

WASHINGTON STATE UNIVERSITY NATURAL
RADIOCARBON MEASUREMENTS I

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The College of Engineering Research Division radiocarbon dating laboratory began operating in November 1962 employing a Sharp Laboratories, Inc., CDL-14 system based upon the methane method of Fairhall, Shell, and Takashima (1961).

Dates reported herein are calculated using a 5568 yr C^{14} half-life. The modern standard is taken as 95% of the NBS oxalic acid C^{14} standard which is converted to CO_2 followed by conversion to CH_4 in the manner of Fairhall *et al.* The errors quoted are the 1σ statistical errors.

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SAMPLE DESCRIPTIONS

I. ARCHAEOLOGIC SAMPLES

A. Alaska

Chagvan Bay series, Alaska

Charcoal samples found in Kuskokwin Bay region of Alaska. Samples coll. and subm. 1963 by Dr. Robert Ackerman, Dept. of Anthropol., Washington State Univ.

WSU-102. Chagvan Bay Bluff site **1740 ± 60**
A.D. 210

Charcoal from hearth in House 1, 2.2' below surface. Assoc. with hearth was check-stamped sherd. *Comment:* this type of pottery has been found in Norton cultural levels. Norton cultural stage.

WSU-117. Chagvan Bay Bluff site **1290 ± 250**
A.D. 660

Charcoal from Trench 2, 1.6' below surface at base of brown gravel-sand layer that overlies yellow gravel which was sterile. *Comment:* sample comes from base of cultural zone. Check-stamp pottery was found at this level. Norton cultural stage.

WSU-119. Chagvan Bay Beach site **230 ± 40**
A.D. 1720

Charcoal from House 6, 2.0 to 2.3' below surface. *Comment:* possible transitional stage following Norton cultural stage.

WSU-123. Chagvan Bay Beach site **1330 ± 60**
A.D. 620

Charcoal from House 1 by hearth, 1.7' below surface in Square 1. *Comment:* later phase of Norton cultural stage.

WSU-121. Nanvak Bay, Alaska **100 ± 50**
A.D. 1850

Charcoal from hearth in House 3, 1.4' below surface. *Comment:* later phase of Norton cultural stage. Sample coll. and subm. 1963 by Robert Ackerman.

WSU-285. Grouse Fort site, Alaska **Modern**

Charcoal from Test Pit 1, which was cut into midden material on bay (SW) side of House Pit 1 at Grouse Fort site (135° 13' W Lat, 58° 14' 20" SE Long). Coll. at Ground Bay area of Icy Strait Region and subm. 1963 by Robert Ackerman.

WSU-412. Juneau, Alaska **10,180 ± 800**
8230 B.C.

Charcoal from clay that had been burned by fire. Taken from trench or top of low terrace 11.7 m above sea level. Sample came from fire hearth area 97 cm below datum in Section N-2-E-1-B of Trench 1. Horizontal location from 0 point, 3.45 m N of EW line, 0.42 m E of NS line. Contamination by rootlets and possible contamination by water coming from limestone deposit. Several artifacts in site were made of limestone or dolomite. Sample coll. and subm. by Robert Ackerman. *Comment:* dates lower component of Site GHB-2. Lower component is chipped stone and rests on glacial gravels (outwash). Dating of component vital to entry of man upon northern NW coast.

*Samples From Combined Prehistoric
Expedition to Egyptian and Sudanese Nubia
B. Egypt*

Shell, charcoal, and bone found at sites in Egyptian and Sudanese Nubia. Collection of samples was started in May, 1963 and was subm. for dating by Dr. Fred Wendorf of Southern Methodist Univ., Dallas, Texas (Wendorf, 1965).

WSU-256. Dungal Oasis, Egypt **22,900 ± 600**
20,950 B.C.

Tufa from Boulder III, Wadi Gravel Bank, Dungal Oasis (23° 26' N Lat, 31° 37' E Long). Sample from top unit in sequence, 0.75 m below surface in exposed cutbank. Coll. 1963 from Site 8709-2-5 by J. Hester. *Comment:* dates marker bed in geologic sequence and Mousterian tools from same level.

WSU-257. Dungal Oasis, Egypt **10,300 ± 260**
8350 B.C.

Tufa from top unit of sequence of beds in pit dug for pollen profile Site 8702-2-6. Sample from surface of pit in clay beds of fossil spring. Coll. 1963 by J. Hester. *Comment:* dates flow of springs in area, geologic marker bed, and Neolithic culture contemporaneous with sample.

WSU-315. Tushka, Egypt **14,500 ± 490**
12,550 B.C.

Charcoal from entire occupation zone of Hearth Mound 2, Site 80, Tushka, (22° 30' N Lat, 31° 45' E Long). From average depth 1 m in mound from gray cemented dune sand, partially laminated, containing ash charcoal and a few artifactual flakes. Coll. 1965 by J. Hester. *Comment*: date is approx. for microlithic implements and minimum for highest silts of Sohaba formation.

WSU-316. Dungal Oasis, Egypt **7900 ± 150**
5950 B.C.

Charcoal from 10 × 20 cm hearth on surface of playa silt, 15 cm below present ground surface. Sample from Site 8723, Sebgon Desert, (23° 30' N Lat, 31° 31' E Long). Cultural rock was above and in hearth. Coll. 1963 by P. M. Hobler. *Comment*: expected to date site occupation and period of greatest use of playa.

WSU-318. Ballana, Egypt **18,600 ± 550**
16,650 B.C.

Charcoal from Site 8859-1-28C, Ballana (22° 15' N Lat, 31° 35' E Long) at 165 cm depth in rapidly accumulating dune with uniform culture from bottom to top. Artifacts and charcoal revealed in trench. Coll. 1965 by P. M. Hobler. *Comment*: expected to date industry found throughout dune and lower end of Sohaba formation.

WSU-327. Dungal Oasis, Egypt **3640 ± 180**
1690 B.C.

