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U. S. GEOLOGICAL SURVEY RADIOCARBON DATES XI*

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This list contains the results of measurements made during 1967 and 1968. Samples are counted in the form of acetylene gas, as previously, and ages computed on the basis of the Libby half-life, 5568 ± 30 yr. The error listed, always larger than the one-sigma statistical counting error commonly used, takes into account variable laboratory factors, but does not include external (field or atmospheric) variations.

Unless otherwise stated, collectors of all samples are members of the U. S. Geological Survey. The authors are indebted to Jeanne Lambert, who assisted in the preparation of the samples.

SAMPLE DESCRIPTIONS

A. Eastern U.S.

W-2170. Wilmington Canyon, Atlantic Ocean — **20,400 ± 800 / 18,450 B.C.**

Aragonite from clear layers in aragonite-cemented sandstone from continental slope near Wilmington Canyon (38° 47.5′ N Lat, 73° 02.6′ W Long), Atlantic Ocean; depth 320 m. Coll. 1968 by H. W. Climm, Jr.; subm. by J. C. Hathaway. *Comment* (J.C.H.): age is maximum for organic matter from which aragonite carbon was derived. δC^{13} values for this carbon ca. −60‰. Quaternary methane, oxidized chemically or microbiologically to CO_2, is the proposed carbon source for the aragonite.

Norfolk series, Connecticut

Charcoal interbedded with stratified drift, thought to be ice-contact delta, of last glaciation. Exposed in Mulville Bros. Pit (41° 59′ 15″ N Lat, 73° 12′ 41″ W Long), Norfolk, Litchfield Co., Connecticut. Coll. 1967 and subm. by R. L. Melvin.

General Comment (R.L.M.): charcoal occurs in deposits from last deglaciation of S New England. However, dates indicate material antedates last glaciation of this area. Possibly material was picked up from older organic sediment by advancing ice and redeposited during deglaciation.

W-2043. — **28,000 ± 1000 / 26,050 B.C.**

Depth 12 ft 2 in. to 12 ft 6 in. Charcoal from large lenticular mass of black organic material.

W-2174. — **>33,000**

Depth 10 ft 3½ in. to 11 ft 1½ in. Charcoal from thick organic layer in sand.

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

W-2083. Panama City, Florida **>27,000**

Wood (*Pinus*) protruding above humate sand layer at −30 ft in entrance channel between Gulf of Mexico and St. Andrew Bay (ca. 30° 09′ N Lat, 85° 41′ W Long), near Panama City, Florida. Coll. 1967 by G. G. Salsman; subm. by V. E. Swanson. *Comment*: humate sand layers are believed by the collector and submitter to represent a still-stand of the sea at that level.

12,380 ± 350

W-2117. East Boothbay, Maine **10,430 B.C.**

Shells (*Mytilus edulis*) from cut on Rte. 96 (43° 51′ 50″ N Lat, 69° 38′ 40″ W Long), East Boothbay, Maine; elev. 110 ft MSL. Coll. 1967 and subm. by R. L. Dow, Dept. Sea and Shore Fisheries, Augusta, Maine. *Comment*: morphology of shells and presence of fragments of warmer-water ribbed mussel suggest animals lived during early climatic optimum, but date indicates they are immediate-Postglacial.

W-2081. Piscataqua River, New Hampshire-Maine **Modern**

Spartina peat from subtidal bottom of Piscataqua R. (ca. 43° 10′ N Lat, 70° 50′ W Long), New Hampshire-Maine. Coll. 1966 and subm. by R. L. Dow. *Comment* (R.L.D.): sample originally thought to have grown when sea level was 8 to 9 ft lower than at present.

6260 ± 300

W-2200. Kittatinny Mountain, New Jersey **4310 B.C.**

Brown, fibrous peat at 9 to 10 ft depth and ca. 2 ft above underlying light gray underclay on main ridge of Kittatinny Mt. (41° 14′ 08″ N Lat, 74° 42′ 10″ W Long), N of Beemerville, Sussex Co., N New Jersey. Below underclay is Silurian Shawangunk Conglomerate. Coll. 1968 and subm. by J. P. Minard. *Comment* (J.P.M.): peat bog formed by damming behind one of the end moraines on Kittatinny Mt. Minimum date for this moraine; enables correlation with other end moraines here and terminal moraine to the S.

Sandy Hook series, New Jersey

Two peat samples, separated by stratigraphic break, from 3½ ft sec. of swamp deposit on Cretaceous Mount Laurel Sand, S Sandy Hook 7½′ quad. (40° 23.6′ N Lat, 74° 04.7′ W Long), New Jersey; alt. 60 ft. Coll. 1967 and subm. by J. P. Minard. *Comment* (J.P.M.): dates indicate ages of pollen samples.

12,330 ± 300

W-2118. Peat **10,380 B.C.**

From near top of upper 2½ ft sec.

13,680 ± 300

W-2119. Peat **11,730 B.C.**

From basal 1 ft sec.

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B. Central U.S.

Arrington series, Kansas

Peat with spruce detritus in core from 2 mi NE of Arrington (39° 29.7′ N Lat, 95° 31.6′ W Long), Atchison Co., NE Kansas, at E edge of Delaware R. flood plain. Coll. 1967 and subm. by H. E. Wright, Dept. Geol., Univ. Minnesota, Minneapolis.

General Comment (H.E.W.): dates indicate that boreal spruce forest prevailed in NE Kansas throughout maximum Wisconsin Glaciation.

24,500 ± 800
W-2205. 22,550 B.C.

