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UNIVERSITY OF WASHINGTON DATES IV

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The dates reported in this list are for geologic and archaeologic samples only. During the interval since our last date list (R, 1966, v 8, p 498-506) most of our measurements have been on samples of sea water. These will be reported separately at a later time. The methods used are essentially those reported previously (R, 1963, v 5, p 80-81) but with the following notable changes and additions: We now prepare our methane counting gas as described in Buddemeier *et al* (1970). Our 1L membrane counter has since been augmented by 3 additional counters. Two of these are 1L quartz proportional counters inside geiger anticoincidence shields. Operating pressures are ca 1.5 to 4atm. Backgrounds of these 2 counters are in the neighborhood of 1.8 and 3cpm and the net counting rate of NBS oxalic acid ranges from 7 to 18.7cpm, depending on the pressure. The third counter ("minicounter") is rather special: a .1L quartz proportional counter inside a methane proportional anticoincidence counter. Sample and anticoincidence counting gases are introduced simultaneously with a differential pressure that never exceeds a few cm Hg. The sample filling side is constructed so as to minimize dead volume; over 80% of the sample gas is inside the active volume of the ^{14}C counter. The range of filling pressures which are possible is ca 1 to 4atm.

Samples with as little as .1g of carbon were measured using this counter. Several samples reported in this date list were measured with it, being particularly useful for samples with $<$ 1g of datable carbon. The counting rate is very stable, a necessary condition for the week-long counting periods required for old samples. The background counting rate is very slightly pressure-dependent. At 4atm filling pressure it is 0.290 $\pm$ 0.005cpm. The corresponding net counting rate of NBS oxalic acid at this filling pressure is 2.260 $\pm$ 0.020cpm. The outer walls of the counter are stainless steel, and the shielding consists of 3cm mercury and 14cm ordinary steel. All electronics are housed on top of the shield inside a faraday cage.

All 4 ^{14}C counters are automatically scaled for 10min and the counts read out onto punched paper tape. Each day the tape is read into a computer and the data re-recorded onto magnetic tape. Simultaneously the computer is programmed to make chi squared tests on the 10min counts to reject any results which fail to satisfy Chauvenet's criterion, (which seldom happens and then only for a datum which barely falls outside the criterion limit), to compute average counting rate and standard deviation, and print out all these data. Ages are calculated from the net counting rate using 5568 yr for the radiocarbon half-life.

SAMPLE DESCRIPTIONS

I. ARCHAEOLOGIC SAMPLES

A. Southern Africa

Nelson Bay Cave series, South Africa

Nelson Bay Cave (34° 6′ 10″ S, 23° 22′ 30″ E) is on the Robberg Peninsula at Plettenberg Bay, ca 500km E of Cape Town, South Africa. Excavations were started in 1965-66 by R R Inskeep and continued by R G Klein and R R Inskeep in 1971-72. A 2m sequence of Middle Stone age levels is overlain unconformably by 6m of Later Stone age. UW-224, -223, and -290 date successively lower Middle Stone age horizons, but are considerably more recent than dates on comparable materials elsewhere, eg, at the Kalasies River Mouth caves (Klein, 1974a). In the absence of easily identifiable charcoal, patches of darkish sediment were chosen for dating and contamination is likely. UW-175 dates earliest Later Stone age occupation in the cave, belonging to the Robberg industry. It agrees with GrN-5884: 18,660 ± 110 (unpub) on the same level and with I-6516: 16,700 ± 240 (unpub) on a slightly higher Robberg horizon. UW-218, -177, -162, -164, and -178 are on successively higher levels of the Albany industry which overlies the Robberg industry at the site. Although UW-218 is out of sequence, the dates agree well with I-6515: 10,080 ± 260, Pta-392: 10,150 ± 90, and Q-1085: 10,256 ± 210 (unpub) which are on the same levels as UW-177, -164, and -178, respectively. Faunal remains accompanying the Albany industry include shells and bones of marine creatures, making their first appearance in the cave in the lowermost Albany horizons. The last appearance of some now extinct large mammals is also recorded in the lowermost Albany levels. UW-184, -181, -179, -222, -187, -176, -186, -216, and -217 date successively higher levels of Wilton industry which closes out the sequence at Nelson Bay. The Nelson Bay cultural sequence and fauna have been discussed by Klein (1972a, b; 1974a, b), sediments by Butzer (1973). An earlier date list may be found in Fairhall and Young (1973). Coll and subm 1970-73 by R G Klein.

UW-162. Nelson Bay Cave — **11,505 ± 110** / **9655 BC**
Charcoal from Level CS.

UW-164. Nelson Bay Cave — **10,180 ± 85** / **8230 BC**
Charcoal from hearth, Level CS.

UW-175. Nelson Bay Cave — **18,100 ± 550** / **16,150 BC** / $\delta^{13}C = -27.3‰$
Fine charcoal in carbonaceous earth from base of Level YGL.

UW-176. Nelson Bay Cave — **6020 ± 160 / 4070 BC**
$\delta^{13}C = -24.5‰$

Charcoal from brown soil, Level BSBI.

UW-177. Nelson Bay Cave — **11,950 ± 150 / 10,000 BC**
$\delta^{13}C = -29.0‰$

Charcoal from brown soil, Level GSL.

