65 ft, but is too young (cf. W-1202, 700 ± 250 on this date list). It suggests one formed long after Stage III terrace emerged from sea and approx. 100 yr before accumulation of peat on Stage V terrace.

W-1210. Moose Creek, Alaska **2560 ± 250**
610 B.C.

Peat from cutbank of Moose Creek floodplain, 1.3 mi S of Northway Airport (62° 57′ N Lat, 141° 56′ W Long), Alaska, from peat bed, 4.3 ft down from top of bank, which underlies silt, clay, and organic material, in part a pond or lake deposit. Coll. 1961 and subm. by A. T. Fernald. *Comment*

(A.T.F.): dates floodplain at this locality, which continued until after deposition of widespread volcanic ash (Fernald, 1962).

W-1206. Nabesna River, Alaska **8200 ± 300 / 6250 B.C.**

Woody material from 6.5 ft down from top of 60-ft bluff in 2-in. organic layer that overlies and underlies dune sand, along Tanana River 3 mi NW of its junction with Nabesna River (63° 04′ N Lat, 140° 57′ W Long), Alaska. Coll. 1959 and subm. by A. T. Fernald. *Comment* (A.T.F.): dates local stabilization of dunes at this place, postdates thick accumulation of dune sand, and antedates continued eolian activity.

W-980. Nabesna River junction, Alaska **10,230 ± 300 / 8280 B.C.**

Brown peat from 6-in. bed of peat with clam shells 14 ft below top of 40-ft bluff along Tanana River, 5 mi NW of its junction with Nabesna River (63° 05′ N Lat, 141° 59′ W Long), Alaska. Bed is overlain by silt, sand, organic material, and fine rubble; volcanic ash near top. Coll. 1961 and subm. by A. T. Fernald. *Comment* (A.T.F.): previous dates on the ash (Fernald, 1962) are 1520 ± 100 (I-276), 1750 ± 110 (I-275), and 2000 ± 250 (W-978, this date list). This date and date of ash bracket upper strata in bluff. Sample existence of pond or lake here.

W-1165. Northeastern Copper River basin, Alaska **1630 ± 350 / A.D. 320**

Peat from eolian deposits at top of bluff on W side of Gakona River 0.3 mi upstream from its mouth (62° 18′ N Lat, 145° 18′ W Long), Alaska. Stratigraphic section, from base upward, is as follows: lacustrine diamicton; 16 in. of peat with interbedded eolian fine sand (lowermost peat from this unit previously dated at 9400 ± 300, W-714, USGS V); 6 ft of eolian fine sand; 14 in. of peat with interbedded eolian fine sand (W-1165 is from uppermost 1 in. of this unit); 4 ft of eolian fine sand; and at surface, 3 ft of peat and woody material interbedded with eolian fine sand. Coll. 1958, subm., and interpreted by O. J. Ferrians, Jr., and H. R. Schmoll. *Comment*: sample dates beginning of period of accelerated eolian deposition.

Old Slana Roadhouse series, Alaska

Wood and peat from exposure on N side of Copper River, 0.65 mi W of mouth of Slana River, near abandoned buildings of Old Slana Roadhouse (62° 42′ N Lat, 143° 59′ W Long), Alaska. Section from River upward is lacustrine: (1) 30 ft massive silt; (2) and (3) 25 silt and fine sand with graded beds; (4) 10 ft laminated silt; (5) and (6) 50 ft sand grading upward into gravel; (7) 5 ft laminated sand; and (8) surface peat. W-1134 was coll. from lower part of unit (5); W-1162 was coll. from top of unit (3). Coll. 1960 and 1961 by H. R. Schmoll, R. H. Bennett, and O. J. Ferrians, Jr.; subm. and interpreted by H. R. Schmoll. *Comment*: W-1134, believed contemporaneous with inclosing sediments, indicates that upper part of section (units 5 to 7) was deposited during last major glaciation. Site, approx. 35 mi in front of present-day Copper Glacier, was thus occupied by glacial lake rather than glacier ice during much, if not all, of this glaciation. Consequently, a similar environment

prevailed in Copper River Basin to W and lower Slana Valley to N. W-1162 probably represents older, reworked material since the peat had been compressed and hardened prior to being rounded.

