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Radiocarbon

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ARIZONA RADIOCARBON DATES VI*

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INTRODUCTION

The C^{14} measurements reported here were made in this laboratory between November 1, 1963 and November 15, 1965. Sample descriptions are classified as follows:

I. Geochemical Samples
II. Geologic-Paleoclimatic Samples
III. Early Man-Alluvial Stratigraphy Samples
IV. Archaeologic Samples

The use of CO_2 and the treatment of samples remains the same as reported previously (Arizona IV and V). With some carbonate samples it has been found that they blacken upon pyrolysis and that a carbon slime can be recovered by acid decalcification. New electronic systems, including automatic printout and alpha-discrimination, have been incorporated in two of the three counter systems. The Libby half life of 5568 yr is still used in computing dates, and all statistical counting errors are reported as one sigma.

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SAMPLE DESCRIPTIONS

I. GEOCHEMICAL SAMPLES

Sequoia No. 3 series, California

Wood, tree rings, *Sequoia gigantea,* from Giant Forest, Sequoia Natl. Park (36° 35′ N Lat, 118° 48′ W Long). Coll. 1959 by H. N. Michael, Univ. of Pennsylvania; subm. by M. A. Stokes. *Comment:* tree began growth ca. 215 B.C. and was cut in A.D. 1950.

	δC^{14},‰	δC^{13},‰	Δ,‰
A-540. A.D. 1500 to A.D. 1520	**+21 ± 6**	**−21.8**	**+14 ± 6**
A-541. A.D. 1040 to A.D. 1060	**+13 ± 6**	**−21.9**	**+ 7 ± 6**
A-542. A.D. 540 to A.D. 560	**+13 ± 6**	**(−21.2)**	**+ 5 ± 6**

Comment: δC^{13} in parentheses is average value for series.

Bristlecone Pine No. 1 series, California

Wood, *Pinus aristata,* from bristlecone pine forest, Inyo Natl. Forest, White Mountains (37° 23′ N Lat, 118° 10′ W Long). Coll. 1962-1964 and subm. by C. W. Ferguson, Univ. of Arizona Lab. of Tree-Ring Research, Tucson.

	δC^{14},‰	δC^{13},‰	Δ,‰
A-416. 750 to 800 B.C.	**+53 ± 7**	**(−22.7)**	**+48 ± 7**

From tree specimen TRL 62-68, Sec. 6, Methuselah Walk.

A-528. 2266 to 2278 B.C.	**+106 ± 5**	**−21.8**	**+99 ± 5**

From tree specimen TRL 63-53, Sec. 31, Methuselah Walk.

A-586. 2112 to 2192 B.C.	**+90 ± 7**	**(−22.7)**	**+85 ± 7**

From tree specimen TRL 62-121, Sec. 31, Pine Alpha ridge.

A-605. 3703 to 3807 B.C.	**+153 ± 7**	**(−22.7)**	**+148 ± 7**

From tree specimen TRL 63-89, Sec. 32, Methuselah Walk.

A-637. 1841 to 1856 B.C. **+79 ± 5** **−23.7** **+76 ± 5**

From tree specimen TRL 63-43, Sec. Q, Part II, Methuselah Walk.

A-638. 1808 to 1840 B.C. **+82 ± 5** **−23.0** **+78 ± 5**

From tree specimen TRL 63-43, Sec. Q, Part II, Methuselah Walk.

A-639. 161 to 206 B.C. **+31 ± 7** **(−22.7)** **+26 ± 7**

From tree specimen F3, Methuselah Walk. δC^{13} in parentheses is average value for series.

Buhen Old Kingdom series, Sudan

Site consisting of domestic and workshop buildings at Buhen in Nubia near Wadi Halfa on W bank of Nile (11° 51′ N Lat, 31° 17′ E Long). Coll. by W. B. Emery and subm. by I. E. S. Edwards, British Mus., London. See Arizona IV (1963) and UCLA IV (1965) for further details on site.

A-519. Buhen **3960 ± 30** **2010 B.C.**

Charcoal from Pit 1, Level 1. For archaeological reasons should be contemporaneous with IV Dynasty (2500-2620 B.C.). Sample identical to and in good agreement with UCLA-665, 3990 ± 80 (UCLA IV).

A-521. Buhen **4020 ± 100** **2070 B.C.**

Charcoal from Pit 2, Level 1. Should also be contemporaneous with IV Dynasty (2500-2620 B.C.). Sample identical to and in good agreement with UCLA-666, 4090 ± 80 (UCLA IV).

A-520. Buhen **3720 ± 80** **1770 B.C.**

Charcoal from Pit 1, Level 2. Archaeologically, sample should be Archaic. Sample is identical to UCLA-667, 3970 ± 80 (UCLA IV).

General Comment: these samples were dated by both UCLA and Arizona because previous Arizona results from this site had yielded consistently younger ages than expected for IV or V Dynasty samples (A-330, 3960 ± 60; A-331, 3960 ± 60; A-332, 3820 ± 50) or for II Dynasty samples (A-333, 4190 ± 60; A-334, 4090 ± 50). This interlaboratory check confirms discrepancy between archaeologic dates and C^{14} dates. This discrepancy is almost identical with discrepancy between C^{14} dates and dendrochronologic dates for tree-ring samples (Arizona V).

Both Arizona dates and UCLA dates for interlaboratory check have been corrected for fractionation. Correction is small, −15 to 30 yr. δC^{13} analyses, expressed as difference from the Chicago PDB standard, were

carried out through courtesy of A. Long, Smithsonian Inst., Washington, D. C.

	δC^{13},‰
A-519	−26.45
A-521	−26.35
A-520	−25.96

4200 ± 90
2250 B.C.

A-569. Tarkhan II linen

Linen from Mastaba 2050 at Tarkhan near Cairo, Egypt (29° 40′ N Lat, 31° 13′ E Long). Coll. by W. M. Flinders Petrie; subm. by I. E. S. Edwards, British Mus., London. Sample is thought to date from I Dynasty. *Comment:* because linen is composed of flax which grew during one season, sample was considered to be good for another UCLA-Arizona interlaboratory check. Result is in excellent agreement with UCLA-739, 4265 ± 80. See UCLA IV for further details.