UW-178. Nelson Bay Cave — **10,540 ± 110 / 8590 BC**
$\delta^{13}C = -19.4‰$

Soil from Level BSBJ.

UW-179. Nelson Bay Cave — **9080 ± 185 / 7130 BC**
$\delta^{13}C = +1.6‰$

Shell (*Patella*) at top of Level RA.

UW-181. Nelson Bay Cave — **8070 ± 240 / 6120 BC**
$\delta^{13}C = -25.6‰$

Charcoal from interface of Levels J and RB.

UW-184. Nelson Bay Cave — **8570 ± 170 / 6620 BC**
$\delta^{13}C = -0.9‰$

Shell (*Patella*) from interface of Levels J and RB.

UW-186. Nelson Bay Cave — **6050 ± 80 / 4100 BC**
$\delta^{13}C = -24.8‰$

Charcoal from brown soil, Level BSBI.

UW-187. Nelson Bay Cave — **5825 ± 150 / 3875 BC**
Fine charcoal in soil from Level BSBH.

UW-216. Nelson Bay Cave — **5830 ± 115 / 3880 BC**
Charcoal, Level H/G.

UW-217. Nelson Bay Cave — **4860 ± 65 / 2910 BC**
Shell (*Patella*), Level I.

UW-218. Nelson Bay Cave — **10,600 ± 150 / 8650 BC**
Charcoal from interface of Levels YSL and BSL.

UW-222. Nelson Bay Cave — **6070 ± 125 / 4120 BC**
$\delta^{13}C = -24.3‰$

Finely divided charcoal in soil matrix.

24,120 ± 660
UW-223. Nelson Bay Cave **22,170 BC**
$\delta^{13}C = -25.0‰$

Charcoal from black loam, MSA SPIT 10.

17,600 ± 195
UW-224. Nelson Bay Cave **15,650 BC**

Carbonaceous sediment from MSA SPIT 8.

22,400 ± 340
UW-290. Nelson Bay Cave **20,450 BC**

Brown soil from MSA SPIT 10.

Hoffman's Cave series, South Africa

Hoffman's Cave (=East Ghwanogat) (34° 6′ S, 23° 22′ E) is ca 300m E of Nelson Bay Cave on the Robberg Peninsula, Plettenberg Bay, South Africa. A C Hoffman excavated a trench ca 1.5m wide and 5m long through roughly 2m of Later Stone age shell midden and recovered numerous human remains, animal bones, and artifacts (all unpub). The trench bottomed out on sterile sand. In 1970, R G Klein attempted unsuccessfully to determine what, if anything, lay below the sand, which is a minimum of 3.5m thick. UW-205 and -204 date bottom and top, respectively, of the Later Stone Age midden sequence in trench. Contents of a balk sample removed from the site in 1970 were reported by H J Deacon (1972, 1974). Subm 1971 by R G Klein.

3190 ± 110
UW-204. Hoffman's Cave **1240 BC**
$\delta^{13}C = +0.4‰$

Shell (*Patella*) from top of midden.

3770 ± 100
UW-205. Hoffman's Cave **1820 BC**
$\delta^{13}C = +0.8‰$

Shell (*Patella*) from bottom of midden, over massive sandy base.

Elandsbay Cave series, South Africa

Elandsbay Cave (32° 30′ S, 18° 30′ E) is ca 160km N of Cape Town on the Atlantic Coast of South Africa. Excavations were conducted in 1970 and 1972 by J E Parkington (1972). UW-193 and -192 date successively higher levels of the Albany industry within the cave, containing, among other things, the latest known occurrence of the giant Cape Horse (*Equus capensis*). They agree well with Pta-737: 10,700 ± 100, -732: 10,640 ± 110, and -686: 9600 ± 90 (unpub), also on successively higher Albany horizons within the cave. Subm 1971 by R G Klein.

11,070 ± 140
UW-192. Elandsbay Cave **9120 BC**
$\delta^{13}C = -23.4‰$

Charcoal from Level 6 (bottom).

10,090 ± 165
8140 BC

UW-193. Elandsbay Cave
Charcoal from Level 6 (middle).

Melkhoutboom Cave series, South Africa

Melkhoutboom Cave (33° 19′ S, 25° 17′ E) is in the Cape Folded Mts, ca 75km NE of Porth Elizabeth, South Africa. Excavations were conducted in 1967 and 1969 by H J Deacon. UW-233 dates earliest occupation of cave, assigned to Robberg industry. UW-234 is on the lowermost Wilton level at the site. The dates are in proper sequence; a series of GaK and Pta dates discussed by Deacon (1969, 1972, 1974). Subm 1971 by R G Klein.

15,400 ± 120
13,450 BC

UW-233. Melkhoutboom Cave
Charcoal from basal unit.

7290 ± 80
7340 BC

UW-234. Melkhoutboom Cave
Charcoal from Wilton Base Marker.