W-1134. Wood **17,600 ± 400**
15,650 B.C.

Small fragments of wood, scattered through lower part of unit (5).

W-1162. Peat **>42,000**

Two rounded fragments of compacted peat, from top of unit (3).

W-1169. Pickerel Lakes, Alaska **2000 ± 300**
50 B.C.

Organic material from shallow excavation in morainal lobe on N side of Pickerel Lakes, near Nabesna River, at base of Alaska Range (62° 33′ N Lat, 142° 23′ W Long), Alaska, 18 in. down in frozen silt, below 4-in. layer of volcanic ash. Coll. 1960 and subm. by A. T. Fernald. *Comment* (A.T.F.): sample antedates widespread volcanic ash in E Alaska (Fernald, 1962), and postdates morainal lobe.

Poplar Grove series, Alaska

Peat from deep excavation in gravel pit at Poplar Grove, Mile 136.7, Richardson Highway, NE Copper River basin (62° 23′ 54″ N Lat, 145° 22′ 48″ W Long), Alaska. Stratigraphy, base to top: sandy silt; peat with interbedded silt and sand (W-1164 is from lowermost 2 in. of peat bed and W-985 from topmost 2 in.); gravel and sand. Coll. 1958, subm., and interpreted by O. J. Ferrians, Jr. and H. R. Schmoll. *Comment*: samples bracket peat accumulation preceded and followed by alluviation. Other samples from this area are W-297 (USGS III), W-377 and W-487 (USGS IV), W-531 and W-714 (USGS V).

W-985. Top of peat unit **6960 ± 290**
5010 B.C.

W-1164. Base of peat unit **7880 ± 400**
5930 B.C.

W-1207. Porcupine Creek, Alaska **10,150 ± 400**
8200 B.C.

Peat from cut bank of local terrace along Porcupine Creek, between Tanana River and Taylor Highway, 1.8 mi above its junction with Tanana River (63° 23′ N Lat, 142° 38′ W Long), Alaska, from 8-in. peat layer, 22 ft below top of bank overlying sand and underlying peat, sand, and rubble. Volcanic ash lies near top. Coll. 1961 and subm. by A. T. Fernald. *Comment*: dates on the ash (Fernald, 1962) are 1520 ± 100 (I-276), 1750 ± 110 (I-275), and 2000 ± 250 (W-978, this date list). Development of local terrace is bracketed between dates of W-1207 and age of ash.

W-1168. Porcupine Creek junction, Alaska **>38,000**

Wood fragments from high bluff along Porcupine Creek 1 mi above its junction with Tanana River between Tanana River and Taylor Highway (63°

23′ N Lat, 142° 40′ W Long), Alaska, from silt, sand, and fine granite rubble 55 ft below top of 75-ft bluff. Coll. 1961 and subm. by A. T. Fernald. *Comment* (A.T.F.): date is minimum for aggradation.

Riverside bluff series, Alaska

Wood and organic material from 115-ft bluff (Riverside bluff) along Tanana River near Bitters Creek (63° 10′ N Lat, 142° 06′ W Long), Alaska. Coll. 1959, 1961 and subm. by A. T. Fernald. *Comment*: samples date major aggradation. W-979 and W-1167 bracket deposition of uppermost part of section; W-976 dates base of section.

W-979. Tree stump **5380 ± 260**
3430 B.C.

Coll. ¼ mi back from bluff face, along deep valley, 9.7 ft below top of bluff. In 8-in. organic layer that overlies and underlies silt, sand, organic material, and fine granite rubble with volcanic ash near top. These units overlie dune sand.

W-1167. Peat and wood **6200 ± 300**
4250 B.C.

Peat and woody material 16 ft below top of same bluff from 1-in. layer within silt, sand, organic material, and fine granite rubble.

W-1174. Organic debris **25,800 ± 800**
23,850 B.C.

Fine organic debris from 45 ft below top of same bluff within thick section of stratified silt, sand, and fine to coarse rubble overlain by dune sand.