Depth 753 to 763 cm, at base of spruce pollen zone.

15,880 ± 600
W-2206. 13,930 B.C.

Depth 303 to 313 cm, at top of spruce pollen zone.

Muscotah series, Kansas

Peat from cores in spring marsh 1.5 mi S of Muscotah, SW ¼ NW ¼ sec. 15, T 6 S, R 17 E (39° 31.8′ N Lat, 95° 30.8′ W Long), Atchison Co., Kansas, on E edge of Delaware R. flood plain. Coll. 1967 and subm. by H. E. Wright.

23,040 ± 600
W-2150. Depth 978 to 988 cm 21,090 B.C.

Organic detritus, largely spruce needles, from base of Wisconsinan spruce pollen zone. *Comment* (H.E.W.): time of main Wisconsin Glaciation was marked in NE Kansas by Boreal spruce forest.

11,340 ± 300
W-2149. Depth 935 to 940 cm 9390 B.C.

Organic detritus from base of early Holocene oak pollen zone. *Comment* (H.E.W.): marks spread of deciduous forest following end of Boreal spruce forest.

9930 ± 300
W-2202. Depth 773 to 778 cm 7980 B.C.

Plant detritus from base of *Ambrosia* pollen zone. *Comment* (H.E.W.): indicates time of climatic change to relatively warm-dry interval of mid-Postglacial time. Date earlier than correlative pollen zone boundary farther N in Minnesota; may indicate slow northward migration of major vegetation belt.

5100 ± 250
W-2203. Depth 373 to 383 cm 3150 B.C.

Plant detritus from top of *Ambrosia* pollen zone. *Comment* (H.E.W.): records onset of cooler, moister climate at end of mid-Postglacial interval of maximum warmth.

W-2127. Hickman, Kentucky **>34,000**

Aragonitic gastropod shells (*Anquispira alternata* [Say]) ca. 4 ft above base of early Wisconsinan age loess, 1½ mi S of Hickman (36° 32′ 55″ N Lat, 89° 13′ 12″ W Long), Fulton Co., Kentucky. Shells are about same stratigraphic position as 4 fossil peccaries (*Platygonus compressus*). Coll. 1968 and subm. by W. I. Finch. *Comment*: infinite age neither proves nor refutes the presumed early Wisconsinan age of the loess.

W-2182. Sanborn Farm site, Michigan **>32,000**

Wood chips and strongly humified organic sediment (paleosol) underlying thick inorganic sediments that represent at least 2 separate glaciations, at Sanborn Farm site, near S edge of NE ¼ Sec. 6, T 8 N, R 4 W (43° 06′ 48″ N Lat, 84° 49′ 24″ W Long), Lebanon Twp., Clinton Co., Michigan. Coll. 1967 by H. Sanborn and C. Oberlitner; subm. by N. G. Miller, Dept. Botany and Plant Pathol., Michigan State Univ., East Lansing, Michigan, and K. E. Vanlier. *Comment* (N.G.M.): date suggests correlation with Port Talbot Interstade. Pre-Late Wisconsin peat uncovered near Grand Rapids in W Michigan is approx. same age.

5700 ± 300

W-2184. Hazen, North Dakota **3750 B.C.**

Wood fragments from depth ca. 25 ft in North Dakota State Water Comm. Test Hole 2677, ca. 100 ft S of Northern Pacific Ry. tracks and 20 ft E of county rd. 18 at Hazen, SW ¼ SE ¼ NE ¼ Sec. 18, T 144 N. R 86 W (ca. 47° 17′ 30″ N Lat, 101° 37′ 30″ W Long), North Dakota. Three major terraces occur within Knife R. Valley; sample from alluvium underlying intermediate terrace, on which thin carbonaceous soil is developed. Lowest terrace, formed of alluvium, is periodically flooded; highest terrace, cut into bedrock, is veneered with till. Coll. 1967 and subm. by M. G. Croft. *Comment* (M.G.C.): indicates alluvium that underlies lowest and intermediate terraces is Postglacial and carbonaceous soil on intermediate terrace <5700 yr old.

10,880 ± 320

W-2201. Day County, South Dakota **8930 B.C.**

Pelecypods from clay-rich, water-laid drift channel filling within till in NW Day Co. (45° 32′ N Lat, 97° 48′ W Long), South Dakota. Coll. 1967 and subm. by D. I. Leap, South Dakota Geol. Survey, Vermillion. *Comment* (D.I.L.): indicates enclosing till is of latest Wisconsinan Age.

W-2044. Java, South Dakota **>28,000**

Pelecypods in channel deposit of alluvium derived from west overlying Cretaceous strata and underlying till, at Java fauna site, SE ¼ NE ¼ Sec. 26, T 123 N, R 75 W (43° 26′ 40″ N Lat, 99° 51′ 00″ W Long), Walworth Co., South Dakota. Coll. 1966 by L. S. Hedges, J. C. Harksen, and R. Stach; subm. by L. S. Hedges, South Dakota Geol. Survey, Sci. Center, Vermillion. *Comment* (L.S.H.): date does not conflict with Yarmouth age suggested for this deposit on basis of vertebrate fossil content J. C. Harksen (oral commun.).

11,560 ± 350

W-2015. Middleton, Wisconsin **9610 B.C.**

Larix at 10 ft depth on marl deposited by Glacial Lake Mendota, NW ¼ SE ¼ Sec. 12, T 7 N, R 8 E (43° 06′ N Lat, 89° 29′ W Long), Middleton, Dane Co., Wisconsin. Coll. 1965 by T. E. Berg and R. F. Black; subm. by R. F. Black, Sci. Hall, Univ. Wisconsin, Madison. *Comment* (R.F.B.): marks close of high level Glacial Lake Mendota.