Montezuma Well series, Arizona

Tufa, turtle and subaerial plants from Montezuma Well, Montezuma Castle Natl. Monument, ca. 10 mi N of Camp Verde, Yavapai Co. (34° 39′ N Lat, 110° 45′ W Long). Montezuma Well is a sink in Plio-Pleistocene fresh water limestone, with diam of ca. 400 ft and depth of 130 ft including 55 ft from bottom to water level. Artesian water enters through deep fissures at rate of ca. 5600 m^3/day.

C^{14} data for aquatic plants and water were given in Arizona V. The C^{14} content of bicarbonate from the artesian water was only 6.46% modern (A-440 apparent C^{14} age is 21,420 ± 220 yr). Aquatic plants were receiving almost all of their CO_2 content from water rather than from atmosphere and consequently had approximately same apparent age as water.

Present suite of samples was collected to further evaluate effect of this significant source of old CO_2 on C^{14} content of immediate environment.

A-515. Modern Aquatic Plant $\delta C^{14} = +590 \pm 6‰$

Scirpus (probably *validus*) an emergent bullrush growing on S side of Montezuma Well. Only parts above water used. Coll. Sept. 1963 by G. A. Cole and W. L. Minckley, Arizona State Univ., Tempe; subm. by G. A. Cole.

A-516. Tree Leaves $\delta C^{14} = +483 \pm 5‰$

Populus fremonti growing at edge of pond, no part except perhaps roots under water. Coll. Sept. 28, 1963 by G. A. Cole and W. L. Minckley; subm. by G. A. Cole.

A-529a. Tufa, carbonate fraction $\delta C^{14} = -870 \pm 3‰$

Carbonate precipitating from Montezuma Well water just before irrigation ditch turns into Rim Ranch near Weir. Coll. Dec. 5, 1963 and

subm. by P. E. Damon and G. A. Cole. Sample demonstrates presence of "old" carbon from artesian water in modern tufa. Apparent age is 16,400 yr.

A-529b. Tufa, organic fraction $\delta C^{14} = -531 \pm 22‰$

Organic material separated from above carbonate. Grass rootlets were removed but probably not completely. Apparent C^{14} age is 6090 ± 380 yr.

A-530. Grass $\delta C^{14} = +770 \pm 25‰$

Grass growing 1 to 2 ft above water level near Island Rock. Coll. Dec. 5, 1963 and subm. by P. E. Damon and G. A. Cole, to check for CO_2 gradient between water level and rim of sink.

A-533. Grass $\delta C^{14} = +819 \pm 28‰$

Grass growing on edge of Montezuma Well, 75 ft above water level. Coll. Dec. 5, 1963 and subm. by P. E. Damon and G. A. Cole. *Comment:* difference between A-533 and A-530 may represent greater increment of pond CO_2 in A-530.

A-538. Turtle $\delta C^{14} = -840 \pm 26‰$

Sonoran mud turtle, *Kinosternon sonoriense* le Conte, died in early 1961. Coll. 1961 and subm. 1963 by G. A. Cole, Arizona State Univ., Tempe. Although possibly omnivorous, it was probably primarily a carnivore. Snails and insects which it ate at Montezuma Well are directly (as in the snail) or indirectly (some insects) dependent on the low-C^{14} aquatics for feed.

A-487. Tucson, Arizona $\delta C^{14} = +730 \pm 24‰$

Bermuda grass rootlets from residence on outskirts of Tucson (32° 08′ N Lat, 110° 58′ W Long). Coll. and subm. Aug. 28, 1963 by C. V. Haynes.

II. GEOLOGIC-PALEOCLIMATIC SAMPLES

Las Vegas Valley series, Nevada

As a result of problems defined during 1962-1963 Tule Springs expedition of Nevada State Mus. (Shutler, 1965), C. V. Haynes and P. J. Mehringer are continuing investigations of ancient springs of Las Vegas Valley in order to learn more about past spring discharge in relation to climatic change, faulting, valley subsidence, and aquifer conditions. Buried organic mats associated with the ancient springs offer a unique opportunity for detailed analysis of fossil pollen and plants (Mehringer, 1965). In addition to chronological control, C^{14} analyses of plants compared to C^{14} analyses of contemporaneous tufa permit estimation of initial C^{14} deficiencies in ground water (Haynes, 1965, p. 97). Previous C^{14} analyses are reported by Fergusson and Libby (1964).

It was found that tufa associated with extinct springs in the Valley yielded 0.1 to 0.2% organic carbon upon pyrolysis, acid leaching and combustion. Both organic and carbonate fractions were analyzed for comparison.

4910 ± 90

A-508. Large vertebrate bone, carbonate **2960 B.C.**

Fragment of bone from base of unit E_1 channel fill (elev 2292 ft) at Tule Springs Locality 4 (36° 19′ N Lat, 115° 11′ W Long) where associated carbonized wood dates 12,400 ± 350 B.P. (UCLA-512). Coll. 1963 by K. Dove and subm. by C. V. Haynes.

5160 ± 200

A-509. Large vertebrate bone, carbonate **3210 B.C.**

Fragment of bone from unit B_2 spring deposit (elev 2295 ft) at Tule Springs Locality 2 (36° 19′ 06″ N Lat, 115° 11′ 38″ W Long) where associated carbonized wood dated >40,000 B.P. (UCLA-517). Coll. 1963 by J. W. Mawby and subm. by C. V. Haynes. *Comment:* carbonate fractions of bone samples buried at similar elevations in strata of widely separate ages were dated for comparison with associated carbonized wood. The young and similar ages of the carbonates indicate secondary deposition presumably upon lowering of water table which left bone above zone of saturation. A lowering of the water table between 4000 and 6000 yr ago is compatible with geologic evidence.