W-976. Wood **>42,000**

Wood from basal section of bluff, in 2.5-ft layer of muck unconformably overlain by thick section of stratified silt, sand, and fine to coarse rubble.

W-1075. Slana—Tok area, Alaska **440 ± 250**
A.D. 1510

Wood from small pit E side of dissected fan about 1½ mi W of Mineral Lake, Mile 88.4 Tok Cutoff section of Glenn Highway (62° 56′ N Lat, 143° 25′ W Long), Alaska. Two organic zones are interbedded in angular sandy gravel, upper zone ca. 5 ft and lower zone ca. 12 ft below surface. Vertical tree stumps as much as 6 ft high and 12 in. in diam (larger than modern trees) extend upward through gravel from each zone. Sampled wood is from vertical member of lower zone. Coll. 1958 by O. J. Ferrians, Jr., and H. R. Schmoll; subm. and interpreted by H. R. Schmoll. *Comment*: dates inundation of a forest by renewed fan deposition, possibly during "lesser ice age"—Tunnel II glacial advance of Karlstrom (1960).

W-968. Southeastern Copper River Basin, Alaska **5160 ± 300**
3210 B.C.

Peat from top of morainal hillock 9 mi E of Chitina (61° 31′ 04″ N Lat, 144° 10′ 15″ W Long), Alaska, from lentil in sand overlying silty sand with an 18-in. soil, and underlying gravelly silt with a thin soil and 18 in. of peat. Coll. 1958 and subm. by D. R. Nichols. *Comment* (D.R.N.): dates deposition that followed a long period of stabilization.

W-969. Southeastern Copper River Basin, Alaska >38,000

Partially decomposed, iron-stained spruce(?) log from pit in terrace gravel at Mile 103.9 Richardson Highway, 2 mi N of Copper Center (62° 59′ 20″ N Lat, 145° 20′ 00″ W Long), Alaska. From near base of coarse sand and gravel; underlain by coarse sand and gravel and overlain by a boulder bed, sand and gravel, with iron staining, and with twigs and worn pieces of wood. Coll. 1958 and subm. by D. R. Nichols. *Comment* (D.R.N.): dates outwash or alluvium antedating last major glaciation.

Sullivan Creek series, Alaska

Wood from drain at SE corner of Sullivan placer pit (65° 05′ N Lat, 150° 53′ W Long), central Alaska. Stratigraphy, top to base: (A) peaty silt; (B) channel deposits sand and fine gravel; (C) peaty silt; (D) pebble gravel; bedrock. Coll. 1959 to 1961 by Bond Taber and D. M. Hopkins; subm. by Hopkins. *Comment*: a fossil tundra rodent fauna, and bones of extinct large mammals including horse, bison, and mammoth were found in Units A and B. Dates indicate that fossils were deposited in present positions very recently, but must originally have been derived from upper Pleistocene sediments in immediate area (Repenning and others, in press).

W-1108. Sullivan Creek, birch log 6730 ± 260
4780 B.C.

Beaver-gnawed wood from (A) (W-733, USGS V, 6820 ± 200 from same horizon).

W-1113. Sullivan Creek, base of unit >38,000

Wood from 1 ft above base of (A).

W-1106. Sullivan Creek, spruce stump from (B) <200

W-1111. Sullivan Creek, beaver-chewed wood (B) <200

W-937. Sullivan Creek, wood from (B) 200 ± 200
A.D. 1750

From same horizon as W-891, USGS VI, 2520 ± 200.

W-1170. Tanana River Valley, Alaska 6930 ± 300
4980 B.C.

Organic silt from 4-in. bed 15 ft down from top of 40-ft bluff at junction of Porcupine Creek and Tanana River (63° 23′ N Lat, 142° 41′ W Long), Alaska. Upper part is wind-blown silt with 3 in. of volcanic ash 1.5 ft below top; lower part is stratified sand and granite rubble. Coll. 1961 and subm. by A. T. Fernald. *Comment* (A.T.F.): dates of the ash (Fernald, 1962) are 1520 ± 100 (I-276), 1750 ± 110 (I-275), and 2000 ± 250 (W-978, this date list). Upper section of bluff is bracketed by dates of W-1170 and of the ash.