Boomplaas Cave A series, South Africa

Bloomplaas Cave A (33° 23′ S, 22° 11′ E) is in mts of the Cape Folded Belt, ca 30km N of Oudtshoorn, Cape Province, South Africa. UW-307 dates a late Wilton level with pottery and sheep remains. UW-336 is on a lower Wilton level with sheep but no pottery. UW-306 is on a yet earlier, pre-pottery, pre-sheep Wilton level. UW-301 is on an early Albany industry level. UW-300, -304, -305, and -308 are on successively lower horizons with, as yet, undescribed cultural materials. In combination with artifactual, faunal, and sedimentologic data, available dates indicate that Boomplaas Cave A contains the longest continuous or near continuous Upper Pleistocene/Holocene sequence discovered in South Africa. Excavation was started in 1974 and continues under the over-all direction of H J Deacon. Subm 1974 by R G Klein.

21,110 ± 420
19,160 BC

UW-300. Boomplaas Cave A
Charcoal dust in soil matrix from Level AF1LP.

14,200 ± 240
12,250 BC

UW-301. Boomplaas Cave A
Charcoal from Level CL.

32,400 ± 700
30,450 BC

UW-304. Boomplaas Cave A
Charcoal in soil matrix from Level BPBH.

UW-305. Boomplaas Cave A **>40,000**
Charcoal from Level OLP1.

UW-306. Boomplaas Cave A **6400 ± 75**
4450 BC
Charcoal from Level AF1 BRL.

UW-307. Boomplaas Cave A **1510 ± 75**
AD 440
Charcoal from Level BLD.

UW-308. Boomplaas Cave A **>40,000**
Charcoal dust in soil matrix from Level P12BOL.

UW-336. Boomplaas Cave A **1955 ± 65**
5 BC
Charcoal from BLD AM-AF/P18.

UW-337. Boomplaas Cave A **1630 ± 50**
AD 320
Charcoal from AF-DGL/L13.

UW-338. Boomplaas Cave A **1700 ± 50**
AD 250
Charcoal from BLD 2/I14.

Saldanha Bay series, South Africa

The Sea Harvest Middle Stone age shell midden is at Saldanha Bay, South Africa (33° S, 18° E). Dates were expected in view of K W Butzer's (ms in prep) tentative geologic evaluation of midden age as later Last Interglacial. The Sea Harvest Middle Stone age shell midden and others around Saldanha Bay are the oldest open-air shell middens discovered anywhere in the world. Coll and subm 1973 by R G Klein.

UW-282. Sea Harvest midden **>40,000**
Ostrich egg shell picked from mixed ostrich egg and *Patella* shells.

UW-292. Sea Harvest midden **>40,000**
Ostrich egg shell.

UW-291. Die Kelders Cave I, South Africa **1570 ± 55**
AD 380
Charcoal from Die Kelders Cave I ca 160km ESE of Cape Town on S coast of South Africa (34° 32′ S, 19° 22′ E). Dates a Later Stone age horizon with earliest sheep remains recovered at the site (Schweitzer & Scott, 1973; Schweitzer, 1974). Date is in proper sequence with a series of GX and GaK dates indicating that entire Later Stone age occupation at Die Kelders I falls within the 1st 500 yr AD (Schweitzer, 1970). Coll 1970 and subm by R G Klein.

UW-287. Gansbaai, South Africa **10,570 ± 85**
8620 BC
Pulverized charcoal in sand from Byeneskranskop Cave I (34° 35′ S, 19° 28′ E), ca 160km ESE of Cape Town, near Gansbaai, South Africa. Sample from a level containing artifacts belonging to the Later Stone

age Albany industry. It is in sequence with I-7948: 12,730 ± 185 (unpub) on a somewhat lower Albany horizon. Excavation was started 1973 by F R Schweitzer and continues. Subm by R G Klein.

B. Northern Africa

Ahaggar series, Algeria

The Ahaggar massif rises in S region of Algerian Sahara above vast lowlands all around, particularly toward W and S. It was mainly formed, at its center, by huge volcanic formations of all kinds, surrounded by granitic chains where most archaeologic sites appear. Geologic formations are sometimes more varied on its ledges, with particularly long plateaus of sandstone, "Tassili". Roughly between 1° and 10° E, 20° and 27° N, it is crossed by the Tropic of Cancer and, thus, has a tropical climate, ranging from dry lowlands to wetter and grassy summits.

This massif was, for a long time, almost totally unknown to archaeologists. Only a few studies were made between 1940 and 1960, *ie,* those by H Lhote, and mainly H J Hugot, who worked in the NW area. By 1963 J P Maître made the 1st surveys and excavations in the Atakôr and Tefedest ranges, the heart of the massif. Ten yr of field work and analysis led to the hypothesis that 2 main Neolithic cultures occupied the central region from ca 9000 to 2000 BC (Maître, 1971, 1974, 1975). The oldest is the Timidouîn culture, or Mountain Neolithic, and is supposedly from late Paleolithic levels, 10th millennium BC; it is found in all the highlands, chiefly in the Tefedest range and the N Atakôr. The other, the Amekni culture, seems more recent and diffused into the rolling country beneath the mts; it is probably an evolved stage of Sudanese tradition Neolithic.