14,100 ± 100

A-459A. Tufa, carbonate fraction **12,150 B.C.**

13,680 ± 160

A-459B. Tufa, organic fraction **11,730 B.C.**

Cylindrical tube of algal (?) tufa from the surface at Locality 68, Eglington scarp (36° 18′ N Lat, 115° 8′ W Long). Tufa encased tree branch that was subsequently destroyed by decay. Alignment of tufa outcrops suggest deposition at fault-controlled springs. Coll. 1963 and subm. by C. V. Haynes.

13,400 ± 230

A-470. Tufa, organic fraction **11,450 B.C.**

Concretionary masses of algal (?) tufa from Locality 63 at foot of Eglington scarp (36° 16′ 42″ N Lat, 115° 9′ 14″ W Long). Coll. 1963 and subm. by C. V. Haynes. Carbonate fraction dated 15,000 ± 300 B.P. (UCLA-641).

10,160 ± 160

A-471. Tufa, organic fraction **8210 B.C.**

Cauliflower-like masses of algal (?) tufa at Locality 64 (36° 17′ 22″ N Lat, 115° 8′ 16″ W Long). Tufa forms a narrow sinusoidal ridge over 1 mi in length. Coll. 1963 and subm. by C. V. Haynes and R. Shutler. Carbonate fraction dated 11,800 ± 250 B.P. (UCLA-642).

>28,800

A-466. Tufa, organic fraction **26,850 B.C.**

Tufa fragments from surface of spring-laid sediments at Tule Springs Locality 2 (36° 19′ 6″ N Lat, 115° 11′ 38″ W Long). Coll. 1963 and subm. by C. V. Haynes. A different specimen from same locality dated 15,920 ± 220 B.P. (UCLA-503). *Comment:* carbonate fractions are commonly older than organic fractions indicating some initial C^{14} deficiency in the spring water. Organic fractions probably yield more accurate dates than carbonates but could also be too old if derived from algae or aquatic plants (Arizona V, p. 93). Cross check by C^{14} dating of an associated organic mat indicates tufa dates to be less than 900 years too old (see comment on A-441 and A-442, this list). Tufa dates are assumed to be minimum for faulting which initiated artesian spring activity.

9870 ± 400

A-464. Plant matter **7920 B.C.**

Plant matter from buried spring mat exposed in an arroyo (36° 17′ 20″ N Lat, 115° 10′ 5″ W Long) cutting Eglington scarp. Truncated mat is buried by unit G alluvium of late prehistoric age. Coll. and subm. 1963 by C. V. Haynes. Recent vegetable matter was removed by repeated decantations after standard decalcification with HCl. *Comment:* minimum date for emergence of the spring.

31,300 ± 2500

A-462. Shell carbonate **29,350 B.C.**

Aquatic molluscs 2 ft above base of lacustrine mudstone (unit D) at Tule Springs Locality 13 (36° 19′ 6″ N Lat, 115° 11′ 38″ W Long). Shells removed from same sediment as pollen sample No. 51, Profile II (Mehringer, 1965). Coll. and subm. 1963 by C. V. Haynes. *Comment:* check of contemporaneous charcoal and shell (UCLA-521 and 543, respectively) indicates shell carbonate is 1000 yr too old due to initial C^{14} deficiency. Large error is due to small size of sample which required dilution for counting.

4190 ± 170

A-465. Charcoal **2240 B.C.**

Charcoal from aboriginal fireplace on Eglington scarp (36° 16′ 52″ N Lat, 115° 9′ 32″ W Long). Charcoal, flint waste flakes, and chopper were exposed by deflation of unit F dunes. Coll. and subm. 1963 by C. V. Haynes and R. Shutler. *Comment:* date plus absence of pottery suggests a desert culture origin for fireplace.

8540 ± 340

A-463A. Charcoal **6590 B.C.**

Lens of disseminated charcoal at Tule Springs Locality 1 (36° 19′ 6″ N Lat, 115° 11′ 38″ W Long). Sample is from top of unit E_{2a} silt. Coll. 1962 by K. Dove; subm. by C. V. Haynes. *Comment:* sample immediately predates a minor erosional interval separating E_{2a} from E_{2b}.

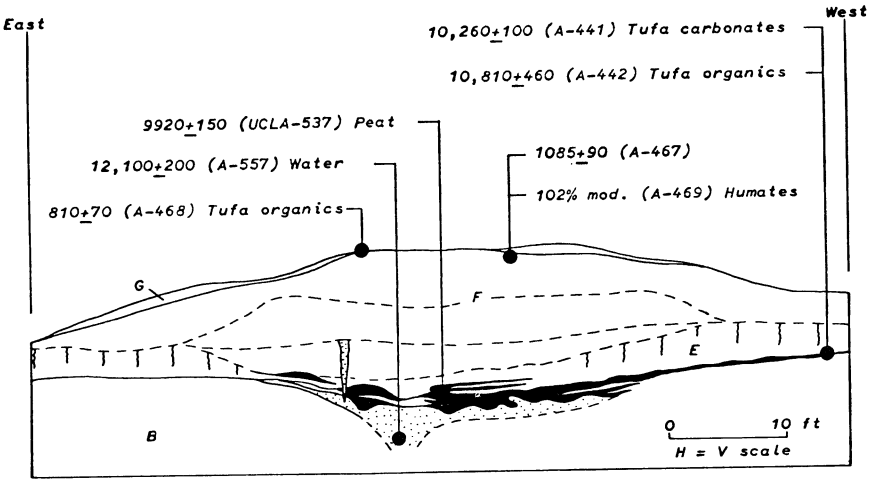

Fig. 1. Geologic cross section of the mound of spring No. 4, Gilcrease Ranch, Las Vegas Valley, Nevada, showing the stratigraphic location of C^{14} samples. Stratigraphic units are designated by the letters B, E, F, and G. Weathering is shown by vertical wavy lines. Stippling indicates sand-filled feeder conduits, and organic mat is shown in solid black. The rest of the sediments are sandy silts (E, F, and G) and mudstone (B).