W-975. Tangle Lakes area, Alaska 9720 ± 320
7770 B.C.

Compressed twigs and branches at base of sandy bed in exposure on N bank of Rock Creek, about 2000 ft above its mouth in Tangle Lakes (63° 02′ 36″ N Lat, 146° 03′ 40″ W Long), Alaska. Bed consists of laminated sand with organic zones; it is overlain by massive sand with organic and oxidized zones,

and overlies sand, silt, and clayey silt, and, at river level, gravel. Coll. 1960 and subm. by D. R. Nichols. *Comment* (D.R.N.): sample probably is part of a lake filling in ice-contact deposits of last major glaciation.

W-1212. Tenmile Creek, Alaska — **12,400 ± 450 / 10,450 B.C.**

Woody material from 5.5 ft down from top of excavation along Alaska Highway, in thin organic zone within dune sand, at Tenmile Creek (62° 56′ N Lat, 141° 33′ W Long), Alaska. Coll. 1959 and subm. by A. T. Fernald. *Comment* (A.T.F.): dates local stabilization of dunes and antedates renewed eolian activity.

W-1173. Tetlin River, Alaska — **6170 ± 300 / 4220 B.C.**

Wood fragments from along Tetlin River, 2 mi SW of Tetlin Village (63° 07′ N Lat, 142° 34′ W Long), Alaska, 9.5 ft below top of bluff, in sand and gravel overlain by lacustrine silt and clay. Coll. 1959 by A. T. Fernald. *Comment* (A.T.F.): dates floodplain development and antedates a pond or lake.

W-1171. Tetlin Village, Alaska — **1550 ± 300 / A.D. 400**

Peat from 5-ft bluff bordering lake in flatlands along Kafukna River, 2.5 mi SE of Tetlin Village (63° 07′ N Lat, 142° 28′ W Long), Alaska, from peat layer, 2.5 ft below top of bluff, overlying sand and underlying lacustrine silt and clay. Coll. 1961 and subm. by A. T. Fernald. *Comment* (A.T.F.): dates pond or lake.

W-1209. Scottie Creek Lodge, Alaska — **3120 ± 250 / 1170 B.C.**

Organic silt from road cut along Alaska Highway in re-entrant valley on side of bedrock hill, 2 mi W NW of Scottie Creek Lodge (62° 41′ N Lat, 141° 07′ W Long), Alaska. From 3 ft below top, in irregular zone within reworked windblown silt and fine rubble on E side (leeward) of bedrock spur. Volcanic ash lies near top. Coll. 1961 and subm. by A. T. Fernald. *Comment*: dates of the ash (Fernald, 1962): 1520 ± 100 (I-276), 1750 ± 110 (I-275), and 2000 ± 250 (W-978, this date list). Upper section is bracketed between date of 1209 and that of the ash.

W-1086. Upper Susitna River area, Alaska — **3510 ± 250 / 1560 B.C.**

Stump from base of peat bed exposed on W tributary of lower Nowater Creek (63° 03′ N Lat, 147° 23′ W Long), Alaska. Peat underlies volcanic ash and organic zones in silt 5 ft below terrace surface, and is thought to overlie till. Till forms hummocky ground moraine behind a major end moraine of last major glaciation. Coll. 1953 by D. M. Hopkins; subm. and interpreted by D. R. Nichols. *Comment*: probably dates alluviation that occurred long after last major glaciation, rather than near-minimum date of retreat, as previously thought.

W-980. Upper Tanana River Valley, Alaska — **10,230 ± 300 / 8280 B.C.**

Brown peat from 40-ft bluff along Tanana River (63° 05′ N Lat, 141° 59′ W Long), Alaska. Peat layer, containing aquatic shells, is 14 ft below top of

bluff and is overlain by lacustrine silt with shells, sand, and granitic grit and overlies sand. Coll. 1959 and subm. by A. T. Fernald. *Comment*: dates lake that existed here ca. 25 ft above present river.

W-978. Upper Tanana River Valley, Alaska **2000 ± 250**
50 B.C.