26,060 ± 800

W-2022. Menominee, Wisconsin **24,110 B.C.**

Spruce from 200 to 210 ft in drilled well in sand and gravel outwash, SW ¼ NE ¼ Sec. 20, T 28 N, R 12 W (44° 54′ N Lat, 91° 52′ W Long), Menominee, Dunn Co., Wisconsin. Coll. 1966 by Karl Young; subm. by R. F. Black. *Comment* (R.F.B.): 1st wood in Wisconsin dated as Farmdalian. Underlies sediments with fossil lake trout formerly correlated with Yarmouthian (Hussakof, 1916), but now recognized as Wisconsinan (Frye *et al.*, 1965, p. 50).

W-2052. Juneau County, Wisconsin **>34,000**

Organic-rich clay from 153 to 155 ft depth in drill hole in NE ¼ NE ¼ Sec. 4, T 19 N, R 4 E (44° 09′ N Lat, 90° 01′ W Long), Juneau Co., Wisconsin. Coll. 1967 by A. F. Allong; subm. by R. F. Black. *Comment* (R.F.B.): dates beginning of last major phase of Glacial Lake Wisconsin; postdates an earlier till.

11,880 ± 600

W-2048. Laird Farm Pond, Wisconsin **9930 B.C.**

Log from peat bed underlying 6 ft red varved clay and overlying red till in excavation for Steve Laird farm pond, Sec. 12, T 22 N, R 16 E (44° 24′ 04″ N Lat, 88° 30′ 37″ W Long), 9 mi NNW of Appleton, Outagamie Co., Wisconsin. Coll. 1966 and subm. by W. F. Read, Dept. Geol., Lawrence Univ., Appleton, Wisconsin. *Comment* (W.F.R.): date indicates Twocreekan age.

C. Western U.S.

7350 ± 350

W-2024. Ray, Arizona **5400 B.C.**

Partly mineralized wood from copper-oxide ore in stream channel in Gila Conglomerate on margin of Pearl Handle Pit, Ray porphyry-copper deposit, NW ¼ Sec. 14, T 3 S, R 13 E (33° 11′ N Lat, 110° 59′ 30″ W Long), Sonora Quad; Arizona. Coll. 1967 by R. A. Metz, Kennecott Corp., Ray, Arizona; subm. by H. R. Cornwall. *Comment* (H.R.C.): age is maximum for secondary copper ore (Metz and Rose, 1966, p. 177) which has now been mined.

510 ± 250

W-2085. Glass Mountain, California **A.D. 1440**

Charcoal from cedar tree engulfed by snout of dacite portion of Glass Mt. composite lava flow 0.4 mi W of Sec. 7, T 43 N, R 5 E (41°

35′ 15″ N Lat, 121° 27′ 30″ W Long), Timber Mt. Quad, California. Coll. 1964 by I. Friedman and J. Ratté. *Comment* (I.F.): dates Glass Mt. flow.

Manzanita Creek series, California

Charcoal from lowest and middle of 3 pumice flows exposed in W bank of Manzanita Creek ca. 200 ft upstream from water storage tank in SW ¼ Sec. 17, T 31 N, R 4 E (40° 32′ N Lat, 121° 32′ W Long), Lassen Volcanic Natl. Park, California. Deposit overlies sand and gravel at top of which is a soil profile. Coll. 1967 and subm. by D. R. Crandell. *General Comment* (D.R.C.): charcoal in uppermost deposit dated as <200 yr (W-812; Radiocarbon, 1960, v. 2, p. 156), but some trees growing on top of deposit are >300 yr old. Apparent age differences between this series and W-812 suggest widely spaced eruptions in recent volcanic history of Lassen Peak.

W-2135. **1230 ± 300**
A.D. 720

Charcoal log in lowest of 3 pumice flows.

W-2137. **1120 ± 300**
A.D. 830

Charcoal log in middle unit of 3 pumice flows.

W-2086. San Luis Canal, California **5180 ± 600**
3230 B.C.

Carbonized wood filling near-surface subsidence cracks in right bank of San Luis Canal, Sta. 3485 + 50, NW ¼ SE ¼ Sec. 25, T 17 S, R 15 E (ca. 36° 24′ N Lat, 120° 15′ W Long), W Fresno Co., California. Coll. 1966 by J. O. Berkland; subm. by W. B. Bull. *Comment* (W.B.B.): dates thousands of sediment-filled tension fractures in alluvial fans of western Fresno County; dates time when stream flow became sufficient to wet moisture-deficient deposits that had been accumulating on fans for thousands of years.

W-2038. Comanche Reservoir, Colorado **6050 ± 600**
4100 B.C.

Black earthy peat from ca. 20 ft below Comanche Reservoir, SW ¼ Sec. 12, T 7 N, R 74 W (ca. 40° 35′ 05″ N Lat, 105° 38′ 40″ W Long), Comanche Peak Quad., Larimer Co., Colorado. Coll. 1966 by P. Voegeli and L. A. Cerrillo; subm. by L. A. Cerrillo, Dept. Geol., Colorado State Univ., Ft. Collins. *Comment*: sample was believed to indicate event between middle and late Pinedale Glaciation, but date is too young.

W-2143. Grand Valley area, Colorado **19,730 ± 500**
17,780 B.C.