Gilcrease Spring Mound series, Las Vegas Valley

Gilcrease Spring No. 4 (36° 17′ 47″ N Lat. 115° 28″ W Long) is a silt mound 12 ft high and 100 ft in diam that has been dry since early 1920s when it was damp. It was dissected by bulldozer trench in 1963 in order to investigate the stratigraphy shown in Figure 1. Analyses of fossil pollen (Mehringer, 1964) augmented stratigraphic and geochronologic studies. Coll. 1963-1964 and subm. by C. V. Haynes.

A-469. Soil humates **102.6 ± 2.1% modern**

Adsorbed humates extracted from soil 1 ft below top of mound by 2% NaOH solution before decalcification. *Comment:* modern soil is enriched in nuclear-age C^{14}. Dated carbon was 0.45% of initial sample weight.

810 ± 70

A-468. Tufa-caliche, organic fraction **A.D. 1140**

Porous tufa transitional to caliche formed partial cap on top of mound. Sample was pyrolysed and decalcified before combustion. *Comment:* dated carbon was 0.14% of initial sample weight. Date is approximate for end of eolian sand accumulation on mound.

1085 ± 90

A-467. Caliche, organic fraction **A.D. 865**

Sandy caliche from 1 ft below top of mound (approx. same level as A-469) was pyrolysed and decalcified before combustion. *Comment:* the

0.1% organic carbon probably represents absorbed humates fixed by calcium. Date is approximate for final stage of mound accretion and is supported by A-468.

A-441. Tufa, carbonate fraction **10,260 ± 100 8310 B.C.**

A-442. Tufa, organic fraction **10,810 ± 460 8860 B.C.**

Buried masses of concretionary algal(?) tufa containing molds of sedge leaves indicating shallow-water deposition. Organic fraction (0.11%) was obtained by pyrolysis and combustion after decalcifation. *Comment:* both fractions agree and indicate deposition in spring water with C^{14} content at least 90% that of the atmosphere when compared to date of 9920 ± 150 B.P. (UCLA-537) on contemporaneous organic mat. This suggests that 10,000 yr ago recharge required less than 800 yr to emerge at the spring.

A-557. Spring water **12,100 ± 200 10,150 B.C.**

Spring water that seeped from floor of bulldozer trench where it cut into sand-filled feeder conduit was coll. and dissolved CO_2 extracted by acidification and agitation. Coll. 1964 by C. V. Haynes, P. J. Mehringer, George Wilson, and R. Shutler; subm. by C. V. Haynes. *Comment:* this date, when compared to analyses of A-441, A-442, and UCLA-537, strongly suggests that spring water emerging today is "fossil" water that fell as rain between 10,000 and 12,000 yr ago and is not a mixture of younger water with older water.

A-526. Glen Canyon Excavation, Utah **24,600 ± 1400 22,650 B.C.**

Horse dung from Oakleaf Alcove, Glen Canyon area excavations at Lake Canyon, ¼ mi upstream from Colorado River, San Juan County, Utah (37° 25′ N Lat, 110° 38′ W Long), excavation coord. 42 SA 374, FS3/2. Coll. ca. 1960 by Univ. of Utah Glen Canyon salvage archaeologists and subm. by P. S. Martin, Geochronology Labs., Univ. of Arizona, Tucson. According to Professor Martin, a 200-grain pollen count contains 43% *Betula* and 39% *Artemisia*. Oakleaf Alcove is considered to be inaccessible to horses or other large herbivores. Sample may have been brought in by pack rats which often line their nests with animal dung.

A-474. China Lake, California **>31,200**

Organic matter in lacustrine silt at 21.5 ft below surface of China Lake playa, California (35° 43′ N Lat, 117° 38′ W Long), same location as drill hole MD-1 of Smith and Pratt (1957). Coll. 1963 by Roland von Huene, Naval Ordnance Test Station, China Lake; subm. by P. S. Martin, Univ. of Arizona, Tucson. *Comment:* dates sedge and cattail pollen peak above a pine pollen maximum.

4100 ± 800

A-554. Owens Lake, California **2150 B.C.**

Organic matter in lacustrine clayey silt 875 to 900 cm below surface of Owens Lake playa, California (36° 25′ N Lat, 118° 00′ W Long), 50 yd E of Bartlett Salt Plant Well No. 2 Coll. 1963 and subm. by P. S. Martin and David Adams, Univ. of Arizona, Tucson. *Comment:* confirms postglacial estimate of age.

Osgood Swamp series, California

These samples were dated to provide geochronological control for pollen analyses of a 4.4 mi core from Osgood Swamp (38° 45′ 45″ N Lat, 120° 02′ 47″ W Long), Eldorado County, California. Coll. 1963 and subm. by David Adam.

2830 ± 200

A-544. 60-70 cm below surface **880 B.C.**

Comment: dates uppermost shift in the pollen record.

9900 ± 800

A-545. 300-310 cm below surface **7950 B.C.**

Comment: dates inception of vegetation similar to that of the present.

Lake Lahontan, Nevada

11,640 ± 100

A-460A. Tufa, carbonate **9690 B.C.**

12,150 ± 400

A-460B. Tufa, organic fraction **10,200 B.C.**

Algal(?) tufa from lowest (4192 ± 2 ft) dendritic terrace of Lake Lahontan at Boot Hill (40° 8′ N Lat, 118° 32′ 20″ W Long), Pershing County, Nevada. Organic fraction obtained by pyrolysis and decalcification. Coll. 1963 by M. Wheat; subm. by R. Shutler, Nevada State Mus., Carson City. *Comment:* the two dates are within statistical agreement. Because algae can metabolize CO_2 from water it cannot be assumed that organic fraction is unaffected by any initial C^{14} deficiency.

Rio Laja, Chile

17,000 ± 4000

A-636A. Base-soluble organic fraction **15,050 B.C.**

15,000 ± 500

A-636B. Carbonized plants **13,050 B.C.**

Carbonaceous debris overlain by volcanic mud flow (lahar) deposit along S bank of Rio Laja, Chile (37° 21′ S Lat, 71° 53′ W Long). Coll. 1960 and subm. by Donald MacPhail, Univ. of Colorado, Boulder. *Comment:* the more precise of the two dates is probably maximum for the lahar.