Peat from low floodplain terrace along Tanana River (63° 08′ N Lat, 142° 06′ W Long), Alaska. Peat, in alluvium, immediately underlies Capp's ash 2.5 ft thick, and more peat and alluvium. Coll. 1959 and subm. by A. T. Fernald. *Comment*: dates formation of Tanana River floodplain and is maximum age for Capp's ash (Fernald, 1962).

Clear Creek series, Kuskulana River, Alaska

Wood from three different discontinuous lenses in a 125 ft high river bluff ¼ mi SW of mouth Clear Creek along NW side of Kuskulana River (SW¼, SE¼, sec. 29, T 3 S, R 9 E, Copper River Meridian, McCarthy C-8 1:63,360 scale quadrangle) (61° 34′ 39″ N Lat, 143° 48′ 45″ W Long), Alaska, 21 mi ENE of Chitina, Alaska. Partial section: (C) moss and peat; (B) outwash gravel and sand with wood near base; (A) lacustrine silt with organic matter near top. Coll. 1961 by L. A. Yehle; subm. 1962 by L. A. Yehle. *Comment* (L.A.Y.): deglaciation following last major glacial maximum created a lake behind a moraine. W-1247 dates closing stages of the lake. W-1246 is minimum date for post-lake outwash. Vegetation was established on the outwash before date of sample W-1156. Accumulation of surficial peat on floor of master Chitina Valley began before 4300 ± 300 yr B.P. (W-1159, this list).

W-1156. Wood from near base of Unit C **1420 ± 280**
A.D. 530

W-1246. Wood from near base of Unit B **3890 ± 300**
1940 B.C.

W-1247. Wood from top of Unit A **7010 ± 350**
5060 B.C.

E. Miscellaneous

W-949. La Paz, Bolivia **>38,000**

Lignitic material from Purapurani Formation from best exposed section in upper part of La Paz River valley (16° 30′ S Lat, 68° 25′ W Long), La Paz, Bolivia. Section, from top to bottom, is as follows: Milluni Drift; Purapurani Formation; Calvario Drift; Chijini Ash; La Paz Formation. Coll. 1960 by Ernest Dobrovolny and R. W. Lemke; subm. by Ernest Dobrovolny. *Comment*: section will become the type from the Pleistocene of Bolivia.

W-948. Puerto Montt, Chile **15,400 ± 400**
13,400 B.C.

Wood from road cut along shore near East Pelluco Creek, 3 km SE of Puerto Montt (41° 31′ S Lat, 73° 30′ W Long), Chile (Dobrovolny and Lemke, 1961). Coll. near base (1 m above road) of lacustrine laminated silt and clay underlain by gravel and locally by till. Coll. 1960 by R. W. Lemke and Ernest Dobrovolny; subm. by R. W. Lemke. *Comment* (R.W.L.): sample is related to latest glaciation of area.

W-1023. Gernmuhle am Sammerberg, Germany **>35,000**

Compressed peat from re-entrant of slope above E side of canyon of Inn River where it debouches onto Alpine foreland at alt 585 m, Gernmuhle am Sammerberg, Oberbayern (47° 40′ N Lat, 12° 15′ E Long), Germany. Sample coll. from peat at base of lake clay (varved in part) that are overlain by Hauptwürm till and Würm recessional deltaic gravel. Coll. 1960 and subm. by G. Richmond.

W-1008. Grossweil, Germany **>38,000**

Wood from Grossweil near Kochel See, Oberbayern (47° 40′ N Lat, 11° 20′ E Long), Germany, from upper 2-ft layer of compressed peat and wood underlying gravel beneath Würm till. Layer overlies, successively, clay, lower peat layer, sand and gravel, and Riss(?) till. Pollen of upper layer suggests Würm glaciation, that of lower layer a cool Riss/Würm interglacial (Reich, 1953). Coll. 1960 and subm. by G. Richmond.