Of the following radiocarbon dates, UW-87 is related to lower phase Amekni culture; UW-96 and -97, probably to Timidouîn culture. The others (UW-88, -89, -93, -95) derive from archaeologic levels of S Atakôr, where confusion still exists; it seems here that an Amekni influence reached numerous sites of Timidouîn type. Some archaeologists, eg, G Camps (1974), reject these views and attribute findings to only one civilization, "Saharo-Sudanese Neolithic", which filled Sahara with several sub-cultures, differing in each area.

UW-87. Amekni **8050 ± 80**
6100 BC

Charcoal from hearth at 80cm depth under collapsed stone shelter in Amekni Wadi valley, ca 40km WNW of Tamanrasset (22° 53′ N, 05° 14′ E). Charcoal from base of site was dated 8670 ± 150 BP (MC-212; R, 1969, v 11, p 127). Other samples from the same site, Gif-464: 5500 ± 250 BP (R, 1970, v 12, p 436) and Gif-1222: 6800 ± 220 BP (R, 1972, v 14, p 293) indicate a long occupation. Coll 1965 by J P Maître and G Camps, Inst Sci Humaines en Algérie; subm by W A Fairservis.

5090 ± 80

UW-88. Abouleg **3140 BC**

Charcoal from site atop small hill on right bank of Aoufayen Wadi (23° 39′ N, 05° 59′ E), depth 15 to 30cm. Replicate samples dated 5130 ± 110 (MC-472, unpub) and 4600 ± 250 BP (Gif-465; R, 1970, v 12, p 437). Coll 1965 by J P Maître; subm by W A Fairservis.

6830 ± 80

UW-89. Abouleg **4880 BC**

Charcoal from same site as above, depth 30 to 60cm. Coll 1965 by J P Maître; subm by W A Fairservis.

Tiltekin sub-series

Discovered in 1961 by M Launey, 5 excavations were made in 1966. The sites are among granitic debris on summit and adjacent slopes of a prominent spur at confluence of Tiltekin and In Daleg Wadis, ca 50km NNE of Tamanrasset (23° 18′ N, 05° 45′ E). Coll and subm 1966 by J P Maître.

7090 ± 90

UW-93. Charcoal **5140 BC**

From a small barrow at edge of site. Exact relation between this site and the others is unknown.

6800 ± 105

UW-94. Hearth γ **4850 BC**

Charcoal, 25 to 45cm depth.

5055 ± 80

UW-95. Midden α **3105 BC**

Charcoal from small midden at edge of site. This site appears to be related to the others.

8475 ± 100

UW-96. Hearth β **6525 BC**

Charcoal, 20 to 40cm depth. Another sample from 30 to 40cm depth dated 7960 ± 100 BP (MC-739, unpub).

9210 ± 115

UW-97. Hearth β **7260 BC**

Charcoal, 40 to 60cm depth. Another sample from 50 to 60cm depth dated 8900 ± 230 BP (MC-740, unpub).

C. New Guinea

Kainantu series, Papua, New Guinea

First archaeologic project directed to discovery and excavation of open sites in the Kainantu subdistrict, Eastern Highlands Dist, Papua, New Guinea. Seventy sites were located, of which 8 were excavated. The bulk of artifacts recovered are stone tools, suggesting a predominantly lithic technology (Watson & Cole, in press). Coll 1967 by J D Cole, Univ Washington.

3300 ± 120

UW-107. Kainantu subdistrict **1350 BC**

Charcoal from habitation surface in Site NGG, Unit 1S18W (6° 25′ S, 145° 50′ E) at +1680m. Assoc with a few stone tools, but at same level as larger concentrations of artifacts in other secs of site. Subm by W A Fairservis.

3780 ± 100

UW-108. Kainantu subdistrict **1830 BC**

Charcoal from Type E hearth (stone-ringed, circular) at Site NGH, Units 2S5W and 2S6W (6° 25′ S, 145° 50′ E) at +1700m. Subm by W A Fairservis.

3530 ± 130

UW-260. Kainantu subdistrict **1580 BC**

Charcoal from Site NFB at E edge of Noreikora Swamp (6° 24′ S, 145° 54′ E). Scatter sample from Level 5, Baulk 16N8W-16N10W, beneath a fragment of stone bowl or mortar at depth 70.5cm, Level 4B. Subm by V D Watson.

3060 ± 70

UW-261. Kainantu subdistrict **1110 BC**

Charcoal from Site NFB at E edge of Noreikora Swamp (6° 24′ S, 145° 54′ E). Sample from Baulk 16N6W-16N8W, Level 4A, above Level 4B. Subm by V D Watson.

11,510 ± 140

UW-262. Kainantu subdistrict **9560 BC**

Charcoal from Site NFX, 200 m N of Malaria R (6° 39′ S, 146° 00′ E). Scatter sample from 3S20W assoc with a few stone tools and debitage that lay on culturally sterile soil. Site was occupied intermittently over a long period. Bulk of artifacts, occurring at overlying level were not radiometrically dated. A frequency seriation suggests their similarity to material from Sites NGH and NGG, in decreasing order, and their post-dating NGG, although exact dates are undetermined. Subm by V D Watson.