Charcoal from Site 8773-3-2d, Sibyon Desert site, 5 mi ENE of Dungal Oasis, (23° 28' N Lat, 31° 35' E Long). Sample from ash and charcoal concentration in floor of possible pottery kiln. Coll. 1963 beneath 50 cm of windblown sand, by P. M. Hobler. *Comment*: should date occupation.

WSU-328. Dungal Oasis, Egypt **4510 ± 255**
2560 B.C.

Charcoal from Site 8718-1-11, Sibyon Desert site, 8 mi WSW of Dungal Oasis. Sample from 25 cm below present dune surface in hearth immediately SW of Slob Rause (Feature 1). Coll. 1963 by J. W. Eddy. *Comment*: should date occupation of site and give minimum date for suitability of playa for herding.

WSU-329. Ballana, Egypt **14,000 ± 280**
12,050 B.C.

Charcoal from Site 8896, Ballana site, 2 mi W of Ballana, (22° 15' N Lat, 31° 35' E Long). Sample was buried by 2 to 6 cm of fill in hearth, part of which was exposed on surface. Coll. 1963 by J. J. Hestes. *Comment*: should date occupation of site and assoc. artifacts.

C. Sudan

- WSU-103. Wadi Halfa, Sudan** **5220 ± 50**
3270 B.C.
Charcoal from Wadi Halfa W at Site WHW-5, Sudan (22° 55' E Lat, 57° 58' N Long). Sample from Oven 2, 10 to 20 cm below surface. Coll. 1963 by Chmielewski. *Comment:* could be Neolithic.
- WSU-106. El Ikhtyarhryia, Sudan** **11,200 ± 150**
9250 B.C.
Shell (*Unio Willcocksii*) from Site 745 in 30 m flood-plain gravel bench. Coll. 1963 by J. de Heinzelin.
- WSU-107. Debeira, Sudan** **14,800 ± 100**
12,850 B.C.
Shell (*Corbicula fluminalis*) from 30 m flood plain at Location 319, Debeira W Ghana Concession, Site P-742. Coll. 1963 by J. de Heinzelin.
- WSU-108. Abka, Sudan** **5990 ± 100**
4040 B.C.
Shell (*Corbicula*) from 34 m flood plain at Site P-743, Location 280, Abka Island. Coll. 1963 by J. de Heinzelin.
- WSU-109. Faras East, Sudan** **12,250 ± 100**
10,300 B.C.
Shell (*Corbicula fluminalis*) from 20 m flood plain at Site P-744, Location 330, Faras E. Coll. 1963 by J. de Heinzelin.
- WSU-110. South Buhen, Sudan** **5120 ± 100**
3170 B.C.
Shell (*Unio*) from Site P-748, Location 235, at 50 × 50" flood plain in S Buhen. Coll. 1963 by J. de Heinzelin.
- WSU-112. Wadi Halfa, Sudan** **3370 ± 50**
1420 B.C.
Shell from Layer 2 in Group "C" occupation level at Site WHW-7, Location 4-S/2K, Feature 1/2 at Wadi Halfa W. Coll. 1963 by Chmielewski. Sample is not Neolithic.
- WSU-142. Halfa Degheim, Sudan** **9975 ± 280**
8025 B.C.
Charcoal mixed with sand and possibly gypsum from Site 1017, Point T-10-2-W, 5 km S of Halfa Degheim, (24° N Lat, 33° E Long). Sample was 60 cm below silt, which was 6 cm thick and 20 cm below surface. Coll. 1963 by A. E. Marks. *Comment:* should date early upper Paleolithic industry featuring high percentage of Levallois technique in stone plus large sample of animal bones.
- WSU-144. Halfa Degheim, Sudan** **11,000 ± 120**
9050 B.C.
Charcoal mixed with earth from partly scattered fire pit assoc. with single occupation from Site 1024-F-1, 5 1/2 km S of Halfa Degheim (24°

N Lat, 33° E Long). Coll. 1963 by A. E. Marks. *Comment*: should date manifestation of Sebilian industry, may be equivalent to Vignard's Middle Sebilian.

WSU-147. Wadi Halfa, Sudan **4800 ± 120**
2850 B.C.

Charcoal mixed with sand in stone-lined hearth at Site 605-33-1, 15 km SW of Wadi Halfa, (24° N Lat, 33° E Long). Coll. 1964 by Shiner. *Comment*: should date early Neolithic industry. Ceramics very scarce, industry primarily lithic.

WSU-174. Diberia West, Sudan **5600 ± 200**
3650 B.C.

Charcoal from fire pit in Trench II in 5 m terrace on W bank, 13.5 km N of Wadi Halfa, from Site DIW-50. Coll. 1964 by R. Schild. *Comment*: dates pottery Neolithic site, containing numerous microliths as well as Neolithic tools. Particular Neolithic involved has not yet been defined. Should date possibly intrusive early Neolithic assemblage.

WSU-175. Diberia West, Sudan **9390 ± 100**
7440 B.C.

Charcoal scattered along base of 10 m terrace, Site DIW-1, on W bank of Nile, 13.5 km N of Wadi Halfa. Coll. 1964 by R. Schild. *Comment*: industry is Microlithic, characterized by scrapers made of flakes produced by bipolar technique and points.

WSU-176. Diberia West, Sudan **7700 ± 120**
5750 B.C.

Charcoal from fire pit in middle of 10 m terrace deposits on W bank of Nile, 13.5 km N of Wadi Halfa, Site DIW-51. Sample from Trench II cultural layer. *Comment*: assoc. industry is development out of DIWIA with less scrapers and introduction of ostrich shell.

WSU-188. Khor Musa, Sudan **10,925 ± 140**
8975 B.C.

Charcoal from Site 1024-3, from scattered fire pit, just subsurface, in center of Sebilian habitation, 2.5 km SW of Wadi Halfa airport building. *Comment*: this is 1st radiocarbon date for any Sebilian site and finally places Sebilian in time perspective.

WSU-189. El Ikhtyarhryia, Sudan **11,410 ± 270**
9460 B.C.

Shell from Site Ad-17, Location 35, P-745, from slab of gravel in channel cut into top of Diberia formation (30 m terrace), 15.2 km N of Wadi Halfa. *Comment*: channel also contained tools of Qada sequence; thus dates probable early phase of Qada sequence.