Organic silt layer 17 ft below surface of alluvial terrace adjacent to and 50 ft above Colorado R., NW ¼ SW ¼ Sec. 34, T 7 S, R 96 W (39° 23′ 30″ N Lat, 108° 06′ W Long), Grand Valley 7½′ Quad., Colorado. Coll. 1965 and subm. by W. E. Yeend. *Comment* (W.E.Y.): early Pinedale

Glaciation age fits in well with field interpretation. Few late Pleistocene dates in S Rocky Mts. Alluvial terrace is thought to be older gravel of Grand Mesa Formation (Pinedale?).

Abert Lake series, Oregon

Carbonate mud from pits in recent playa sediments at NNE end of Abert Lake, Sec. 7, T 33 S, R 22 E (42° 44′ N Lat, 120° 09′ W Long), S-central Oregon. Samples are same as W-1593 and W-1594 (Radiocarbon, 1967, v. 9, p. 517-518) except for leaching with distilled water to remove water-soluble carbonate. Coll. 1964 by B. F. Jones, A. H. Truesdell, A. S. Van Denburgh, and G. I. Smith; subm. by B. F. Jones.

General Comment (B.F.J.): although leached samples appear 700+ yr older than W-1593 (1150 ± 250) and W-1593 (3830 ± 250), indicating loss of significant C^{14} activity on removal of interstitial salts, age difference remains same, consistent with maximum sedimentation rate of 500 yr/ft for Abert Lake deposits.

W-2192. Silt **1890 ± 250** **A.D. 60**

Dark silt from 2.0 to 2.2 ft depth.

W-2196. Clay **4530 ± 250** **2580 B.C.**

Dark clay from 4.0 to 5.0 ft depth.

W-2172. Cape Fisheries, Oregon **>45,000**

Wood and *Picea sitchensis* cones in peaty sand zone at base of highly weathered marine sediments capping low marine terrace that displays southward tilt of 26.6 ft/mi along access road to Cape Fisheries dock, SE ¼ SW ¼ Sec. 5, T 33 S, R 15 W (42° 45.5′ N Lat, 124° 30′ W Long), Port Orford Quad., Oregon. Coll. 1967 and subm. by R. J. Janda. *Comment* (R.J.J.): shells from same stratigraphic horizon 7.5 mi to N of Port Orford have yielded concordant radiocarbon and uranium-thorium ages of 35,000 yr. The >45,000 yr age is more compatible with amount of weathering and tectonic deformation that have taken place since deposition of these marine sediments which probably occurred during Sangamon Interglaciation.

W-2084. Bench Lake, Washington **5130 ± 1000** **3180 B.C.**

Wood, overlying pumice Layer Y from Mt. St. Helens and underlying series of thin younger ash beds, in stream bank ca. 1000 ft S of NW-point of Bench Lake (ca. 46° 45.5′ N Lat, 121° 42′ W Long), Mt. Rainier Natl. Park, Washington. Coll. 1967 and subm. by D. R. Mullineaux. *Comment* (D.R.M.): date is anomalously old for wood above well-dated, easily recognized Layer Y which is between 3000 and 3500 yr old (Crandell *et al.*, 1962, p. 64-68); sample may have been mislabeled or contaminated.

5020 ± 300

W-2053. Cowlitz Park, Washington **3070 B.C.**

Peat, overlying pumice Layers D and N and underlying Layer F in sequence of Mt. Rainier pyroclastic layers (Mullineaux, 1965, p. 24), from stream bank in Cowlitz Park (ca. 46° 49′ N Lat, 121° 38.5′ W Long), Mt. Rainier Natl. Park, Washington; ca. 6200 ft alt. Coll. 1966 and subm. by D. R. Mullineaux. *Comment* (D.R.M.): indicates pyroclastic Layer F is at least approx. same age as Osceola Mudflow which it does not overlie and which is also dated ca. 5000 yr old (Crandell and Waldron, 1956, p. 349).

16,070 ± 600

W-2125. Factoria, Washington **14,120 B.C.**

Peaty silt, overlying glacial drift and underlying Vashon recessional outwash gravel, from borrow pit along S side of Hwy 10, E of Seattle (47° 34.8′ N Lat, 122° 09.8′ W Long), near Factoria, Washington. Coll. 1968 by D. S. Tillson; subm. by D. R. Mullineaux. *Comment* (D.R.M.): indicates peaty material was deposited during late part of Olympia Interglaciation rather than during Vashon Stade.

W-2028. Maplewood, Washington **>42,000**

Peaty silt underlain by pre-Vashon oxidized till in bluff on W side of Colvos Passage, NE ¼ NE ¼ Sec. 21, T 22 N, R 2 E (47° 23′ 15″ N Lat, 122° 33′ W Long), ca. 0.8 mi S of Maplewood, Kitsap Co., Washington. Coll. 1963 by D. R. Crandell, H. H. Waldron, and D. R. Mullineaux; subm. by H. H. Waldron. *Comment* (H.H.W.): this unit is believed to be equivalent in age to Olympia Interglaciation.

W-2034. Paradise Valley, Washington **<200**

Wood and charcoal from above Paradise debris flow and below Mt. Rainier pumice Layers L and D in road cut along hwy. on E side of Paradise Valley (ca. 46° 47′ N Lat, 121° 44′ W Long), Mt. Rainier Natl. Park, Washington. Coll. 1966 and subm. by D. R. Mullineaux. *Comment* (D.R.M.): sample apparently from roots that grew into pyroclastic sequence rather than from material laid down between older eruptions.