D. North America

Enumclaw, Washington series, United States

The Osceola Mudflow was a massive flow emanating from volcanic activity above 3000m on Mt Rainier (Crandell, 1963) previously dated: L-233A, -233B (Science, 1956, v 124, p 158), W-564 (R, 1960, v 2, p 163) at ca 4800 BP. Excavations began in 1968 at the Imhof site, 45PI44 (47° 12′ N, 122° 07.5′ W). Subsequently, in 1972, excavations began at the Jokumsen site, 45KI5 (47° 11.5′ N, 122° 0.2.5′ W). In 1974, excavation was initiated at the Pedersen site, 45KI4 (47° 11′ N, 122° 02′ W) ca .8km S of the Jokumsen site, and are in progress. UW-254 and -255, from 2 pits dug through the flow into the soil beneath, are oldest pub dates for an archaeologic site W of the Cascade Mts in Washington State. UW-283, from the interface between mudflow and pre-existing soil, probably dates

the occurrence of the mudflow. The sites were subsequently reoccupied between 3400 and 300 yr ago (Hedlund, 1974; Hedlund, Northwest Anthropol Research Notes, in press). Coll and subm 1970-1974 by G C Hedlund, Green River Community Coll, Auburn, Washington.

Imhof subseries, 45PI44

445 ± 50

UW-253. Z6 **AD 1505**

Charcoal from fire pit 28 to 43cm from surface in mudflow.

690 ± 85

UW-254. Z6 **AD 1260**

Charcoal assoc with fire-cracked rock and worked jasper flakes at 57cm depth in mudflow.

Jokumsen subseries, 45KI5

5730 ± 90

UW-255. N2 W8 Loc 1 **3780 BC**

Charcoal assoc with leaf-shaped projectile point of red jasper at depth 1.65m from surface and 56cm below mudflow interface.

4980 ± 60

UW-283. N1 W2 Loc 2 **3030 BC**

Charcoal assoc with stone chips, flakes, and artifacts at interface of mudflow and underlying soil, 91cm below surface.

5750 ± 108

UW-284. N1 W2 Loc 2 **3800 BC**

Charcoal from hearth assoc with stone chipping detritus and artifacts 1.16m below surface and 25.5cm below mudflow interface.

1125 ± 70

UW-285. N1 W1 Loc 1 **AD 825**

Charcoal assoc with heavy cobble-sized rocks, probably an earth oven, at 75.5cm depth in mudflow and above interface.

5035 ± 90

UW-297. S1 W9 Loc 1 **3085 BC**

Charcoal assoc with many stone chips and flakes, scrapers, and 1 projectile point, at 1.34m from surface and 5cm below mudflow interface. Area appeared to be a hearth feature and work area.

UW-298. N9 W8 Loc 1 **Modern**

Wood, one of 5 posts found 48cm below surface in N-S alignment, probably part of house or shed structure. *Comment* (GCH): feature is probably of Euro-American origin.

960 ± 100

UW-302. S1 W10 Loc 1 **AD 990**

Charcoal assoc with stone chips and flakes, possibly a pit house, at 70cm from surface in mudflow.

980 ± 50

UW-303. S1 W8 Loc 1 **AD 970**

Charcoal assoc with stone chips and flakes in same pit as UW-302, at 60cm from surface.

695 ± 50

UW-316. S2 W10 Loc 1 **AD 1255**

Charcoal and carbonized wood from post 63 to 78cm below surface, assoc with stone chips, a stone knife, and red-stained soil.

3450 ± 80

UW-317. S1 W12 Loc 1 **1500 BC**

Charcoal from a hearth assoc with artifacts and chipping detritus, 63 to 78cm from surface at bottom of a large house pit feature.

3230 ± 60

UW-333. N2 W13 Loc 1 **1280 BC**

Charcoal from near base of house pit depression dug into mudflow at 93cm from surface. Assoc with chips, flakes, and artifacts.

315 ± 55

UW-334. Pedersen site, 45KI5 **AD 1635**

Charcoal from Test Pit 1 in what was probably a hearth, 45 to 58cm from surface, assoc with wild cherry pits, flakes, and a blade knife.

1070 ± 70

UW-38. Vantage, Washington **AD 880**

Charcoal from a prehistoric house pit on E bank of Columbia R, 45GR73, ca 22km upstream from Vantage (47° 08′ N, 120° 00′ W). Sample V from Housepit 11, 65cm below surface. Coll 1961 and subm by R E Greengo. *Comment* (REG): acceptable date for late Columbia Valley basally notched point complex.

1860 ± 110

UW-68. Redmond, Washington **AD 90**

Charcoal from Indian house pit (47° 40′ N, 122° 07′ W) 45KI9-A, Pit 27-S, Stratum 4, 90 to 110cm. Coll 1964 and subm by R E Greengo, Univ Washington. *Comment*: small sample required dilution with dead CO_2 prior to methane conversion.

E. Middle America

2820 ± 90

UW-118. Pololcingo, Mexico **870 BC**

Charcoal from Site Figueroa, 14Q MR 52-1, ca 1km W of Pololcingo village, Guerrero State (18° 17′ N, 99° 24′ W). Coll in Cut 5, 60 to 66cm below surface. Site exhibits only preclassic sherds and figurine fragments on surface. Sample assoc with Tlatilco-like pumpkin-shaped bottle vessel. Coll 1967 and subm by R E Greengo.