W-1002. Hormating, Germany **>38,000**

German alpine foreland compressed wood from Hormating, Oberbayern (47° 55′ N Lat, 12° 00′ E Long), Germany, from peat bed at base of water-laid silt that overlies Laufen gravel and is overlain by upper Laufen gravel, in drumlin covered with Hauptwürm till (Ebers, 1960). Coll. 1960 and subm. by G. Richmond. *Comment* (G.R.): peat may not be in same stratigraphic position as that from this locality dated 45,300 ± 1000 (Gro-2593). In another part of exposure a layer of soil reworked by solifluction separates upper from lower gravel. Peat is believed to be slightly younger than soil layer.

North Greenland series

Marine shells and driftwood from emerged marine terraces along E and NE of Greenland from Hekla Sund (80° N) to N end of Greenland. Coll. 1957, 1960 and subm. by W. E. Davies. *Comment* (W.E.D.): well-developed marine terrace systems show variations in crustal uplift with maximum uplift extending from western Independence Fjord SE to Ingolf Fjord, parallel to and about 50 mi beyond the present front of the Greenland Ice sheet. Uplift in the Independence Fjord area is about 265 ft, dropping to 190 ft in the Ingolf Fjord area. The isobasic gradient SW of the maximum is 4 to 5 ft per mi; to the N it is 1 ft per mi with maximum uplift of 30 ft or less along the Arctic Ocean.

W-1072. Ingolf Fjord **6650 ± 600**
4700 B.C.

Marine shells, primarily *Hiatella arctica* and *Mya truncata*, from marine terrace, 2 mi S of Naesen, Ingolf Fjord (80° 25′ N Lat, 20° 07′ W Long), NE Greenland. Shells were from upper 4 ft of marine silt at alt ca. 175 ft.

W-1063. Danmark Fjord **6035 ± 300**
4085 B.C.

Marine shells, *Hiatella arctica*, 1 mi N of Kap Renaissance on marine terrace at alt 135 ft (81° 05′ N Lat, 21° 50′ W Long), N Greenland. From uppermost 4 ft of marine clayey silt.

W-1066. Station Nord **4200 ± 320**
2250 B.C.

Driftwood from marine terrace adjacent to airstrip at Station Nord (81° 36′ N Lat, 16° 41′ W Long), N Greenland; imbedded in gravel at alt 20 ft.

W-1073. Brønlund Fjord **4970 ± 260**
3020 B.C.

Driftwood from alt 35 ft on surface of marine terrace, 2 mi NE of Kap Harald Moltke (82° 10′ N Lat, 29° 50′ W Long), E end of Brønlund Fjord, N Greenland. Terrace is formed of silt with thin veneer of stones.

W-1067. Kap Clarence Wyckoff, 30 ft **6100 ± 1000**
4150 B.C.

Marine shells, *Hiatella arctica*, SE side of Kap Clarence Wyckoff (82° 48′ N Lat, 22° 58′ W Long), N Greenland, imbedded in gravel at alt 30 ft.

W-1076. Kap Clarence Wyckoff, 25 ft **6880 ± 300**
4930 B.C.

Marine shells, primarily *Hiatella arctica*, from N side of Kap Wyckoff from storm ridge of beach (82° 50′ N Lat, 23° 00′ W Long), N Greenland, imbedded in gravel at alt 30 ft.

W-1083. Kap Clarence Wyckoff, 40 ft **7060 ± 300**
5110 B.C.

Marine shells, *Hiatella arctica* and *Mya truncata*, from locality of W-1076 at alt 40 ft.

W-1084. Depot Bay **5980 ± 300**
4030 B.C.

Marine shells, primarily *Hiatella arctica*, on marine gravel beach at alt 53 ft 300 ft E of head of Depot Bay, Frederick E. Hyde Fjord (83° 08′ N Lat, 26° 25′ W Long), N Greenland.

W-1090. Kaffeklubben, Ø, 35 ft **7730 ± 400**
5780 B.C.

Marine shells, *Hiatella arctica*, from NE side of Kaffeklubben Ø at alt 35 ft (83° 36′ N Lat, 30° 30′ W Long), N Greenland, imbedded in gravel on small marine terrace.

W-1088. Kaffeklubben, Ø, 10 ft **1200 ± 300**
A.D. 750

Shells, primarily *Mya truncata* and *Astarte elliptica*, from uppermost 2 ft of marine silt in marine terrace at S end of Kaffeklubben Ø, alt 10 ft (83° 36′ N Lat, 30° 30′ W Long), N Greenland.