450 ± 200

W-2027. Renton, Washington **A.D. 1500**

Wood from sand layer at 26 ft depth in alluvial fill of Duwamish Valley (47° 27.5′ N Lat, 122° 14′ W Long), ca. 2 mi SW of Renton, Washington. Sand layer is overlain by flood-basin silt and fine sand. Coll. 1967 by D. S. Tillson; subm. by D. R. Mullineaux. *Comment* (D.R.M.): these fine-grained White R. deposits were laid down rapidly, here at least 1 ft each 20 yr, compared to rate of deposition of alluvium of nearby rivers. Fine-grained alluvium above wood contains sand-size pumice of Layer W from Mount St. Helens, radiocarbon dated as ca. 300 yr old (Crandell, *et al.*, 1962, p. 64-68) and by tree-ring studies as at least 400 yr old.

9060 ± 300

W-2041. Grouse Creek Delta, Wyoming **7110 B.C.**

Organic-rich, gently crossbedded sand representing foreset or bottomset delta beds in S-central Frank I. Quad., ¾ mi up Grouse Creek from entrance to S arm of Yellowstone Lake (44° 16.6′ N Lat, 110° 20.6′ W Long), Yellowstone Natl. Park, Wyoming. Coll. 1966 and subm. by K. L. Pierce. *Comment* (K.L.P.): dates delta built during high stand, apparently 60 to 110 ft above present level, of Yellowstone Lake.

13,140 ± 700

W-2037. Rocky Creek, Wyoming **11,190 B.C.**

Humic silt from undercut bank on E side of Rocky Creek (44° 21.6′ N Lat, 110° 09.6′ W Long), 1.5 mi up valley of Rocky Creek from junction with Beaverdam Creek, Yellowstone Natl. Park, Wyoming. Overlies ice-contact stratified drift of middle Pinedale age, overlain by fluvial material of late Pinedale age. Coll. 1966 and subm. by K. L. Pierce. *Comment* (K.L.P.): sample closely post-dates stagnation of middle Pinedale icecap ca. 5 mi E of ice cap axis.

2200 ± 250

W-2142. Spread Creek Canyon, Wyoming **250 B.C.**

Wood from tree stumps in carbonaceous silt, overlain by loess and underlain by 2 tills, in Spread Creek Canyon, Sec. 13, T 44 N, R 114 W (43° 45′ N Lat, 110° 27′ 30″ W Long), Teton Co., Wyoming. Coll. 1967 and subm. by J. D. Love. *Comment* (J.D.L.): sample from what looks like an old soil zone—much older than date indicates. Appears older than loess material in Jackson Elk Refuge, 15 mi SW, where all dates are 10,000 to 15,000 yr.

D. Alaska

Amchitka Island series, Alaska

Plant remains interbedded with 3 ash falls from 2.8 m thick peat deposit on Amchitka I. (51° 26′ N Lat, 179° 15′ E Long), Rat Is. group, Aleutian Is., Alaska. Coll. 1968 and subm. by H. T. Shacklette.

General Comment (H.T.S.): plant material was at surface when 3 ash falls occurred; dates 3 ash layers within peat. Humified peat deposits are formed ca. 2 in. per century on this island. Considering amount of peat below ash layers, peat has been forming here for ca. 3000 yr, which may indicate length of time that this part of island has been elevated above sea level.

1740 ± 250

W-2129. **A.D. 210**

Sample coll. 0.80 m from bottom of 2.8 m thick peat deposit; from 1 cm thick ash deposit in peat.

1950 ± 250

W-2130. **A.D. 0**

Sample coll. 0.87 m from bottom of 2.8 m thick peat deposit; from 1 cm thick ash deposit in peat.

W-2131. **725 ± 250**
A.D. 1225

Sample coll. 1.4 m from bottom of 2.8 m thick peat deposit; from 1½ cm thick ash deposit in peat.

W-2154. Birchwood Elementary School, Alaska **>45,000**

Peat, overlying 2 ft gray silty clay and overlain by 9 ft horizontally bedded gravel, from E side of Birchwood Loop Rd. in utilidor excavation along N side of Birchwood Elementary School, NW ¼ SW ¼ Sec. 19, T 15 N, R 1 W (61° 22′ 26″ N Lat, 149° 31′ 42″ W Long), Anchorage (B-7) Quad., Alaska. Coll. 1967 and subm. by E. Dobrovolny and H. R. Schmoll. *Comment* (E.D. and H.R.S.): compatible with other dates [(W-77 (Science, 1954, v. 120, p. 467-473), W-174 (Science, 1955, v. 121, p. 481-488), W-535 (Radiocarbon, 1960, v. 2, p. 164), W-644 (*ibid.*, p. 169), and W-1806 (Radiocarbon, 1969, v. 11, p. 221)] in area underlying deposits of Naptowne Glaciation. Silty clay underlying sample is older than Bootlegger Cove Clay at type locality as dated by W-2151 (this date list).

W-2159. Brakes Bottom, Alaska **>45,000**

Wood in carbonaceous lens of sand in Kougarok Gravels in gravel pit at intersection of Kougarok Rd. and Dahl Creek (65° 21′ 30″ N Lat, 164° 40′ 50″ W Long), Bendeleben (B-6) Quad., Seward Peninsula, Alaska. Gravels display abundant fossil ice wedge casts. Coll. 1967 and subm. by C. L. Sainsbury. *Comment* (C.L.S.): Kougarok Gravels in this locality are cold weather fluvial gravels; they must be at least as old as Wisconsin Glaciation.