3460 ± 60

UW-120. Santa Teresa, Mexico **1510 BC**

Charcoal from El Calvario site, 14Q MR41-1, on N edge of Santa Teresa village, Guerrero State (18° 14′ N, 99° 30′ W). An occupation and burial site comprising at least 5 low mounds. Sample from lowest levels of highest mound, 1, combines samples from level 300 to 320cm and level 320 to 340cm below surface. Mound 1, ca 3m high, and its vicinity have potsherds and figurines of preclassic assoc. Other parts of site have materials of both preclassic and later periods. Coll 1967 and subm by R E Greengo.

F. South America

Guayaquil series, Ecuador

The following 3 samples are from the old hacienda La Atarazana on the N perimeter of Guayaquil (01° 10′ 48″ N, 79° 53′ 40″ W). The middens, only ca 1m deep, are on a bank leading down to a salt marsh, since closed off by urban development. Samples relate to Regional Developmental period, ca 300 to 400 BC. Coll 1967 by R & I Parducci, Mus House of Ecuadorian Culture, Guyayaquil; subm by R E Greengo.

2175 ± 60

UW-123. Cut M **225 BC**

Oyster shells found near sherds of pottery, depth 60 cm.

2185 ± 80

UW-124. Cut G **235 BC**

Charcoal from deepest stratum in deposit, depth 80cm.

2290 ± 100

UW-125. Cut E **340 BC**

Charcoal from 60cm depth.

II. GEOLOGIC SAMPLES

A. Western United States

Portland, Oregon series

The following 5 samples of carbonized wood fragments were obtained from borehole drillings: UW-310 and -311 are from a borehole in scoria of Boring Basalt atop West Hills near corner of SW Barnes and Miller Rd (45° 31′ N, 122° 45′ W). These dates indicate that Boring Basalt volcanism occurred > 40,000 yr ago, and that at least part of the volcanic deposits in this area was covered by sediments at that time. UW-314 is from a borehole at a dock along the W bank of the Willamette River N of Linnton (45° 36′ 28″ N, 122° 47′ 12″ W). UW-312 and -315 are from another borehole nearby on the bank (45° 36′ 34″ N, 122° 47′ 19″ W). These 3 samples reveal the young age of sediments filling the Portland basin (Hammond, ms in preparation). We can assume that either, 1) the Portland basin has been subsiding during the past 5000

yr or more, or 2) that sea level, hence, the levels of the Columbia and Willamette Rivers, have been rising during the same period of time, or 3) the sediments have been compacting. From differences in alt and ages between samples, we infer that rate of sediment accumulation and/or subsidence in the area is ca .4cm/yr (Hammond, 1975). Coll and subm 1974 by P E Hammond, Portland State Univ.

UW-310. B1, SS-11, wood **>40,000**

From gray silt, at 9.1 to 9.6m depth in borehole, at ca +222.5m.

UW-311. B1, SS-12, wood **>40,000**

From dark scoria (Boring Basalt), at 10.7 to 11.1m depth in same borehole as above.

UW-312. ZTE-8-15, charcoal **6490 ± 100**
4540 BC

From thin volcanic ash, tentatively id as Mazama ash, at 22.1 to 22.6m depth in borehole, at ca −13m. Date of Mazama eruption has been placed at 6600 BP (Fryxell, 1965) and 7000 BP (Kittleman, 1973). Small sample size required the minicounter.

UW-314. ZTE-13-2, wood **4800 ± 90**
2850 BC

From gray silt at 14.5 to 14.9m depth in borehole at ca −5.8m.

UW-315. ZTE-8-12, charcoal **5420 ± 100**
3470 BC

From gray silt at 17.5 to 18m depth in same borehole as UW-312, at ca −8.4m.

UW-309. Trout Lake, Washington **>40,000**

Charcoal in crossbedded fluvial basaltic sandstone underlying Skull Creek Point Basalt. Age is minimum for lava flow. Coll and subm 1974 by P E Hammond.

Cascade Range series, Washington

UW-66. Ronald, Washington **37,500 ± 2800**
35,500 BC

Charcoal from eolian silt beneath Bullfrog Till on E bank of Cle Elum R, 2.7km S of Ronald, Washington (47° 13′ N, 121° 01′ W). Coll and subm 1964 by S C Porter, Univ Washington. *Comment* (SCP): sample probably contaminated with Eocene coal. A duplicate sample was dated >37,000 (I-1717, unpub).

UW-116. Mt Baker, Washington **130 ± 40**
AD 1820

Wood from cutbank in Lateral Moraine II of E Nooksack Glacier (48° 50.6′ N, 121° 33.2′ W) ca 1.3m from top of moraine. Coll and subm 1967 by S C Porter.

Snoqualmie Pass series, Washington

The following 3 samples were coll in and beneath a bog resting on Hyak drift at Snoqualmie Pass, Washington (47° 29.5′ N, 121° 24.9′ W).

UW-73. Snoqualmie Pass, Washington **7200 ± 210 / 5250 BC**

Charcoal from basal peat, directly beneath Mazama ash. Minimum date for Hyak drift. Coll and subm 1964 by S C Porter.

UW-322. Snoqualmie Pass, Washington **7450 ± 70 / 5500 BC**

Wood at base of bog. Coll and subm 1974 by S C Porter.