Kau series, Hawaii

Fragments of charcoal coll. on Mamalahoa Highway, 0.5 mi SW of Kau boundary of Hawaii Natl. Park (19° 21′ 54″ N Lat, 155° 23′ 06″ W Long), Island of Hawaii, in sandy, silty ash in uppermost 6 in. of Pahala ash, the principal marker bed of Island of Hawaii, overlain by black sandy ash. Coll. 1956 and subm. by G. A. MacDonald, Univ. of Hawaii, Honolulu. *Comment* (G.A.M.): it was believed that samples were from same horizon, but either W-1046 must have come from lower in the section or W-1047 was contaminated with younger C.

W-1046. Charcoal, early collection **4030 ± 350**
2080 B.C.

Coll. 1926 by T. A. Jaggar and W. C. Mendenhall; subm. by G. A. MacDonald.

W-1047. Charcoal, later collection **600 ± 250**
A.D. 1350

Pianico-Sellere series, Italy

Wood and mard from Pianico-Sellere, NW of Lago d'Iseo, at foot of Alps (45° 50′ N Lat, 10° E Long), N Italy, from lower part of Riss/Würm interglacial lake marl (coll. at stream level) containing leaves of box, apple, rhododendron, sycamore, and hornbeam. Marl is overlain by Würm till and grades laterally into sliderock and fan alluvium on valley slopes. Coll. 1960 and subm. by G. Richmond.

W-1009. Wood **>38,000**

W-1010. Marl **>35,000**

W-1166. Sperlonga, Italy **1650 ± 350**
A.D. 300

Charcoal from a hearth in cave above Via Flacca and Galleria Capovento near Sperlonga, Province of Latina (41° 20′ N Lat, 13° 30′ W Long), Italy. Sample was coll. on surface of cave deposit consisting of cultural complexes belonging to neoeneolithic (Segre and Ascenzi, 1956; Alciati and Natali, 1962). Coll. 1958 and subm. by A. Ascenzi, Citta Univ., Rome, Italy. *Comment* (A.A.): C^{14} date, too young by several thousand years, indicates that material of Sperlonga cave has been reworked. Sample was dated as cross-check on obsidian dating method.

Panama Canal Zone series, Panama

Black organic muck and wood from Canal Zone, Panama (Woodring, 1957), coll. from core holes within Pleistocene muck, generally saturated with water. Coll. 1957 and 1958 by R. H. Stewart; subm. by W. P. Woodring.

W-958. Core Hole BBR-53, depth 32.7 ft **6720 ± 300**
4770 B.C.

Black organic muck from W side of Pacific entrance of Panama Canal, 0.6 mi WNW of Point Farfan (8° 56′ N Lat, 79° 34′ W Long), Canal Zone, from 13.7 ft below top of Pleistocene muck which is 32.5 ft thick.

W-959. Core Hole BBR-125, depth 73.2 to 73.5 ft **7680 ± 300**
5730 B.C.

Black organic muck from E side of Pacific entrance of Panama Canal, 0.3 mi E of terminus of Thatcher Ferry (8° 57′ N Lat, 79° 34′ W Long), Canal Zone, from 4.8 to 5.1 ft above base of Pleistocene muck which is 34.7 ft thick.

W-960. Core Hole 2, depth 35 ft **7240 ± 300**
5290 B.C.

Wood from Mindi Road Bridge Exploration Core Hole 2, depth 35 ft, Mindi Dairy Farm, 0.15 mi E of Bolivar Road, 4 mi S of Colon (9° 18′ N Lat,

79° 54′ W Long), Canal Zone, from 5 ft below top of Pleistocene muck which is 10 ft thick.

General Comment: samples record rate of sealevel rise, as sediment is believed to represent basin filling. Rates and depths agree with results from similar samples from Gatun Lake (UCLA 183, 184, 185, 186, UCLA II) and compares favorably with studies along Atlantic coast.

W-1036. Rio Grande de Manati, Puerto Rico **3300 ± 300**
1350 B.C.