WSU-190. Mirghissa, Sudan **6430 ± 200**
4480 B.C.

Charcoal from fire pit in center of surface concentration of microlithic artifacts, on W bank of Nile, 13.7 km SW of Wadi Halfa, Site

605-49 at Flat 49. *Comment:* dates late phase of microlithic Qadan sequence.

16,500 ± 500

WSU-201. Knor Musa, Sudan

14,550 B.C.

Charcoal from 2 adjacent earth ovens in habitation site of 60 cm depth. Site, 443-2, J-213, is located on W side of Khor Musa, 3 km W of Wadi Halfa airport building. It rests on sand dune banked against Diberia formation (30 m terrace). Coll. 1963 by A. E. Marks. *Comment:* should date early Mesolithic site.

12,500 ± 460

WSU-202. El Ikhtyarhryia, Sudan

10,600 B.C.

Charcoal from decomposed plant remains *in situ* in top of Sahaba formation (20 m terrace), 15.2 km N of Wadi Halfa. Coll. 1964 by J. de Heinzelin. *Comment:* should date building of 20 m terrace.

20,900 ± 280

WSU-203. Khor Musa, Sudan

18,950 B.C.

Charcoal from living floor in fluvial sand deposit covered by Nile silts, 57 cm below ground surface from Site 1017, 3.3 km SW of Wadi Halfa airport building. Coll. 1963 by A. E. Marks. *Comment:* should date early Upper Paleolithic assemblage.

17,800 ± 500

WSU-215. Anquash, Sudan

15,850 B.C.

Charcoal from upper Paleolithic habitation layer resting on fossil sand dune covered by fluvial sands, 100 m W of village of Anquash, on W side of Nile, 4.5 km WS of Wadi Halfa at Site ANW3-25. Coll. 1964 by A. E. Marks. *Comment:* should date late Upper Paleolithic assemblage.

14,340 ± 500

WSU-290. Wadi Halfa, Sudan

12,390 B.C.

Charcoal found just below brown soil, in sand with Upper Paleolithic culture on Level 6 at Site 440, 1 $\frac{1}{3}$ km W of Wadi Halfa airfield. Coll. 1965 by J. Shiner. *Comment:* dates earliest upper Paleolithic site W. Halfa area. Should be earlier than any known Nile sediments.

19,150 ± 375

WSU-332. Wadi Halfa, Sudan

17,200 B.C.

Charcoal mixed with sand and ash from partially deflated earth oven from Site 2014, 2.5 km W of Wadi Halfa airport, (21° 49' 30" Lat, 31° 16' Long). Small bits of charcoal *in situ* from middle of oven, 5 to 10 cm below surface. Coll. 1965 by J. L. Shiner. *Comment:* dates occupation of relatively late Halfan peoples.

D. Idaho

Double-house series, Cottonwood, Idaho

Mussel shell (*Margaritifera m. falcata*) and charcoal from Double-house, stratified, 2-phase village site on high terrace in lower reach of

Rocky Canyon (45° 55' N Lat, 116° 23' W Long), 7 mi S of town of Cottonwood, in Camas Prairie region of N-central Idaho. Coll. and subm. 1963 by B. R. Butler, Idaho State Univ. Mus., Pocatello, Idaho.

WSU-124. Site 10-IH-80/4 **400 ± 50**
A.D. 1550

Charcoal from surface of lower E house midden, 120 to 150 cm below 2e3, Level D. *Comment:* should date termination of accumulation of silt at site and provide solid carbon check on 10-IH-80/2 and 3.

WSU-125. Site 10-IH-80/2 **735 ± 60**
A.D. 1215

Mussel shell from upper floor of lower W house, 90 to 125 cm below 2w5, Level 2d. *Comment:* should date upper floor of lower house and provide approx. terminal date for occupation of house and accumulation of silt sequence at site.

WSU-126. Site 10-IH-80/5 **Modern**

Charcoal from floor of upper W house, 20 cm below Datum 1w6, Level 3b. *Comment:* should date occupation of upper village at site.

WSU-127. Site 10-IH-80/3 **1770 ± 56**
A.D. 180

Mussel shell from lower floor of lower W house, 130 to 160 cm below Datum 2w5. *Comment:* should date earlier than 10-IH-80/2 by ca. 100-500 yr.

WSU-253. Site 10-IH-80/F.S. 62/12 **280 ± 140**
A.D. 1670

Charcoal from sandy loam deposit separating upper E house floor from lower E house floor, 37 to 46 cm below Datum 5e5. *Comment:* WSU-253 and WSU-254 should provide good checks on previously dated samples from the 2 sites and help firm up chronology established for this locality.

WSU-254. Site 10-IH-80/F.S. 64/7 **2040 ± 190**
90 B.C.

Charcoal from hearth area, lower E house floor, 158 cm below Datum 5e4.

Cottontail Cave series, Blue Dome, Idaho

Charcoal samples from Cottontail Cave in Clark County, 4 mi E of Blue Dome, Idaho (44° 10' N Lat, 112° 52' W Long). Coll. 1961 by R. Bonnicksen and subm. 1963 by Dr. Earl Swanson, Idaho State Univ. Mus., Pocatello, Idaho.

WSU-133. Site 46565/10-CL-23 **150 ± 125**
A.D. 1800

Charcoal from Test Pit 4, Level 5b, 46 to 64 cm below surface datum.

WSU-137. Site 45563/10-CL-23 **4420 ± 145**
2470 B.C.

Charcoal from Test Pit 2, Level 20, 290 to 303 cm below surface datum.

Jackknife Cave series, Howe, Idaho

Charcoal from Jackknife Cave in Butte County (43° 50' N Lat, 112° 52' W Long), 7.5 mi NE of Howe, Idaho. Coll. 1963 by B. R. Butler and subm. 1963 by B. R. Butler and Earl Swanson.

WSU-134. Site 10-BT-46/105 **840 ± 125**
A.D. 1110

Charcoal from Block B-5, Feature 3; fireplace assoc. with Level V.