Dahlak Archipelago series

Carbonate samples from raised fossil reef, Entedebir Island, Dahlak Archipelago, E of Massaua, Ethiopia in S Red Sea (15° 53′ N Lat, 39° 55′ E Long). Coll. 1962 and subm. by Yaacov Nir, Geol. Survey of Israel, Jerusalem.

A-447. 7 m above mean sealevel **28,000 ± 600 26,050 B.C.**

Coll. from base of highest ridge on Entedebir Island, Papenfuss Ridge, 7 m above mean sealevel.

A-448. 19 m above mean sealevel **16,400 ± 150 14,450 B.C.**

Coll. from 12 m above A-447 at top of fossil reef on Papenfuss Ridge. *Comment:* A-448 and A-359 (17,200 ± 330 B.P., Arizona IV, p. 296) indicate that time of last uplift of Archipelago was between 16,000 and 17,000 B.P. Rate of reef-carbonate accumulation appears to be 1 m per 1000 yr. All samples were washed in dilute HCl before hydrolysis to remove possible recent contamination.

A-513. Potato Lake, Coconino County, Arizona **14,400 ± 300 12,450 B.C.**

Organic material from sediment core, Potato Lake, Coconino County, Arizona (34° 26′ N Lat, 111° 20′ W Long). 142 to 172 cm depth in core. Coll. 1963 by G. A. Cole and Mel Whiteside; subm. by Mel Whiteside, Arizona State Univ., Tempe. *Comment:* palynological studies indicate high *Picea* and *Abies* at level of this sample.

University of Arizona series, Tucson

A-692. Caliche **34.8 ± 2.0% modern**

Uppermost portion of upper caliche bed, 3 ft below ground surface, Univ. of Arizona campus, Tucson (32° 20′ N Lat, 111° 00′ W Long). Coll. 1965 by David Coatsworth, Melissa Lukow and D. C. Grey; subm. by D. C. Grey, Geochronology Labs., Univ. of Arizona.

A-693. Caliche **7.8 ± 2.0% modern**

Lowest portion of upper caliche bed, 5 ft below ground surface. *Comment:* samples A-692 and A-693 are part of a chemical and radiometric study of caliche formation.

III. EARLY MAN-ALLUVIAL STRATIGRAPHY

Lehner Ranch series, Arizona

Lehner site, San Pedro Valley (31° 25′ 23″ N Lat, 110° 06′ 48″ W Long), Cochise County, Arizona, Ariz:EE:12:1, is an elephant-kill site in which Clovis fluted points were found in association with charcoal, bones of nine immature mammoths, and remains of horse, bison and tapir (Haury *et al.,* 1959; Lance, 1959; Antevs, 1959). Pollen investigations are being conducted by P. J. Mehringer, Jr. and geochronology and

geochemistry of the sediments are being investigated by C. V. Haynes, Jr. Coll. 1963-1965 and subm. by C. V. Haynes and P. J. Mehringer.

A-479A. Wood — **1430 ± 160** / **A.D. 520**

A-479B. Humates — **110 ± 20** / **A.D. 1840**

Wood from one of two buried pits exposed by Bulldozer Trench A and 3 ft below ground surface. *Comment:* dates upper part of unit G (undifferentiated) and unidentified aboriginal occupation. Humates show a modern component.

A-611. Charcoal — **1460 ± 120** / **A.D. 490**

Charcoal from fireplace buried in alluvial fan near mouth of Lehner Ranch arroyo and exposed by Bulldozer Trench C. *Comment:* dates upper part of unit G (undifferentiated) and an unidentifiable aboriginal occupation.

A-633. Soil humates — **2550 ± 500** / **600 B.C.**

Humates extracted from very dark brown soil in unit G (undifferentiated) ¼ mi upstream from Lehner site. *Comment:* soil is believed to have formed between 3000 and 4000 yr ago.

A-480. Charcoal — **3950 ± 180** / **2000 B.C.**

Charcoal from fireplace buried 16 in. below surface and exposed by Bulldozer Trench B. *Comment:* dates lower part of unit G (undifferentiated) and an unidentified aboriginal occcupation.

A-632A. Calcareous sinter — **7900 ± 600** / **5950 B.C.**

Organic fraction of calcareous sinter obtained by pyrolyzing and decalcifying. Sample from Bulldozer Trench B. *Comment:* apparently dates secondary deposition of soil organic matter as the sample is stratigraphically below A-33 bis (10,410 ± 190 B.P.) (Arizona III, p. 243).

A-478B. Carbonized wood — **11,600 ± 400** / **9650 B.C.**

Carbonized wood from unit E was dissolved in 2% NaOH after decalcification and was precipitated as humates. *Comment:* date is minimum for unit E because of possible younger humate contamination.

A-525A. Carbonized wood — **10,550 ± 550** / **8600 B.C.**

A-525B. Base-soluble organic fraction — **11,080 ± 300** / **9130 B.C.**

average: 10,815 ± 450 / **8865 B.C.**

Carbonized wood (charcoal?) from buried concentration associated

with bones exposed in arroyo wall ¼ mi upstream from the Lehner site. *Comment:* excavations are planned at this locality.

A-576. Caliche **7000 ± 300**
5050 B.C.

Buried caliche in unit F_3 on top of unit F_2 (Layer K, dated 10,410 ± 190 B.P., A-33 bis) and exposed by Bulldozer Trench A. *Comment:* apparently dates secondary deposition of pedogenic (?) carbonate in unit F_3.

A-575. Caliche **10,250 ± 550**
8300 B.C.

Secondary deposit of pedogenic(?) caliche in unit E (>11,600 B.P., A-478B) and overlain by unit F_2 (10,410 ± 190 B.P., A-33 bis) in Bulldozer Trench A. *Comment:* carbonate was apparently deposited upon desiccation of wet-meadow soil of unit F_2 (Layer K).

A-573. Caliche **15,450 ± 700**
13,500 B.C.

Caliche cementing gravel (unit C) which caps N rim of Lehner Ranch arroyo. Exposed by Bulldozer Trench A. *Comment:* maximum date for pedogenic deposition of calcium carbonate in gravel believed to be considerably older.