Carbonized wood from black organic muck from E side of Rio Grande de Manati, near Punta Manati (18° 29′ N Lat, 66° 31′ W Long), Puerto Rico, from two logs ca. 6 ft below water level (approx. sealevel) and ca. 10 ft below land surface. Logs were in black organic muck which formed in old river channel. Coll. 1959 and subm. by R. P. Briggs. *Comment* (R.P.B.): because deposits in which logs were found are associated with alluvium near present sealevel and with existing swamps, deposition took place after Puerto Rican land mass assumed its present position relative to sealevel.

W-1035. Ishigaki, Ryukyu Islands **8500 ± 600**
6550 B.C.

Mamal bones probably from domesticated pig, from Todorokigawa fossil site, Ishigaki-shima (24° 30′ N Lat, 124° 15′ E Long), Ryukyu Islands, from stream terrace of silt built onto a nip in the post-Miocene limestone cliffs. Sediments contain layers of small land snails and mammal bones. Since deposition, the river has cut down 40 ft. Coll. 1956 by Helen L. Foster and H. G. May; subm. by F. C. Whitmore. *Comment*: this may be one of earliest examples of domestication. Same locality was dated by bones (W-588, 8500 ± 500, USGS V) previously; this sample was run as a check.

Saudi Arabian ground water series

Bicarbonate and CO_2 extracted from deep well water from Saudi Arabia, analyzed to determine rate of recharge. Samples are part of series of well waters previously dated (W-887 to 889, 894, 904, USGS VI) and discussed (Thatcher, Rubin, and Brown, 1961). Coll. 1960 by Arabian-American Oil Co.; subm. by G. F. Brown. *Comment*: W-953 agrees with ages of other samples of series, representing charging of aquifers by high rainfall of pluvial occurring at climax of Wisconsin Glaciation. W-955, however, must represent later recharge.

W-953. Jalamid **21,500 ± 1500**
19,550 B.C.

Well water from tapline WW 5A-2, in area of Jalamid (31° 17′ N Lat, 40° 05′ E Long), Saudi Arabia, depth 1161 to 1431 ft in sandstone thought to be of Cretaceous age; water, 86° F.

W-955. Wadi al Batin **6300 ± 1000**
4350 B.C.

Well water from Tapline WW 3-5, in area of Wadi al Batin (28° 22′ N Lat, 45° 56′ E Long), Saudi Arabia, depth 190 to 345 ft in sand of Miocene age.

Kingston series, South Australia

Fine-grained mixture of dolomite and calcite from Lagoon M, N of Kingston (36° 40′ S Lat, 139° 54′ E Long), South Australia (Alderman and Skinner, 1957). Coll. 1957 by H. C. W. Skinner; subm. by B. J. Skinner. *Comment*: samples are believed to be primary precipitates from saline lake water. Age equivalents indicate accumulation rate of ca. 0.2 mm of carbonate sediment per yr (Skinner, Skinner, and Rubin, 1963). No C^{13} measurements made, no Δ estimate given.

W-1101. Carbonate, 1 to 2 in. interval $\delta C^{14} = -75‰$

Calcite and dolomite from interval 1 to 2 in. below surface. Age equivalent to less than 600 yr. Small sample.

W-1100. Carbonate, 19 to 20 in. interval $\delta C^{14} = -312 \pm 75‰$

Calcite with some dolomite from interval 19 to 20 in. below surface. Age equivalent to 3000 ± 600 yr. Small sample.

W-1016. Taipei, Taiwan **4800 ± 300**
2850 B.C.

Dried, porous, carbonized wood plus smaller, flatter carbonaceous remnants of wood from water purification site S side of Taipei, along margin of former lake (25° 01′ N Lat, 121° 32′ E Long), Taiwan, from mud ca. 3 m below surface. Coll. 1960 and subm. by Sam Rosenblum. *Comment* (S.R.): uppermost portion of the Taipei Basin lake deposits is related to a lake formed by volcanic mudflow now standing as a water gap between basin and Taiwan Strait. Date is minimum for mudflow that may represent last mobile volcanism in area.

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