WSU-135. Site 10-BT-46/101 **160 ± 135**
A.D. 1790

Charcoal from Block A-5, Feature 2; fire pit intrusive from Level VII into Level VIII.

WSU-136. Site 10-BT-46/117 **6200 ± 155**
4250 B.C.

Charcoal from Block L-6, Feature 1; fire pit intrusive from Level VIII into Level IX.

WSU-138. Site 10-BT-46/148 **380 ± 125**
A.D. 1570

Charcoal from Block K-5, Feature 1; fire pit intrusive from Level VI into Level VII.

WSU-255 Weis Rock-shelter, Cottonwood, Idaho **6300 ± 100**
4350 B.C.

Charcoal mixed with soil-humus from Site 10-IH-66, #125, Trench 3, 3.4 to 3.6 m below Datum O, Cottonwood Canyon near Cottonwood, Idaho. Coll. 1962 and subm. 1964 by R. B. Butler.

WSU-319. Eagle Creek site, Idaho **Modern**

Charcoal from Camas oven at depth 25 to 30 cm below surface. Site is located on N slope of Whitebird Hill, Idaho county, Idaho (45° 60' N Lat, 116° 15' W Long). Coll. 1964 and subm. 1965 by L. R. Gaarder, Idaho State Univ., Pocatello, Idaho. *Comment:* should provide *terminus ante quem* date for artifacts found above it.

Alpha and Beta Rock-shelter series, Shoup, Idaho

Shell and charcoal from Alpha and Beta Rock-shelters ca. 10 mi SW of Shoup, N of Salmon R. in Lemhi county, Idaho. Subm. 1965 by Earl Swanson.

WSU-358. Alpha Rock-shelter, 10-LH-23/18 **4730 ± 202**
2780 B.C.

Shell from balk between A-3 and A-4, Layer 6a. Coll. 1965 by P. Sneed, Idaho State Univ.

WSU-359. Alpha Rock-shelter, 10-LH-23/17 **7150 ± 231**
5200 B.C.

Shell from Block D-1, Layer 6c. Coll. 1965 by P. Sneed.

WSU-416. Alpha Rock-shelter, 10-LH-23/61 **12,410 ± 115**
10,460 B.C.

Shell from Block A-1, Layer 4b, 56 to 68 cm below ground surface. Sample column located 80 to 120 cm E of SW corner of Block A-1. Coll. 1965 by P. Sneed and K. Wood, Idaho State Univ.

WSU-402. Beta Rock-shelter, 10-LH-63/114 **8175 ± 230**
6225 B.C.

Charcoal from Block S-4, Layer 6d; depth 383 cm. Coll. 1965 by C. Chesbro, Idaho State Univ.

WSU-403. Beta Rock-shelter, 10-LH-63/204 **5600 ± 175**
3650 B.C.

Charcoal from Block S-5e and S-4e, Layer 6d, 380 to 390 cm below Datum 1. Coll. 1965 by M. Pavisic and C. Sims, Idaho State Univ.

WSU-404. Beta Rock-shelter, 10-LH-63/203 **5675 ± 175**
3725 B.C.

Shell from Block S-4e, Layer 5a. Coll. 1965 by P. Sneed, C. Chesbro, and C. Sims.

D. Nevada

Deer Creek Cave series, Jarbidge, Nevada

Charcoal and wood from Deer Creek Cave site, 4 mi N of Jarbidge, Elco county, Nevada (42° 56' 00" N Lat, 115° 25' 15" W Long). Coll. 1960 and subm. 1964 by Dr. Richard Shutler, Jr., Nevada State Mus., Carson City, Nevada.

WSU-244. Deer Creek Cave **715 ± 410**
A.D. 1235

Charcoal from Site 34 from Fire Hearth 1, Trench A, Cut 1; 2' S of W corner stake on top of hearth, 8" from surface. Hearth is 10" in diameter and 3" thick. *Comment:* should give idea of rate of midden accumulation in front of cave and date some assoc. metates and projectile points.

WSU-245. Deer Creek Cave **1510 ± 140**
A.D. 440

Wood from Site 196, Trench C, Pit 2; depth 12 to 18". Assoc. with projectile points, scrapers, disc. beads, antler flakes, and fragments. *Comment:* should date assoc. artifacts.

Falcon Hill series, Nevada

Basketry samples from Falcon Hill, elev. 4249.5' at NW end of Lake Winnemucca in Washoe county, Nevada (40° 19' 20" N Lat, 119° 20' 40" W Long). Coll. and subm. 1961 by Dr. Richard Shutler, Jr.

1480 ± 155
A.D. 470

WSU-268. Falcon Hill

Basketry sample from Section D, 12 to 24" below datum. Included was rat's nest at N wall of Site 28.

1400 ± 155
A.D. 550

WSU-269. Falcon Hill

Basketry sample from Section D, Site 39. Same location and contents as in WSU-268.

5100 ± 180
3150 B.C.

WSU-270. Falcon Hill

Basketry sample from Area 2, 17 to 24" below surface, Cache 2 from tule-lined Cache pit at Site 61.

E. New Hebrides

Inmanhat series, Island of Aneityum, South New Hebrides

Charcoal from Island of Aneityum, S Pacific, (20° 10' 2" S Lat, 169° 42' 0" E Long). Samples coll. 1963 and subm. 1964 by Dr. Richard Shutler, Jr.

WSU-139. Inmanhat/9 **Modern**

Charcoal from shell midden with fire hearths from Pit 1, 18 to 24" level. *Comment:* should date shell edge, and together with WSU-140 should provide information on rate of midden accumulation.

WSU-140. Inmanhat/18 **Modern**

Charcoal from shell midden with fire hearths from Pit 1, 72 to 90" level. *Comment:* should date earliest occupation of rock-shelter and island (Aneityum). Together with WSU-139 will provide information on rate of midden accumulation, and check internal consistency.

Island of Futuna series, South New Hebrides

Charred leaves and charcoal from Island of Futuna in Southern New Hebrides, S Pacific. Sites at Ipau are located ca. (19° 30' 50" S Lat, 170° 13' 30" E Long). Samples coll. 1964 and subm. 1964 by Dr. Richard Shutler, Jr.