A-635. Caliche **17,760 ± 700**
15,810 B.C.

Nodular caliche in paleosol exposed in arroyo wall ¼ mi upstream from Lehner site. Overlies A-525 (10,815 ± 450 B.P.). *Comment:* maximum date for carbonate deposition in younger sediment. This suggests deposition from ground water.

A-574. Carbonates **>28,800**

Calcareous mudstone in unit D exposed in Trench A. *Comment:* the mudstone and carbonates may be lacustrine deposits.

A-572. Caliche **>30,000**

Caliche nodules in upper part of unit B and exposed by Bulldozer Trench A. *Comment:* date is in accord with pre-Wisconsin age estimate for unit B.

Blackwater No. 1 series, Clovis, New Mexico

The Blackwater No. 1 locality (34° 17′ N Lat, 103° 19′ W Long), Roosevelt County, New Mexico is a commercial gravel mine and early-man site described by Sellards (1952, p. 29-31). Recent exposures of springlaid sediments are described by Haynes and Agogino (in press). Coll. 1963 and subm. by C. V. Haynes unless indicated otherwise.

A-512. Burned bone **8470 ± 350**
6520 B.C.

Burned bone fragments from aboriginal fireplace at eroded contact between "carbonaceous silt" (unit E) and "jointed sand" (unit F).

Archaic notched projectile point was found on same burial surface 10 ft away, and stem of a Scottsbluff point was found on same surface elsewhere. Sample decalcified and combusted. Coll. 1963 and subm. by G. A. Agogino, Eastern New Mexico Univ. *Comment:* it is not known whether fireplace was on buried eroded surface or exposed by erosion before deposition of unit F, but date is consistent with dating of similar projectile points elsewhere in U. S.

9890 ± 290
7940 B.C.

A-489. Plant remains

Humates and soluble lignins extracted from "carbonaceous" silt," unit E_1, N wall. Rootlet contamination was removed by flotation and repeated decantations after decalcification. *Comment:* date is compatible with A-512 stratigraphically higher and A-488 and A-492 which are lower.

10,200 ± 250
8250 B.C.

A-488. Plant remains

10,490 ± 200
8540 B.C.

A-492. Plant remains

Humates and soluble lignins extracted from plant remains in "diatomaceous earth," unit D_2 at two places along N wall. *Comment:* dates are stratigraphically equivalent and are above unit D_{1b} containing Agate Basin projectile points and which overlies unit D_{1a} containing Folsom points. Dates are comparable to A-386 (10,490 ± 900 B.P.) and A-379-380 (10,250 ± 320 B.P.) from deeper pond facies of "diatomaceous earth" (Arizona V, p. 101).

11,040 ± 500
9090 B.C.

A-490. Plant remains

11,630 ± 400
9680 B.C.

A-491. Plant remains

Humates and soluble lignins extracted from plant remains at bottom and top, respectively, of unit C_1, N wall. Vertical separation is 2 ft. *Comment:* dates are stratigraphically inverted but within one sigma of each other and are comparable with A-481 (11,170 ± 360 B.P., Arizona V) in unit C_0, a coeval facies containing Clovis points and mammoth bones.

Blackwater Draw barrow pit series, Clovis, New Mexico

A barrow pit, Locality 7 (34° 15′ 50″ N Lat, 103° 18′ 55″ W Long), in Blackwater Draw, has exposed a stratigraphic section consisting of (from bottom to top) fluvial sand (B_1), lacustrine mudstone (B_2), and diatomaceous silt (D). Haynes (in press) correlates unit B_2 with top of Tahoka formation in Texas and unit D with "diatomaceous earth" at Clovis site (Blackwater No. 1). An erosional contact between units B_2 and D truncates a thick caliche in top of B_2.

A-493. Shell carbonate **10,600 ± 200**
8650 B.C.

Anodonta shells from base of unit D at approximate level of Wendorf pollen samples 22 and 23. *Comment:* date supports correlation of "diatomite" in Blackwater Draw to that in gravel pit at Clovis site.

A-669B. Lacustrine carbonate **15,770 ± 440**
13,820 B.C.

Mudstone of Wendorf pollen samples 27 to 29, 2 ft below zone of caliche and ½ ft above unit B_1 sand. Subm. by F. Wendorf. *Comment:* date supports correlation of unit B_2 with top of Tahoka and with shallow pond sediments at McCullom Ranch site dated 15,750 ± 760 B.P. (A-375) (Arizona V, p. 101).

Hell Gap series, Wyoming

Since 1959 the late Quaternary alluvial stratigraphy associated with early man sites in Wyoming has been investigated by C. V. Haynes, Jr. in collaboration with archaeologists H. T. Irwin, Peabody Mus., Harvard Univ., Cynthia Irwin-Williams and George A. Agogino, Eastern New Mexico Univ. Attention is being focused upon the Hell Gap (42° 24′ 35″ N Lat, 104° 38′ 25″ W Long) and Pattern Creek (42° 26′ 53″ N Lat, 104° 43′ 20″ W Long) areas where archaeologists have demonstrated a remarkably complete record of human occupation from 11,000 B.P. to the present. Carbonaceous silt samples were extracted with 4% NaOH after decalcification and decantation. Coll. 1963 and subm. by C. V. Haynes except where otherwise indicated.

A-501. Hell Gap Site 1 **8600 ± 380**
6650 B.C.

Mixed charcoal and earth associated with burned area in Frederick level, lower part of unit F (S-13, 5 ft 4.5 in. to 5 ft 7.5 in. below datum). *Comment:* date is same as I-245 (8600 ± 600 B.P., Isotopes IV) for Scottsbluff level a few in. below and separated by a minor conformity.

A-498. Hell Gap Site 2 **5740 ± 230**
3790 B.C.

Charcoal from firepit on the contact between units F and G_1. Weathering in unit G_1 is believed to represent a late "Altithermal" soil. Unit F is pre-"Altithermal." *Comment:* date supports the interpretation.

Hell Gap Site 2, unit E:

A-500. **10,150 ± 300**
8200 B.C.