W-2147. Chekok Creek, Alaska **5520 ± 250**
3570 B.C.

Organic-rich sand 10 in. below surface of old beach ridge (52 to 55 ft above present lake level) of Iliamna Lake, 2.2 mi N 45° W of mouth of Chekok Lake, Alaska. Coll. 1966 and subm. by R. L. Detterman. *Comment* (R.L.D.): date falls between several other dates from beach ridges at W end of lake (Detterman, Reed, and Rubin, 1965); probably minimum date for melting of last major glaciation in area.

Douglas Island series, Alaska

Peat and sedge deposits from Douglas, Alaska. Coll. 1966 and subm. by R. D. Miller. *Comment* (R.D.M.): dates aid in determining rate of uplift of shoreline relative to sea level on Douglas I.

W-1949. **5730 ± 350**
3780 B.C.

Peat, sedge, and woody fragments from base of muskeg in contact with beach gravel below hwy. in excavation for rd. for new subdivision, NE ¼ SE ¼ Sec. 26, T 41 S, R 67 E (58° 16′ 51″ N Lat, 134° 13′ 56″ W Long), Douglas, Douglas I., Alaska.

3650 ± 250

W-2029. **1700 B.C.**

Peat, at 211 ft alt., from silty zone separating 2 thicker peat deposits in muskeg behind Douglas Elementary School, NE ¼ NE ¼ NE ¼ Sec. 35, T 41 S, R 67 E (58° 16′ 41″ N Lat, 134° 24′ 13″ W Long), Douglas, Douglas I., Alaska.

5640 ± 280

W-2030. **3690 B.C.**

Peat, sedge, and woody particles from muskeg at alt. 209 ft behind Douglas Elementary School, NE ¼ NE ¼ NE ¼ Sec. 35, T 41 S, R 67 E (58° 16′ 41″ N Lat, 134° 24′ 13″ W Long), Douglas, Douglas I., Alaska.

6580 ± 300

W-2031. **4630 B.C.**

Peat from base of muskeg where intermixed with upper part of 2 ft sec. of beach gravel and sand, over blue-gray diamicton, behind Douglas Elementary School, SE ¼ SE ¼ Sec. 26, T 41 S, R 67 E (58° 16′ 42″ N Lat, 134° 24′ 00″ W Long), in excavation for retaining wall, Douglas, Douglas I., Alaska.

2630 ± 600

W-2032. **680 B.C.**

Peat and sedge from 1 in. layer in beach gravel and tidal silts, underlain by hard diamicton, below hwy. in excavation for rd. for new subdivision, NE ¼ SE ¼ Sec. 26, T 41 S, R 67 E (58° 16′ 51″ N Lat, 134° 13′ 56″ W Long), Douglas, Douglas I., Alaska.

3900 ± 250

W-2153. Eagle River, Alaska **1950 B.C.**

Wood, slightly compressed, ca. 16 ft above base of 28.5 ft exposure of lacustrine blue-gray silt and clay, upper part of which includes interbedded sand, in exposure on N side of Eagle River, SE ¼ SW ¼ Sec. 18, T 14 N, R 1 W (61° 17′ 53″ N Lat, 149° 31′ 26″ W Long), Anchorage (B-7) Quad., Alaska. Ash bed 1.0 ft above sampled wood; sediments are in part disturbed and ash bed repeated. Coll. 1967 and subm. by Ernest Dobrovolny and H. R. Schmoll. *Comment* (E.D. and H.R.S.): seems too young to date late sediments as Eagle R. should not have been impounded by ice at that time. Wood was probably incorporated into sediments at time of disturbance which may have produced deep fractures.

Glacier Bay series, Alaska

Samples collected to determine Hypsithermal and Neoglacial history in NW arm of Glacier Bay and damming of Muir Inlet, causing deposition of middle Van Horn lake clay. Coll. 1966 and subm. by A. T. Ovenshine.

3090 ± 250

W-2017. Cushing Glacier terminus **1140 B.C.**

Tree rooted in peat layer on bedrock in recently deglaciated area

2.46 mi bearing 350° from hill elev. 1960 at N end of Bruce Hills, Skagway (A-4) Quad., Alaska. *Comment* (A.T.O.): burial of stump by upper Van Horn gravel probably resulted from outwash accumulation in front of advancing glaciers. Date closely reflects onset of glacial advance, as locality is close to headwater area of Muir Glacier drainage.

W-2018. Johns Hopkins Inlet **8210 ± 300**
6260 B.C.

Twigs from brown, fetid organic-rich lacustrine silts, interbedded with coarse gravel 500 ft thick, containing abundant angular clasts of local provenance, at 800 ft in gully on N side Johns Hopkins Inlet, 3.42 mi at 305° from prominent point N of E side of terminus of Lamplugh Glacier, Mt. Fairweather (D-3) Quad., Alaska. *Comment* (A.T.O.): establishes presence of gravels beneath Neoglacial deposits; NW Glacier Bay not continuously glaciated during Hypsithermal Interval as believed previously.

W-2019. Tarr Inlet **7620 ± 300**
5670 B.C.

Bark in sand and gravel in valley on E side of Tarr Inlet, 6.35 mi bearing 170° from Mt. Barnard, Glacier Bay, Skagway (A-6) Quad., Alaska. *Comment* (A.T.O.): sand and gravel may be equivalent to gravel in Johns Hopkins Inlet (see W-2018 above).

W-2021. Reid Glacier **9010 ± 300**
7060 B.C.