905 ± 190
A.D. 1045

WSU-184. Futuna/462

Charred leaves mixed with charcoal from depth 18 in. from present surface, layer of leaves approx. 1/2 in. thick. *Comment:* sample from Lap-Lap cooking earth-oven. Lap-Lap is common Melanesian food made from vegetables and meats, cooked on leaves over hot rocks. Sample should date time when hearth was constructed and meal cooked.

200 ± 190
A.D. 1750

WSU-196. Futuna/BPBM-457

Charcoal assoc. with fragmented shell and bone from cultural deposit in Rock-shelter FU-RS-12, Trench 3, depth 36 to 42". *Comment:* sample should date earliest occupation of site and probably that of Futuna.

Efate series, South New Hebrides

Charcoal from island of Efate, New Hebrides, S Pacific (17° 45' 00" S Lat, 168° 17' 30" E Long). Samples coll. and subm. 1964 by Dr. Richard Shutler, Jr.

1225 ± 175

WSU-197. Efate/BPBM-494 **A.D. 725**

Charcoal from cultural deposit in Rock-shelter EF-RS-7, Trench E at depth 36 to 42". *Comment:* should date earliest occupation of site.

1090 ± 140

WSU-198. Efate/BPBM-495 **A.D. 860**

Charcoal from midden shallow, in coral bedrock at 12 in. depth; EF-3, Location B, Trench B, Pits 7, 8, and 9. *Comment:* should date pottery and worked shell.

1020 ± 130

WSU-199. Efate/BPBM-508 **A.D. 930**

Charcoal from cultural deposit; EF-3, Location E, Pit 2 at depth 18 in. *Comment:* sample should date earliest occupation of village site and give maximum date for burial found just above hearth.

815 ± 180

WSU-200. Efate/BPBM-499 and 500 **A.D. 1135**

Charcoal assoc. with fragmented shell from cultural deposit; EF-3, Location D, Pits 3 and 7, at depth 30 to 36 in. *Comment:* should date earliest occupation of old village site, worked shell, and fragmented shell.

Mangarisiu Village series, Tongoa Island, South New Hebrides

Charcoal from island of Tongoa, 1 mi N of village of Mangarisiu (16° 55' 20" S Lat, 168° 34' 25" E Long). Samples coll. 1965 by A. H. G. Mitchell, U.S. Geol. Survey and subm. 1964 by U.S. Geol. Survey for Dr. Richard Shutler, Jr.

2720 ± 200

WSU-219. Mangarisiu/1 **770 B.C.**

Charcoal from 9 ft deep exposure pit dug in cliff top, 10 yds inland from sea-cliff edge, 4'4" to 5' below cliff top, from 1st cultural level. *Comment:* should date settlement by charcoal and pottery fragments which can be traced on several islands in Shepherd group. Should give maximum age to overlying volcanic ash, possibly connected with local legend of violent volcanic activity 300 to 400 yr ago.

2300 ± 200

WSU-220. Mangarisiu/2 **350 B.C.**

Charcoal from same location as WSU-219, 8' 10" to 9' 4" below surface, from 2nd cultural level. *Comment:* should date charcoal and pottery fragments and give maximum age to overlying volcanic ash, and minimum age for underlying deposits.

F. Oregon

WSU-228. Cascadia, Oregon **7910 ± 280**
5960 B.C.

Charcoal from 1 mi E of Cascadia, Oregon, N bank of S Santiam R., Linn county, (44° 24' N Lat, 122° 28' W Long). Coll. and subm. 1964 by T. M. Newman, Dept. of Anthropol., Portland State College, Portland, Oregon. *Comment:* dates Old Cordilleran culture, which cultural materials assoc. with this sample are expected to date for this part of NW. Is probably Altithermal in age.

WSU-284. Wildcat Canyon site, Oregon **4480 ± 360**
2530 B.C.

Peat-like deposit from Site 35-GM-9/5 at Wildcat Canyon on Columbia R. Coll. summer, 1964 and subm. 1965 by D. L. Cole, Dept. of Anthropol., Univ. of Oregon, Eugene, Oregon.

Arlington series, Oregon

Charcoal from 7 to 19 mi outside Arlington, Oregon (45° 46' N Lat, 120° 33' W Long). Coll. 1964 by D. L. Cole and C. Calley and subm. 1965 by D. L. Cole.

WSU-298. Arlington/JD-64-2 **1740 ± 175**
A.D. 210

Charcoal mixed with shell and bone from Site 35-GM-15, Area 13, from floor of large house (Feature 8), ca. 80 cm from present surface. *Comment:* should date house type and several related art forms.

WSU-299. Arlington/JD-64-3 **1170 ± 160**
A.D. 780

Charcoal from burned structural timber on lowest of 2 floors of house (Feature 25) in Site 35-GM-3 (Hook site), 2 m below surface. *Comment:* should date house and certain artifacts.

WSU-300. Butte Creek Cave, Fossil, Oregon **400 ± 150**
A.D. 1550

Hide sample from Site B.C.C.-1 at Butte Creek Cave ca. 8 mi NW of Fossil, Oregon, (45° 3' N Lat, 120° 20' W Long). Coll. 1946 by L. S. Cressman and id. by Wm. G. Hagg, Louisiana State Univ. Subm. 1965 by D. L. Cole. *Comment:* indicates time at which dog lived to secure information if smallness is indicative of earliest type of Indian dog; should secure date on use of Catlow twine basketry in area; should secure date on burial complex.

H. Washington

WSU-101. Ozette Lake, Washington **387 ± 80**
A.D. 1563

Charcoal from deep fire pit in lowermost cultural stratigraphy. Coll. and subm. 1963 by S. T. Gwinn, Dept. of Anthropol., Washington State Univ., Pullman, Washington.