UW-321. Snoqualmie Pass, Washington **11,050 ± 50 / 9100 BC**

Wood in late-Hyak gravel. Age is minimum for Hyak readvance. Coll and subm 1974 by S C Porter.

Olympic Peninsula series, Washington

The following 4 samples, all of the same age, are 1400 yr too young to have been incorporated in glacial drift by last glacial advance into the Puget Lowland. The anomaly has been attributed to a forest invasion of debris-mantled stagnant ice remaining after general ice recession. Subsequent melting and collapse of the superglacial terrain incorporated the younger trees into the glacial drift (Porter and Carson, 1971).

UW-144. Lake Dickey, Washington **12,660 ± 220 / 10,710 BC**

Wood from Fraser till in roadcut 4km S of Lake Dickey (48° 03.3′ N, 124° 28′ W). Coll 1969 D Biederman; subm S C Porter.

UW-146A. Simpson Lake, Washington **12,700 ± 160 / 10,750 BC**

Wood from a complex diamicton of late Fraser age exposed on N side of small hill immediately S of Simpson Lake (47° 7.8′ N, 123° 20.2′ W) and < 1km from drift border. Coll and subm 1969 by R J Carson, III.

UW-146B. Simpson Lake, Washington **12,430 ± 160 / 10,480 BC**

Duplicate of above.

UW-147. Simpson Lake, Washington **12,620 ± 150 / 10,670 BC**

Wood from same formation as UW-146A. A piece measured as a cross check by the Rudjer Boskovic Inst (R, 1971, v 13, p 138) gave 12,700 ± 200 BP. Coll and subm 1969 by R J Carson, III.

B. Alaska

Chagvan Bay series, Alaska

The following 4 samples are from bases of lacustrine sediments exposed in a sea cliff N of the mouth of the Salmon R near Platinum, Alaska. Peat directly overlies iron-stained glacial drift and dates a minimum age for 2 glaciations (Porter, 1967). Coll and subm 1963 by S C Porter.

UW-56. Salmon River **8910 ± 110 / 6960 BC**

Peat from bog 3km N of river mouth (58° 53.4′ N, 161° 46.9′ W).

UW-57. Salmon River **>45,000**

Peat from bog 2.6km N of river mouth (58° 53′ N, 161° 46.8′ W).

UW-70. Salmon River **12,830 ± 160 / 10,880 BC**

Peat from bog 1.9km N of river mouth (58° 52.7′ N, 161° 46.7′ W).

UW-71. Salmon River **12,070 ± 140 / 10,120 BC**

Peat from bog 2.1km N of river mouth (58° 52.8′ N, 161° 46.7′ W).

Icy Bay series, Alaska

Wood incorporated in Neoglacial drift along shore of Icy Bay records last advance of Icy Bay glacier to a point beyond mouth of bay (Post, in press). Coll and subm 1972 by S C Porter.

UW-267. Guyot Hills **Modern**

Outer rings of limb from Neoglacial till (60° 08.8′ W, 141° 27.7′ W). Dates advance of Icy Bay glacier.

UW-268. Clayey Bluff **325 ± 40 / AD 1625**

Bark from log *in situ* at Clayey Bluff on SW shore of Icy Bay ca .8km NE of logging camp (59° 59.5′ N, 141° 30.2′ W). Dates last advance of Icy Bay glacier.

UW-269. Pt Rion **Modern**

Log embedded in Neoglacial till 2km E of Pt Rion on SE shore of Icy Bay (59° 52.2′ N, 141° 25.9″ W).

C. Hawaiian Islands

Mauna Kea series, Hawaii

Sub-series 1. The lower S slope of Mauna Kea is blanketed by mid-Holocene tephra that represents latest major eruptions of the volcano. A widespread buried soil (Humuula Soil) contains locally abundant charcoal (Porter, 1971; 1973; 1975).

4470 ± 70

UW-165. Humuula Sheep Station **2520 BC**

Charcoal from Humuula Soil, .5km E of Humuula Sheep Sta (190° 42.1′ N, 155° 27.4′ W). Coll and subm 1970 by S C Porter.

4790 ± 70

UW-166. Puu Huikau **2840 BC**

Charcoal from top of Humuula Soil under Puu Kole tephra in gully on W side of Keanakolu Rd, .8km N Puu Huikau, alt 2158m (19° 43.4′ N, 155° 26.6′ W). Coll and subm 1970 by S C Porter.

4500 ± 100

UW-188. Humuula Sheep Sta **2550 BC**

Charcoal from buried soil, .5km E of Hale Pohaku Rd, alt 2020m (19° 42.1′ N, 155° 27.5′ W). Coll and subm 1971 by S C Porter.

Sub-series 2. Charcoal fragments contained in surface soil at various points around mountain record widespread fires near timberline. Coll and subm 1971 by S C Porter.

570 ± 70

UW-189. Loc 112 **AD 1380**

Charcoal from fire-reddened zone in soil overlying weathered ash beds (19° 45.0′ N, 155° 22.8′ W).

80 ± 60

UW-214. Loc 292 **AD 1870**

Charcoal from fire-reddened zone in roadcut overlying 3m weathered bedded ash on N side of Mauna Kea near Makahalau (19° 57.6′ N, 155° 31.2′ W).