Brown peat layer, 4 in. thick, resting on compact clay till and overlain by gravels in streambank on E side of terminus of Reid Glacier, 3.14 mi bearing 222° from Ibach Point, Mt. Fairweather (D-3) Quad., Alaska. *Comment* (A.T.O.): date places upper limit age on lower till and gives approx. age for previously unrecognized advance in Glacier Bay.

W-2134. Hogatza, Alaska **>40,000**

Compressed peat with woody material from 8 in. thick horizon overlain by 35 ft of organic muck and underlain by 7 ft coarse, well-oxidized, auriferous gravel at base of bluff along N side of Hogatza gold placer mine workings ca. 1 mi E of Hogatza (66° 11′ 53″ N Lat, 155° 41′ 31″ W Long), Alaska. Coll. 1967 and subm. by O. J. Ferrians, Jr. *Comment* (O.J.F., Jr.): auriferous gravel is at least 40,000 yr old.

W-2123. Kamishak Bay, Alaska **2620 ± 250**
670 B.C.

Peat 30 in. deep and 18 ft 4 in. above top of wave-cut bedrock platform 50 ft above present sea level in sea cliff on S side of Kamishak Bay (59° 04′ 30″ N Lat, 154° 00′ 40″ W Long), Cook Inlet, Alaska. Coll. 1967 and subm. by R. L. Detterman. *Comment* (R.L.D.): this date in conjunction with other samples still to be run will hopefully determine uplift rate along W side of Cook Inlet.

W-2161. Kougarok Landing Strip, Alaska >45,000

Peat at top of silty, carbonaceous layer intercalated in Kougarok Gravels in pit E of Kougarok Rd. at Kougarok Landing Strip (65° 24′ 10″ N Lat, 164° 38′ 40″ W Long), Bendeleben (B-6) Quad., Seward Peninsula, Alaska. Coll. 1967 by R. Kachadoorian; subm. by C. L. Sainsbury. *Comm.* (C.L.S.): confirms that upper part of exposed Kougarok Gravels are at least as old as earliest Wisconsin.

260 ± 250

W-2169. Lake George, Alaska A.D. 1690

Wood from Troublesome Creek fan-delta, upper Lake George, Sec. 30, T 14 N, R 5 E (61° 16′ 31″ N Lat, 148° 36′ 46″ W Long), Anchorage (B-5) Quad., Alaska. Coll. 1967 by W. W. Barnwell, H. R. Schmoll, and E. Dobrovolny; subm. by Barnwell. *Comment* (W.W.B.): confirms that lake and lake-associated deposits, as well as moraines, in Lake George area are late Holocene, assignable to Tunnel (II) Glaciation.

10,730 ± 300

W-2171. Mentasta Basin, Alaska 8780 B.C.

Organic silt at base of flood-plain alluvium overlying 5 ft lacustrine deposits extending down to river level in exposure on S side of Slana R., 0.5 mi NW of Slana R. bridge (62° 51′ 32″ N Lat, 143° 42′ 33″ W Long), Nabesna (D-6) Quad., Alaska. Coll. 1963 by H. R. Schmoll and John Trach; subm. by H. R. Schmoll. *Comment* (H.R.S.): dates a level of Slana R. deposits slightly higher than today's, and correlated with terraces upstream that postdate moraines in Slana Valley. Age is minimum for lake here, and in Copper R. basin at 2200 ft level, older than believed previously (W-1161, Radiocarbon, 1964, v. 6, p. 63).

4610 ± 250

W-2173. Mentasta Basin, Alaska 2660 B.C.

Organic silt overlying 27 ft of sand of probable lacustrine origin and overlain by 2.5 ft of oxidized sand in exposure on W side of Slana R., 0.1 mi downstream from Slana R. bridge (62° 51′ 18″ N Lat, 143° 41′ 34″ W Long), Nabesna (D-6) Quad., Alaska. Coll. 1963 and subm. by H. R. Schmoll. *Comment* (H.R.S.): since W-2173 is higher but younger than W-2171 (this date list), probably it represents reworking of lacustrine sand in surface depression, prior to development of river bluff exposure. Samples demonstrate that whereas in some places river was close to present vertical and lateral position >10,000 yr ago, elsewhere valley has been widened since 5000 yr ago.

1930 ± 250

W-2157. Muir Inlet, Alaska A.D. 20

Wood embedded in reddish-brown, partly indurated, partly weathered, poorly stratified gravel from W side of Muir Inlet near mouth of Morse Creek (ca. 58° 48′ N Lat, 136° 30′ W Long), SE Alaska. Coll. 1966 and subm. by A. T. Ovenshine. *Comment* (A.T.O.): date suggests gravel is lateral equivalent of middle Van Horn lake clay. Its deposition

near mouth of Muir Inlet may have been responsible for ponding of through drainage and development of middle Van Horn lake(s).

1340 ± 250

W-2148. Pedro Bay, Alaska **A.D. 610**

Organic material, undisturbed by human occupation, 10 in. deep at archaeologic site on beach ridge at Pedro Bay (59° 47′ 05″ N Lat, 154° 07′ 30″ W Long), Iliamna Lake, Alaska. Coll. 1966 by B. L. Reed; subm. by R. L. Detterman. *Comment* (R.L.D.): age is maximum for occupation of site at Pedro Bay Village. Compares with other sites on Alaska Peninsula.