Marmes Rock-shelter series, Washington

Charcoal and shell from Marmes Rock-shelter in Franklin county, Washington. Samples, unless otherwise stated, were coll. and subm. 1963 and 1964 by Dr. R. D. Daugherty, Dept. of Anthropol., Washington State Univ. *Comment:* considered to be site of oldest human remains in W Hemisphere.

WSU-120. Marmes Rock-shelter/45-FR-50 **7550 ± 100**
5600 B.C.

Shell from location (25° N Lat, 190° W Long), 8 in. below surface of Unit 1.

WSU-205. Marmes Rock-shelter/45-FR-50 **1300 ± 60**
A.D. 650

Charcoal from Unit VI, Feature 6. Coll. 1964 by C. R. Nance, Dept. of Anthropol., Washington State Univ.

WSU-206. Marmes Rock-shelter/45-FR-50 **1110 ± 50**
A.D. 840

Charcoal from Unit VII, elev. 98.81 to 96.61 ft, 0.5 to 0.10 ft below surface, near top of unit (80° 85' N Lat, 40° 48' W Long). Subm. by C. R. Nance.

WSU-207. Marmes Rock-shelter/45-FR-50 **4200 ± 150**
2250 B.C.

Shell from Unit VII at Datum 96.26 to 95.36 ft, on same location as WSU-206. Subm. by C. R. Nance.

WSU-209. Marmes Rock-shelter/45-FR-50 **7400 ± 110**
5450 B.C.

Shell from Unit III at datum elev. 92.2 to 92.5 ft (85° N Lat, 45° 05' W Long). Coll. 1964 by W. Moore; subm. by C. R. Nance.

WSU-210. Marmes Rock-shelter/45-FR-50 **7870 ± 110**
5920 B.C.

Shell from Unit II-III at datum elev. 89.6 to 89.8 ft (87° 88' N Lat, 40° W Long). Coll. by W. Moore and subm. by C. R. Nance.

WSU-211. Marmes Rock-shelter/45-FR-50 **10,750 ± 90**
8800 B.C.

Shell from Burial 15 at datum elev. 88.27 ft (87° 88' N Lat, 23° 24' W Long).

WSU-212. Marmes Rock-shelter/45-FR-50 **1300 ± 140**
A.D. 650

Charcoal from Unit VII.

WSU-362. Marmes Rock-shelter/45-FR-50 **Modern**

Charcoal from hearth. Coll. by Dr. K. P. Oakley, British Mus., London, England.

WSU-363. Marmes Rock-shelter/45-FR-50 **10,810 \pm 275**
8860 B.C.
 Shell from Site F-65(5) 8-10A.

WSU-366. Marmes Rock-shelter/45-FR-50 **10,475 \pm 270**
8525 B.C.
 Shell from Site F-65(5) 8-10B.

Palouse River series, Washington

Shell and charcoal from Site 45-WT-2, Whitman county, Washington. Samples coll. summer, 1963 by C. R. Nance, unless otherwise stated.

WSU-170. Palouse River **7300 \pm 180**
5350 B.C.

Shell from Pit CL-9 at 94.50 ft below datum, beneath layer of Mazama ash. *Comment:* confirms date of Cascade Point-type Archeological Complex found below volcanic ash.

WSU-171. Palouse River **150 \pm 80**
A.D. 1800

Charcoal mixed with corn from Pit CL-13, 1 to 1.1 ft below surface. Coll. 1963 by W. Moore and J. Chatters, WSU Archeol. field crew.

WSU-187. Palouse River **2740 \pm 110**
790 B.C.

Charcoal from Pit CL-5, 95.58 to 94.9' below datum by fire hearth at Feature 6, (7° 2.5' S Lat, 15° 1.5' W Long). *Comment:* should date deposits below slump in this part of site.

Vashon Island series, Washington

Charcoal and shell from Leo Long property at InterQuartermaster Harbor on Vashon Is. Samples coll. 1965 by Dr. R. M. Chatters and subm. by Leo Long.

WSU-348. Vashon Island **1670 \pm 160**
A.D. 280

Charcoal from upper midden on Vashon Is.

WSU-349. Vashon Island **1890 \pm 170**
A.D. 60

Shell from lower midden on Vashon Is.

WSU-354. Vashon Island **1740 \pm 170**
A.D. 210

Shell mixed with finely divided charcoal from lower midden on Vashon Is.

WSU-367. Tucannon River, Washington **1720 \pm 165**
A.D. 230

Bone from mouth of Tucannon R., 5 mi S of Starbuck, Columbia county, Washington. Coll. by C. M. Nelson and subm. by Dr. R. D. Daugherty, Anthropol. Dept., Washington State Univ. *Comment:* provides date on lower part of loess.

Wawawai series, Washington

Shell and charcoal from site 3.5 mi down Snake R. from Wawawai, Whitman county, Washington. Coll. 1965 by Richard Sprague, Dept. of Anthropol., Washington State Univ.

WSU-409. Wawawai/45-WT-36-C10 **7710 \pm 150**
5760 B.C.

Shell from Camas Prairie RR cut, near Thorn Thicket Creek; elev. 99.50 to 99.25 ft. *Comment:* indicates relative placement of geological deposits containing sample and its level.

WSU-410. Wawawai/45-WT-36-F4 **470 \pm 610**
A.D. 1480

Charcoal mixed with shell from Camas Prairie RR cut; elev. 101.77 ft. *Comment:* indicates relative placement of component assoc. with feature.

WSU-411. Wawawai/45-WT-36-F2 **834 \pm 560**
A.D. 1116

Charcoal from Camas Prairie RR cut near Thorn Thicket Creek, Feature 2, elev. 102.50 ft. *Comment:* indicates relative placement of component assoc. with feature.

II. GEOLOGIC SAMPLES*A. Idaho*

WSU-283. Troy, Idaho **3180 \pm 210**
1230 B.C.

Charcoal chunks covered by soil from hand-dug soil pit ca. 18 to 24 ft below surface, Site 64-IDA-2923, 5 mi NW of Troy, Latah county, Idaho. Soil enclosing sample is high in volcanic ash. Coll. 1964 by Lowell Garber; subm. by Maynard Fosberg, Dept. of Agricultural Biochem. and Soils, Univ. of Idaho, Moscow, Idaho.