Carbonaceous silt of Level II (1075-12E, 11 ft 5 in. below datum) believed to correspond to the Hell Gap and Alberta occupation level elsewhere.

10,000 ± 200
A-499. **8050 B.C.**

Carbonaceous silt of Level V (113-1145, 15-20E). Midland point occurred 2 in. above the ½-in. thick carbonaceous band.

10,600 ± 500
A-504. **8650 B.C.**

Carbonaceous silt of Level V (100-1055, 5E). Unidentified projectile point occurred ½ in. above the ¼ in. thick carbonaceous band.

10,200 ± 500
A-502. **8250 B.C.**

Carbonaceous silt 2 ft below Level IV (46S-OE, 11 ft 4 in. to 11 ft 8 in. below datum). Middle and darkest of three bands and 8 to 10 in. above contact with unit B. May correlate with Level V (Midland level).

10,840 ± 200
A-503. **8890 B.C.**

Carbonaceous silt at base of unit E (27S-OE, 11 ft below datum) and on the contact with gray silty clay of unit B.
Comment: considering that the sample material is subject to contamination by mobile humic acids, it is not surpising that one of the dates (A-499) in inconsistent with the sequence. It is, however, within 2σ of A-504 which should be the same age. The data, including A-501 (this list), indicate that unit E was deposited between 9000 and 11,000 yr ago. During this 2000-yr period, four different cultures camped at the site at various times.

3340 ± 200
A-563. Adams' locality **1390 B.C.**

Charcoal from buried fireplace 1.5 ft below top of a 7-ft terrace (42° 24′ 27″ N Lat, 104° 38′ 02″ W Long). Coll. 1962 and subm. by D. Adams. *Comment:* sample overlies a late "Altithermal" paleosol.

1790 ± 180
A-497. Patten Creek **A.D. 160**

Charcoal from aboriginal fireplace buried 1 ft below 7-ft terrace and 6 in. below unconformable contact (42° 26′ 55″ N Lat, 104° 43′ 32″ W Long). *Comment:* date is maximum for period of degradation separating the alluvial deposits.

2900 ± 140
A-706. Patten Creek **950 B.C.**

Charcoal from aboriginal firepit buried 2.5 ft below terrace surface at test trench No. 1 (42° 26′ 53″ N Lat, 104° 43′ 20″ W Long). Level 8128 (PC65, I-99-100, 32 in. below datum). Coll. and subm. 1965 by Sally Keller. *Comment:* dates second occupational level with Patten Creek projectile points.

IV. ARCHAEOLOGIC SAMPLES

Casa Brandes series, Mexico

Charred corn kernels, twigs, and charcoal from Casa Grandes archaeological site (30° 22′ N Lat, 107° 58′ W Long), NW Chihuahua, Mexico. Coll. 1957-1959 and subm. 1964 by C. C. DiPeso, Amerind Foundation, Inc., Dragoon, Arizona. *Comment:* a tree ring chronology has been established which covers a period of 486 yr from A.D. 851 to A.D. 1336 (Scott, 1963).

A-612. Charcoal, CG(P)233 **470 ± 90**
A.D. 1480

From fire hearth No. 2, Room 24-N, Buena or Diablo phase.

A-609. Charred twigs, CG(C)185 **740 ± 115**
A.D. 1210

From house No. 1, fill No. 2, 8th floor, CH1H:D:9:14, Reyas phase of medio period.

A-608. Charred corn kernels, CG(P)57 **320 ± 250**
A.D. 1630

From floor of House C, CH1H:D:9:2, Pelon phase of Viejo period.

A-610. Charred log, CG(D)319 **300 ± 90**
A.D. 1650

Tree fragment from central post hole, room No. 2, CH:G:2:3, Robles site.

Powder River Canyon series, Wyoming

Charcoal samples from a multi-component rock shelter site on rim of canyon of Middle Fork of Powder River, Wyoming (43° 35′ N Lat, 107° 00′ W Long). Field work of Wyoming Archaeol. Soc. Coll. 1959 and subm. by D. C. Grey. *Comment:* site appears to show habitation through the hiatus between Early period and Middle period.

A-483. **3450 ± 40**
1500 B.C.

Charcoal from hearth in upper Layer II, associated with McKean artifacts. Appears to postdate a dry, windy climatic period of possible "Altithermal" age. Date agrees well with other McKean dates. *Comment:* an aliquot of the field sample was dated by the collector in a private lab. at 1220 B.C. ± 180.

A-484. **7800 ± 110**
5850 B.C.

Charcoal from a hearth in middle Layer III, associated with beveled points indentified as Meserve-Dalton affiliates. Predates what appears to be "Altithermal" deposit. Postdates water-laid sand. *Comment:* an aliquot of this sample was previously dated at 8600 ± 250 in a private lab. by the collector.

3980 ± 70
A-485. 2030 B.C.

Charcoal from hearth in upper Layer III, dating earliest appearance of McKean points in the site. Sample appears to date transition into a deposit interpreted as being "Altithermal." *Comment:* an aliquot of the sample was previously dated at 5600 ± 200 in a private lab. by the collector.

A-548. PK Ranch, Sheridan County, Wyoming, burial **900 ± 240**
A.D. 1050

Human bone from PK Ranch, Sheridan County, Wyoming (44° 30′ N Lat, 107° 30′ W Long). Multiple burial 2 ft below surface on hilltop. Coll. 1958 by Glenn Sweem and D. C. Grey; subm. 1963 by D. C. Grey, Geochronology Labs., Univ. of Arizona, Tucson. *Comment:* multiple burial with Late Prehistoric cultural association (Grey, 1958; Bass and Lacy, 1963).

A-583. Big Horn Mountains, Wyoming, Turk burial **670 ± 160**
A.D. 1280

Human bone from Site 48WA301, Gray Mount, Big Horn Mountains, Wyoming (43° 38′ N Lat, 107° 09′ W Long). Multiple burial in limestone fissure. Coll. 1960 by Glenn Sweem and D. C. Grey; subm. by D. C. Grey. *Comment:* multiple burial showing evidence of violent death (Birkby and Bass, 1963; Grey, 1963).