7890 ± 250

W-2152. Potter Hill railroad cut, Alaska **5940 B.C.**

Peat, underlain by 4 ft gravel and 42 ft interbedded sand and diamicton of glacioaqueous origin, within lower part of 4-ft sand unit in top of Potter Hill cut along Alaska R.R., ¼ mi S of intersection of Seward Hwy. and de Armoun Rd., SW ¼ NE ¼ Sec. 32, T 12 N, R 3 W (61° 05′ 20″ N Lat, 149° 50′ 19″ W Long), Anchorage area, Alaska. Coll. 1965 and subm. by E. Dobrovolny and H. R. Schmoll. *Comment* (E.D. and H.R.S.): dates deposition of sand of uncertain origin, probably alluvium or colluvium, date is minimum for underlying gravel. Both units probably correlative with the Tanya advance of Karlstrom (1964).

4730 ± 250

W-2158. Reid Glacier terminus, Alaska **2780 B.C.**

Wood embedded in stratified gravel in stream bank at E side of Reid Glacier terminus (ca. 59° N Lat, 136 ° 50′ W Long), Mt. Fairweather (D-3) Quad,. Alaska. Coll. 1966 and subm. by A. T. Ovenshine. *Comment* (A.T.O.): age is minimum for underlying compact clay till. Dates advance, previously unrecognized in Glacier Bay, which is younger than Wisconsinan and older than the Neoglacial (Little Ice Age of Bengtson [1962]).

Stikine River delta series, Alaska

Wood fragments from boring in prodelta deposits of Stikine R. in Dry Straits (56° 36′ 56″ N Lat, 132° 32′ 36″ W Long), Petersburg (C-2) Quad., SE Alaska. Coll. 1967 by W. H. Slater; subm. by R. W. Lemke. *General Comment* (R.W.L.): dates indicate very rapid sedimentation. W-2164 is anomalous, probably because of contamination of sample.

1690 ± 250

W-2163. **A.D. 260**

Depth, 90 ft.

960 ± 250

W-2164. **A.D. 990**

Depth, 80 ft.

1580 ± 250
W-2165. **A.D. 370**
Depth, 60 ft.

9330 ± 300
W-2160. Washington Creek, Alaska **7380 B.C.**

Wood from old beaver dam at base of silt, ca. 8 ft thick, that overlies auriferous gravel along Washington Creek (65° 44′ N Lat, 164° 52′ W Long), W fork of Kougarok R., Bendeleben (C-6) Quad., Seward Peninsula, Alaska. Coll. 1967 and subm. by C. L. Sainsbury. *Comment* (C.L.S.): dates warm cycle, despite its correspondence to postulated glacial advance recognized elsewhere on Seward Peninsula.

13,690 ± 400
W-2151. Woronzof Bluffs, Alaska **11,740 B.C.**

Mollusk shells from bluffs in Bootlegger Cove Clay on S side of Knik Arm, ca. 1 mi E of Point Woronzof, adjacent to Clay Products Rd., SW ¼ SW ¼ Sec. 22 and NE ¼ SE ¼ Sec. 21, T 13 N, R 4 W (61° 11′ 58″ N Lat, 149° 59′ 00″ to 21″ W Long), Anchorage (A-8) Quad., Alaska; 23 to 27 ft above mean high water. Coll. 1966 by L. A. Yehle, H. R. Schmoll, E. Dobrovolny, and R. A. M. Schmidt; subm. by Dobrovolny and Schmoll. *Comment* (E.D. and H.R.S.): significantly younger than previous ionium-uranium date of 33,000 to 48,000 yr on shells from same zone. If C^{14} date is correct, the clay in its type area, and hence the Woronzofian transgression, is younger than maximum of Naptowne Glaciation as currently dated, and the clay represents an intra-Naptowne marine transgression rather than one during Knik-Naptowne interglacial interval.

E. Hawaii

3620 ± 250
W-2016. Waiohino, Kau, Hawaii **1670 B.C.**

Charcoal underlying surface pahoehoe lava flow at Bishop Mus. Site 31, a cesspool excavation (15° 04′ 15″ N Lat, 155° 36′ 52″ W Long), Waiohino, Hawaii. Coll. 1966 by V. Hansen; subm. by R. R. Doell. *Comment* (R.R.D.): date is maximum for lava flow and substantiates 3740 ± 250 for W-856 (Radiocarbon, 1960, v. 2, p. 157) from beneath same flow.

F. Miscellaneous

W-2138. La Viborita mine, Colombia **>42,000**

Carbonized wood from clay in younger of 2 high-level bodies of alluvium exposed in La Viborita alluvial-gold mine (6° 56′ N Lat, 75° 05′ W Long) and vicinity, Amalfi, Antioquia, Colombia. Coll. 1967 and subm. by T. Feininger. *Comment* (T.F.): only indication of age of surficial materials in this area.

4780 ± 300
W-2082. Oetz Valley, Austria **2830 B.C.**

Larix decidua charcoal from within what appeared to be lateral

moraine of Gschnitz Stade at Roppen (47° 14′ N Lat, 10° 50′ E Long), Oetz Valley, Tyrol, Austria. Coll. 1967 and subm. by H. Heuberger, Univ. Innsbruck, Austria. *Comment* (H.H.): date is not relevant to advance of Oetz Valley glacier that built moraine.

1440 ± 250

W-2141. Gardnersville, Liberia **A.D. 510**

Truncated root *in situ* in weathered sandstone overlain by black soil covered by unconsolidated sand at oil refinery at Gardnersville near Monrovia (ca. 6° 30′ N Lat, 6° 00′ W Long), Liberia. Coll. 1967 and subm. by R. White. *Comment* (R.W.): should represent maximum age of sand deposition.

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