B. Montana

WSU-369. Upper Yellowstone Drainage, Montana **1230 \pm 160**
A.D. 720

Charcoal from Site 24, Pa 301, Occupation Level III, ca. 2 mi N of Gardiner, Montana, immediately N of Yellowstone Park (3° 45' N Lat, 110° 41' Long). Coll. by G. W. Arthur and subm. 1965 by Montana State Univ., Missoula, Montana.

*C. Oregon***Blue Lake Crater series, Oregon**

Charcoal from Blue Lake Crater area, Oregon. Samples are from interface cinders from Blue Lake Crater and ash from Sand Mt. volcano. Coll. and subm. by E. M. Taylor, Dept. of Geol., Washington State Univ. (Taylor, 1965).

- 3440 \pm 250**
1490 B.C.
- WSU-291. Blue Lake Crater/T-13-S**
Charcoal mixed with ash from road cut exposure at depth 15 ft from surface, from Site R-8-E, #S-16.
- 1590 \pm 160**
A.D. 360
- WSU-292. Blue Lake Crater/T-14-S**
Charred tree roots from lava flow at Site R-7-E, #S-28.
- 2883 \pm 175**
933 B.C.
- WSU-364. McKenzie Pass, Oregon**
Charcoal mixed with volcanic ash 1 mi W of Dee Wright Observatory, McKenzie Pass, Oregon Cascades, Site TFJ-207. Coll. 1965 by E. M. Taylor.
- 2550 \pm 165**
600 B.C.
- WSU-365. Three Sisters area, Oregon**
Charcoal $\frac{1}{8}$ mi E of Four-in-One Cinder Cone, Three Sisters area, Oregon Cascades, Site TS-374. Coll. 1965 by E. M. Taylor.
- Three-Fingered Jack Quad series, Oregon**
Charred wood and root from Three-Fingered Jack Quad area. Coll. and subm. by E. M. Taylor.
- 1950 \pm 150**
A.D. 1
- WSU-371. Three-Fingered Jack Quad**
Charred wood near Jack Pine Road, S of Pass Highway. *Comment:* dates 1st eruptions of coarse cinders from Lost Lake Cones, which are among oldest of Sand Mt. volcanic field.
- 3850 \pm 215**
1900 B.C.
- WSU-372. Three-Fingered Jack Quad**
Charred root bark mixed with soil and rootlets near Old Santiam Wagon Rd. *Comment:* dates Fish Lake lava flow from Nash Crater, one of youngest flows of Sand Mt. lava fields.

D. Utah

- 5600 \pm 170**
3650 B.C.
- WSU-246. Big Cottonwood Canyon, Utah**
Marl from Big Cottonwood Canyon, S of Salt Lake City, Utah. Should date maximum of Lake Bonneville for Pinedale standard. Coll. and subm. by Roald Fryxell, Dept. of Geol., Washington State Univ. and U.S. Geol. Survey. *Comment:* will provide date closely corresponding to age of maximum Lake Bonneville stand during Pinedale time.

E. Washington

- 12,000 \pm 310**
10,050 B.C.
- WSU-155. Lower Grand Coulee, Washington**
Shell from Site LGC-2, abandoned quarry in Glacier Peak ash at E wall of Lower Grand Coulee, ca. 8 km N of Soap Lake, Washington. Coll. and subm. by Roald Fryxell.

WSU-231. Round Lake, Washington **10,210 ± 210**
8260 B.C.

Marl from NW side of Round Lake in Twin Lake area, Washington. Coll. and subm. by Roald Fryxell.

WSU-232. Willow Island, Washington **1440 ± 185**
A.D. 510

Wood from Willow Is., S of Whiskey Dick at Monolith site. Coll. and subm. by Roald Fryxell.

WSU-243. Moran Prairie, Washington **20,200 ± 550**
18,250 B.C.

Charcoal of "Miocene" oak from Moran Prairie, S of Spokane, Washington. Log buried by lava flow. Coll. and subm. by Kurt Lunum, Dept. of Forestry, Washington State Univ.

III. OCEANOGRAPHIC SAMPLES

A. Arabia, NE Africa

Red Sea series, between Arabia and NE Africa

Calcareous fragments cementing *Creseis* and planktonic *Foraminifera* from Red Sea from research vessel *Vema*. Coll. 1958 and subm. by Yvonne Herman, Dept. of Geol., Washington State Univ.

WSU-374. Red Sea/V-14-120 **12,625 ± 715**
10,675 B.C.

Sample at depth 70 cm at (20° 26' N Lat, 38° 13' E Long). *Comment*: WSU-374, 375, and 376 give absolute age for onset of unusual conditions which lead to precipitation of submitted "hard crust" in Red Sea. This is 1st instance that cemented calcareous rocks have been cored from ocean bottom. It is expected that precipitation of CaCO_3 took place at end of last glacial period as result of temperature increase and temporary separation of basin from Indian Ocean.

WSU-375. Red Sea/V-14-117 **11,950 ± 150**
10,000 B.C.

Sample at depth 40 cm at (18° 48' N Lat, 39° 31' E Long).

WSU-376. Red Sea/V-14-119 **10,825 ± 845**
8875 B.C.

Sample at depth 55 cm at (20° 50' N Lat, 38° 17' E Long).

IV. HYDROLOGIC SAMPLES

Pullman-Moscow Water Dating Project series, Washington-Idaho

Dates reported below resulted from study in which carbon-14 dating techniques were used as inventory technique and as means of contributing to basic knowledge of ground-water accumulation and movement.

