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SOUTHERN METHODIST UNIVERSITY RADIOCARBON DATE LIST I

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INTRODUCTION

The SMU Radiocarbon Laboratory is operated by the Department of Geological Sciences within the Institute for the Study of Earth and Man. One laboratory room contains the benzene synthesis system where samples are pretreated and converted to CO_2 in a standard way and gas is purified after the procedures of Broecker (1957) by passage through hot CuO, 10% $AgNO_3$ solution, chromic acid, hot copper, and P_2O_5 via cryogenic pumping with liquid nitrogen. Purified CO_2 is then converted to Li_2C_2 which is hydrolized to C_2H_2 and converted to C_6H_6 catalytically following the procedures of Noakes *et al* (1966). Carbon dioxide and benzene yields are routinely in excess of 90% in both cases.

Liquid scintillation counting is performed in a separate room utilizing a lead-shielded Intertechnique LS-20 counter optimized for handling 3ml of benzene. Principle innovations in optimizing the counter were 1) lining the sample chamber with ca 1cm "quiet" lead to accommodate 2) a pure quartz spectrophotometric cell as counting vial, and 3) adding the scintillator as a precisely weighed powder (0.91% butyl PBD) directly to the sample benzene, thus eliminating the dilution of the sample by a scintillator solution. All samples are transfered via syringe to reduce contact with oxygen.

The count rate for the NBS oxalic acid radiocarbon dating standard is ca 23cpm (specific activity = 8.92cpm/gC) and the background count, using benzene produced from Pennsylvanian anthracite is ca 3cpm yielding a figure of merit (S^2/B) of 143. One to 4 unknown samples are counted between counting runs of background and standard which are statistically averaged for calculating the ages. All samples are counted for at least 1400 min and monitored by printouts every 100 min.

The liquid scintillation counting and benzene conversion systems which will be described in detail elsewhere (Haas & Haynes) have been in operation since the fall of 1972 and routine age analyses were begun in January 1973. Several months of analyzing standards, backgrounds, and samples of known age reveal a high degree of precision and reliability in all systems. Prior to 1973, 130 samples pretreated at SMU were analyzed and dated at the University of Texas radiocarbon laboratory and appear in Valastro *et al* (in press).

The complete methane conversion and counting system of the Mobil Field Research Laboratories was donated to Southern Methodist University and is now a part of our radiocarbon dating facilities at the Institute for the Study of Earth and Man. After installation, testing, and dating of the first eleven samples (SMU-1-11) the CH_4 system was shut down for

repairs and modifications, and current plans are to optimize it for the CO_2 counting of very small samples.

ACKNOWLEDGMENTS

The SMU Radiocarbon Laboratory was created through the generosity and forethought of the late William B Heroy, who provided the space and most of the equipment for which we are most grateful. Claude C Albritton, James E Brooks, William B Heroy, Jr, and Fred Wendorf promoted the laboratory within the Institute for the Study of Earth and Man, and without their wholehearted support it could not have been established. Michael J Holdaway provided controlled heating equipment and collaborated in the initial experiments in pyrolyzing bone samples.

E Mott Davis and Sam Valastro, Texas Memorial Museum, arranged analysis and dating of our samples before 1973 at the University of Texas laboratory. Close cooperation has been maintained between the two laboratories and special gratitude is due Sam Valastro and Alejandra G Varela for their help and advice in constructing our benzene synthesis system.

We gratefully acknowledge the gift of the Mobil Field Research Laboratory's methane dating system and thank S M Foulks and J S McNiel, Mobil Research and Development Corp, and Fred Wendorf, SMU for arranging this. John R Cooper, Operator of the Mobil Lab, assisted us in setting up the equipment and dating the first samples.

Indispensible technical assistance in the field and laboratory was provided by Steven Haney, Don Henry, Afifa Hassan, Nancy Neubert, Joe Davis, and Robert Leeper and secretarial work was provided by Marlene Altman, Elise Murphy, and Barbara Doolin. Financial support is provided by the Institute for the Study of Earth and Man, the National Science Foundation (Grants GA-12772 and GA-35625), and the National Geographic Society, which sponsored six years of archaeologic excavations at the Murray Springs Clovis site in Arizona.

Finally, to Paul E Damon and Austin Long, University of Arizona, the senior author is indebted for invaluable experience in the fine points of radiocarbon dating.

SAMPLE DESCRIPTIONS

The samples are classified into (I) Geochemical Samples, (II) Geochronolgic Samples, and (III) Archaeologic Samples. Under the first heading are samples analyzed not for dating *per se* but for calibration, interlaboratory checks, isotopic content, and tests for contamination or geochemical alteration. Where such samples are a part of a series of dated samples they are included with the series under Geochronologic Samples. The latter are all those analyzed primarily for dating purposes and include paleoecologic samples. Archaeological samples are listed separately and all samples are subheaded by geographic area.

I. GEOCHEMICAL SAMPLES

SMU-11. Crude oil FRL-1 **>36,900**

Sample of unknown provenience subm 1972 by Henry F Nelson, Mobil Field Research Lab. Analyzed for possible contamination by organic substances of Modern age. *Comment*: sample is uncontaminated within limits of detectability.