18,600 ± 1900
A-518. Arka, Northern Hungary **16,650 B.C.**

Charcoal in East-Gravettian level in secondary loess deposit and under a paleosol at Arka, Northern Hungary (48° 30′ N Lat, 21° 30′ E Long). Coll. 1963 and subm. by Laslo Vertes, Hungarian Natl. Mus., Budapest. *Comment:* date is in statistical agreement with GrN-4038 (17,050 ± 350 B.P., Vogel and Waterbolk, 1964, p. 354) on the alkali soluble fraction which could be somewhat younger because of humic acid contamination.

284 ± 90
A-522. Easter Island **A.D. 1670**

Charcoal sample from Easter Island (27° 08′ S Lat, 109° 25′ W Long). Site E-5, ½ mi E of Arizona Cove on N coast, 60 to 80 cm depth in refuse mound. Sample rested on sterile soil and represents remains of one of earliest fires in refuse pit. Should approximate date of thick-walled adjoining masonry dwelling. Coll. 1955 and subm. by Edwin Ferdon, Jr., Arizona State Mus., Tucson (Heyerdahl and Ferdon, 1961, p. 305-311).

20 ± 140
A-593. Nevado de Toluca, Mexico **A.D. 1930**

Copal (resin) from larger of two lakes in crater of Nevado de Toluca, Mexico (19° 06′ 28″ N Lat, 99° 45′ 44″ W Long). Sample recovered

from bottom mud of lake and presumed to have been ceremoniously thrown into lake to appease rain god. *Comment:* date confirms the ritual is still practiced.

A-595A. Pinacate, Sonora, Mexico, soluble bone organic matter **110% modern**

A-595B. Pinacate, Sonora, Mexico, bone black carbon **117% modern**

Burned bones of deer, antelope, and sheep from surface concentration near Papago Tanks (31° 55′ N Lat, 113° 35′ W Long), Pinacate, Sonora, Mexico. Coll. and subm. 1964 by J. D. Hayden, Arizona State Mus., Tucson. *Comment:* data indicates animals lived during the atomic era. C^{14} content of the atmosphere was at this level between 1955-1956 (Broecker and Walton, 1959).

A-615A. Hunter Wash, Arizona, charcoal **3440 ± 100**
1490 B.C.

A-615B. Hunter Wash, Arizona, soluble lignins and humates **3050 ± 250**
1100 B.C.

Charcoal from rock-lined fireplace exposed in N wall of Hunter Wash (31° 28′ N Lat, 110° 9′ W Long), Arizona. Hearth is in brown alluvial sand is 1 ft above basal contact with gray mudstone. *Comment:* alluvium is correlated with unit G at Lehner site, about 4 mi to the SE.

A-549. Laguna Salada, Arizona **6400 ± 500**
4450 B.C.

Carbonaceous mud from pollen-sample core, 320 to 339 cm beneath surface of Laguna Salada playa (34° 21′ N Lat, 110° 17′ W Long). Coll. and subm. 1963 by R. H. Hevly and P. S. Martin, Geochronology Labs., Univ. of Arizona, Tucson (Hevly, 1962; Harrell and Eckel, 1939). *Comment:* samples diluted for counting.

A-550. Carter Ranch, Snowflake, Arizona **1280 ± 120**
A.D. 670

Charcoal from pithouse hearth, site No. 186, (34° 30′ N Lat, 110° 05′ W Long), near Snowflake, Arizona. Coll. 1963 by R. H. Hevly; subm. by P. S. Martin, Chicago Natural History Mus. (Martin *et al.*, 1961).

A-495. Glen Canyon, Arizona, charcoal **1510 ± 80**
A.D. 440

Charcoal from a hearth buried 120 cm beneath surface in sandy Quarternary detritus beneath cliff of Navajo sandstone in Glen Canyon (37° 07′ 30″ N Lat, 110° 56′ 30″ W Long). Coll. 1960 by A. J. Lindsay, Jr.; subm. by P. V. Long, Jr., Mus. of Northern Arizona, Flagstaff. *Comment:* site has no ceramic associations but appears to be important in local archaeology.

A-581. Tiburon Island, Gulf of California, burials **1100 ± 300 A.D. 850**

Human bone from Tiburon Island 29° 10′ N Lat. 112° 26′ W Long). Interred beneath deep midden deposit into truncated alluvial fan. Coll. 1949 and subm. by W. N. Smith. *Comment:* date is average of two independent measurements on samples from different burials: 800 ± 500 and 1400 ± 300.

A-109. Bisti site, San Juan County, New Mexico **2140 ± 90 190 B.C.**

Charcoal from pits 26-25, 27-27, and 28-26, in grey sand 24 to 36 in. below surface at Bisti site (36° 28′ N Lat, 108° 08′ W Long), 18 mi SW of Bloomfield, New Mexico. Coll. 1958 and subm. by Albert Mohr, Anthrop. Dept., Univ. of Wisconsin, Madison. *Comment:* dates the aboriginal occupation and stratigraphic unit.

A-110. Cly site, San Juan County, New Mexico **2510 ± 110 560 B.C.**

Charcoal from aboriginal occupation Level O in sandy soil at Cly site (36° 16′ N Lat, 107° 52′ W Long), San Juan County, New Mexico. Coll. 1958 and subm. by Albert Mohr. *Comment:* dates the occupation and the stratigraphic unit.

A-669. Williamson Farm, Dinwiddie County Virginia **1590 ± 150 A.D. 360**

Charcoal in yellowish-grey silt 18 to 30 in. below surface and in a buried depression containing chert flakes, Williamson Farm (37° 04′ 30″ N Lat, 77° 30′ 40″ W Long), Dinwiddie County, Virginia. Coll. and subm. 1965 by C. V. Haynes and Ben C. McCrary. *Comment*: the abundance of fluted projectile points from plowed fields on this farm (McCrary, 1951) made it advisable to date this sample. Date does not apply to either the fluted points or to historic charcoal-making activities.

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