In this study of Pullman (Washington) — Moscow (Idaho) ground-water basin of E Washington and W Idaho, data indicate that ground-

Summary of Pullman-Moscow Basin Ground-Water Analyses

| Sample Number | Well Number | C ¹⁴ Age | Detection Limits | Date Collected | Elevation Productive Zone | Type of Aquifer |
|---------------|-------------|---------------------|------------------|----------------|---------------------------|---------------------|
| 156 | 14/44-14P1 | 7,650 | ± 250 | 4/15/64 | 2052-2252? | Basalt |
| 158 | 14/44-14P1 | 6,850 | ± 240 | 4/28/64 | 2052-2252? | Basalt |
| 342 | 14/44-21M1 | 18,000 | ± 400 | 6/18/65 | 2418-2423 | Basalt |
| 344 | 14/44-34C1 | 4,640 | ± 190 | 6/18/65 | 2257-2277 | Basalt |
| 311 | 14/45-3H2 | Modern | | 5/11/65 | 2470-2475 | Loess |
| 307 | 14/45-3K1 | 19,550 | ± 400 | 5/5/65 | 2219-2224 | Basalt? |
| 153 | 14/45-4H1 | 11,800 | ± 220 | 4/9/64 | 2178-2188 | Porous Basalt |
| 172 | 14/45-4H1 | 14,900 | | 5/22/64 | 2178-2188 | Porous Basalt |
| 346 | 14/45-4H1 | 13,500 | ± 410 | 6/28/65 | 2178-2188 | Porous Basalt |
| 182 | 14/45-4N1 | 6,550 | ± 150 | 6/4/64 | 2282-2287 | Basalt |
| 148 | 14/45-5B4 | 9,250 | ± 290 | 4/3/64 | 2257-2267 | Basalt |
| 149 | 14/45-5B4 | 8,550 | ± 280 | 4/7/64 | 2105-2160 | Basalt |
| | | | | | 2257-2267 | |
| 334 | 14/45-7F2 | 3,240 | ± 190 | 5/21/65 | 2105-2160 | Soft Basalt |
| 323 | 14/45-15B1 | 5,400 | ± 195 | 5/18/65 | 2250-2255 | Basalt |
| 309 | 14/45-28H1 | Modern | | 5/7/65 | 2394-2399 | Fine, white sand |
| 322 | 14/46-8K1 | 37 | ± 150 | 6/10/65 | 2348-2363 | Decomposed granite |
| 345 | 14/46-19M1 | 2,410 | ± 180 | 6/21/65 | 2555-2560 | Sand |
| 159 | 15/44-15A2 | Modern | | 5/1/64 | 2401-2402 | Decomposed granite |
| 160 | 15/44-15A2 | Modern | | 5/2/64 | 2166-2174 | Decomposed granite |
| 340 | 15/44-15G1 | 9,550 | ± 230 | 6/17/65 | 2166-2174 | Basalt |
| 337 | 15/45-10F1 | 3,180 | ± 185 | 6/15/65 | 2206-2228 | Basalt |
| 312 | 15/45-14Q1 | 10,390 | ± 260 | 5/11/65 | 2506-2511 | Basalt & Quartzite? |
| 310 | 15/45-29G1 | 19,150 | ± 410 | 5/7/65 | 2247-2257 | Basalt |
| | | | | | 2204-2209 | |

Summary of Pullman-Moscow Basin Ground-Water Analyses (cont'd.)

| Sample Number | Well Number | C ¹⁴ Age | Detection Limits | Date Collected | Elevation Productive Zone | Type of Aquifer |
|------------------|----------------|------------------------|---------------------|-------------------|------------------------------|--------------------|
| 336 | 15/45-30G4 | 15,900 | ± 370 | 6/8/65 | 2170-2195 | Porous Basalt |
| 157 | 15/45-32N2 | 6,150 | ± 260 | 4/23/64 | 1391-1946 | Basalt |
| 335 | 15/45-32N2 | ≥ 32,000 | | 6/9/65 | 1391-1946 | Basalt |
| 181 | 15/45-34L2 | 13,900 | ± 350 | 5/26/64 | 2138-2145 | Basalt |
| 306 | 15/45-35F1 | 2,110 | ± 190 | 4/30/65 | 2360-2402 | Basalt? |
| 339 | 16/45-27R1 | 1,685 | ± 190 | 6/17/65 | 2353-2356 | Basalt |
| 347 | 39/5W-4N1 | 9,160 | ± 300 | 6/18/65 | 2430-2434 | Porous Basalt |
| 165 | 39/5W-7E1 | 9,100 | ± 150 | 5/11/64 | 1877-1882 | Basalt |
| 314 | 39/5W-7E1 | 23,800 | ± 440 | 5/17/65 | 1276-1889 | Basalt |
| 352 | 39/5W-7C2 | 19,700 | ± 410 | 7/8/65 | 1257-1667 | Basalt |
| 305 | 39/5W-7J2 | 13,250 | ± 340 | 4/29/65 | 2313-2343 | Basalt |
| 313 | 39/5W-7P1 | 24,200 | ± 340 | 5/13/65 | 2278-2346 | Basalt & Sand |
| 161 | 39/5W-8F1 | 18,600 | ± 450 | 5/2/64 | 1282-1675 | Basalt & Sand |
| 304 | 39/5W-8F1 | ≥ 31,000 | | 5/23/65 | 1282-1675 | Basalt & Sand |
| 162 | 39/5W-15F1 | 7,340 | ± 270 | 5/7/64 | 2456-2459 | Basalt |
| 338 | 39/5W-15G1 | 7,800 | ± 240 | 6/16/65 | 2339-2469? | Basalt |
| 341 | 40/5W-30L1 | 11,120 | ± 250 | 6/17/65 | 2296-2336 | Decomposed granite |

waters are distinctly stratified and display a well-defined relationship between water age and elevation of the productive zone.

The bulk of the ground-water appears to have been placed in storage by the closing phases of the Pleistocene glaciation. Some additional recharge has been occurring in the Pullman sub-basin since the thermal maximum about 6500 yr ago.

The carbon-14 data indicate that there has been no measurable recharge in the Moscow area in recent times. However, recharge in the Pullman sub-basin is estimated to be 108,000 gallons per year, or about 10% of the present pumping rate.

The samples were coll. by the ion-exchange technique between April, 1964 and July, 1965 and were subm. by J. W. Crosby, III, Albrook Hydraulic Lab. and R. M. Chatters, Radioisotopes and Radiations Lab, unless otherwise stated (Crosby and Chatters, 1965 a,b).

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