2190 ± 50

UW-215. Kemole Cabin **240 BC**

Charcoal from 30 to 40cm beneath surface in modern solum. Caps colluvial/alluvial fill just below Kemole Cabin on W side of Mauna Kea (19° 52.9′ N, 155° 32.2′ W).

Sub-series 3. 3 old tephra layers on W rift zone of volcano underlie eolian sand of last glacial age and overlie eolian sand of earlier glaciation. Charcoal intercalated with tephra layers limits ages of the 2 glaciations (Porter, in press). Coll and subm 1971 by S C Porter.

29,700 ± 500

UW-213. Saddle Rd **27,750 BC**

Charcoal underlying uppermost of 3 tephra layers on Saddle Rd, alt 1660m (19° 50.2′ N, 155° 38.6′ W).

37,200 ± 1400

UW-219. Saddle Rd **35,250 BC**

Charcoal underlying lowermost tephra layer on Saddle Rd, at alt 1650m (19° 50.2′ N, 155° 38.6′ W).

31,900 ± 550

UW-220. Saddle Rd **29,950 BC**

Charcoal between lower and middle tephra layers on Saddle Rd at alt 1650m (19° 50.2′ N, 155° 38.6′ W).

Modern

UW-197. Mauna Kea $\delta^{14}C = 0 \pm 5‰$

Shells (*Patella*) from adze quarry (19° 47.5′ N, 155° 28.2′ W).

22,150 ± 250

UW-270. Nohonaohae cinder cone **20,200 BC**

Charcoal in silt below cinder layer from Nohonaohae cinder cone (19° 57.1′ N, 155° 41.4′ W). Dates latest eruptive phase on lower NW rift of Mauna Kea. Coll and subm 1972 by S C Porter.

UW-271. Mauna Kea **>40,000**

Charcoal underlying buried soil developed in alluvium and overlain by loess on lower NW rift zone of Mauna Kea, alt 1320m (19° 50.3′ N, 155° 40.2′ W). Dates aggradational interval. Coll and subm 1972 by S C Porter.

D. Europe

E Norway series

The following samples are from 8 peat bogs in E Norway, the sites of which range from Magnor in the S to Roros in the N, ca 300km distance. Dates are fairly consistent with general chronology of region, based on other radiocarbon dates and postglacial vegetational succession as determined by pollen analyses of these and many other secs by other workers. The 8 bogs are among 25 secs in the same region, analyzed for pollen and interpretation of vegetational record. A maximum age of 9400 yr was determined by dating other samples at the Radiological Dating Lab, Trondheim, Norway. Coll and subm 1971 by H P Hansen, Oregon State Univ.

8460 ± 90

UW-225. Magnor **6510 BC**

$\delta^{13}C = -28.5‰$

Clay from base of bog, depth 6.25m (59° 57′ N, 12° 15′ E). Pine predominant, with birch and grass; Early Boreal age.

8560 ± 90

UW-226. Tangen **6610 BC**

$\delta^{13}C = -28.5‰$

Clay from base of bog, depth 12m, 8km SE of Tangen (60° 37′ N, 11° 39′ E). Pine predominant with birch and hazel; probably Early Boreal age.

8200 ± 100

UW-231. Lillehammer **6250 BC**

Clay from base of bog, depth 2.5m, 14km NE of Lillehammer (61° 09′ N, 10° 40′ E). Pine predominant with birch and grass; probably

Boreal age. *Comment* (HPH): date is rather high considering shallow depth of bog and alt 850m. Depth can be attributed to slow rate of organic sedimentation at this alt but magnitude of date in relation to the time of deglaciation is significant.

7420 ± 150

UW-232. Elverum **5470 BC**

Clay from base of bog, depth 6m, 6km W of Elverum (60° 50′ N, 15° 28′ E). Pine, birch, and alder; Late Boreal age. Small sample size required minicounter.

7760 ± 90

UW-239. Tynset **5810 BC**

Clay from base of bog, depth 3m, 10km S of Tynset (62° 11′ N, 10° 46′ E). Pine predominant with birch, alder, and grass; Late Boreal age.

5710 ± 90

UW-244. Tynset **3760 BC**

Wood from same bog as UW-239, depth 2m. Pine predominant with birch and alder; early Sub-Boreal age.

7210 ± 100

UW-245. Roros **5260 BC**

Clay from base of bog, depth 3.5m, 25km NE of Roros (62° 36′ N, 11° 32′ E). Pine predominant, with birch; Atlantic age. Small sample size required minicounter.

7125 ± 120

UW-246. Amot **5175 BC**

Limnic peat from base of bog, depth 4.3m, 15km NE of Amot (61° 11′ N, 11° 11′ E). Pine and alder predominant with birch; Atlantic age.

6480 ± 110

UW-247. Amot **4530 BC**

Wood from same bog as UW-246, depth 3.2m. Pine predominant with birch, alder, and grass; Late Atlantic age.

7625 ± 110

UW-248. Arneberg **5675 BC**

Clay from base of bog, depth 5m, 16km SE of Arneberg (60° 14′ N, 12° 07′ E). Pine predominant with birch and hazel; Boreal age. Small sample size required minicounter.

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