SMU-12. Spruce wood **11,850 ± 70**
9900 BC

SMU-16. Spruce wood **11,740 ± 140**
9790 BC

Sample from Appleton, Wisconsin, 4.2m below plain of glacial Lake Oshkosh (44° 24′ N, 88° 25′ W) run as interlaboratory check with Tx-541, 11,620 ± 80 on same wood specimen. Should be same age as Two Creeks Forest Bed. *Comment*: agrees well with other dates summarized with Tx-541 (R, 1970, v 12, pp 249-250).

SMU-13. Greenwade House, B **130 ± 50**
AD 1820

Wood from foundation post of pioneer log cabin built in middle 1850's in Brazos R valley near Whitney, Texas (31° 54′ N, 97° 23′ W) run as an interlaboratory check with Tx-540, 120 ± 50 on the same wood specimen (R, 1970, v 12, p 249).

II. GEOCHRONOLOGIC SAMPLES

A. Arizona

Murray Springs site (31° 34′ 15″ N, 110° 10′ 38″ W), San Pedro Valley, Cochise Co, Arizona (Ariz: EE:8:25) is a buried Clovis hunting camp and kill site where artifacts assoc with mammoth, bison, and horse occur within a sequence of late Quaternary sediments (Haynes & Hemmings, 1968; Hemmings, 1970). Samples are classified in stratigraphic order by geologic unit. Investigations supported by Natl Geog Soc (Archaeol) and Natl Sci Foundation (Geol). Coll 1966-1973 and subm by C V Haynes.

Murray Springs Unit F_1 series

Unit F_1 (Graveyard sand member, Lehner formation) is a coarse sand and gravel channel deposit of a small stream along which mammoth and bison were killed by Clovis hunters. Remains of extinct forms of horse and camel occur in lower portions of channel fill but not in upper part where Clovis artifacts are concentrated. Charcoal dated from several occurrences to determine time range of deposition. A-805, 11,230 ± 340 (R, 1967, v 9, p 11) is from same unit.

SMU-17. Charcoal, Loc 1, Sq C4 **8770 ± 70**
6820 BC

SMU-18. Charcoal, Loc 2, Sq F2 **11,730 ± 180**
9780 BC

SMU-41.	**Charcoal, Loc 2, Sq E3**	**10,840 ± 70** **8890 BC**
SMU-42.	**Charcoal, Loc 2, Sq E1**	**10,840 ± 140** **8890 BC**
SMU-43.	**Humates from SMU-42**	**11,160 ± 110** **9210 BC**
SMU-19.	**Humates, Trench 28**	**10,740 ± 190** **8790 BC**
SMU-29.	**Humates, Trench 28**	**10,790 ± 150** **8840 BC**
SMU-27.	**Charcoal, Trench 20**	**10,890 ± 180** **8940 BC**
SMU-28.	**Humates from SMU-27**	**11,210 ± 200** **9260 BC**

Comment: all except SMU-17 indicate a millennium or less for deposition of Unit F_1. SMU-17 was analyzed after treatment with preservative for wood identification tests at College Agric, Univ Arizona. All Unit F_1 wood identifications are ash (*Fraxinus* sp).

Murray Springs Unit E series

Unit E, Coro marl member, Murray Springs formation, is a pond or emergent water table deposit of calcium carbonate that dried up and was eroded by Unit F_1 channel prior to deposition of Graveyard sand. Previous dates on carbonate CO_2 (Valastro *et al,* in press) overlap with dates on more reliable charcoal from younger units indicating contamination by exchanged CO_2. This series was run on organic carbon residue recovered after pyrolysis followed by acid removal of carbonates. Uppermost sample (#2) occurred 20cm below eroded upper contact and lowermost sample (#11) occurred 20cm above basal contact of a 2m sec of marl exposed in S wall of S branch of Curry Draw 70m E of Loc 1, Stake AO.

SMU-33.	**Residue #2**	**11,880 ± 250** **9930 BC**
SMU-34.	**Residue #4**	**13,980 ± 190** **12,030 BC**
SMU-35.	**Residue #6**	**18,060 ± 150** **16,110 BC**
SMU-36.	**Residue #8**	**16,810 ± 420** **14,860 BC**
SMU-37.	**Residue #10**	**27,560 ± 2300** **25,610 BC**

19,650 ± 1400

SMU-38. Residue #11 **17,700 BC**

Comment: all ages should be considered minimum due to possible contamination by organic matter from overlying soil.

500 ± 80

SMU-39. Curry Draw, Unit G_3 **AD 1450**

Charcoal from base of 2.4m alluvial terrace exposed in N bank of Curry Draw opposite Murray Springs homestead (31° 34′ 20″ N, 110° 10′ 05″ W) 13km E of Sierra Vista, Cochise Co, Arizona. Coll and subm 1972 by C V Haynes. *Comment*: dates beginning of youngest alluvial fill prior to modern arroyo cutting.

3190 ± 80

SMU-40. Curry Draw, Unit G_{2a} **1240 BC**

Charcoal from hearth 1.2m below surface of 2.4m alluvial terrace and 3m below contact with overlying Unit H exposed in N bank of Curry Draw 1.5km W of Lewis Springs (31° 31′ 50″ N, 110° 09′ 05″ W), Cochise Co, Arizona. Coll 1972 and subm by L Escapule and C V Haynes. *Comment*: dates upper part of Unit G_{2a} (McCool member, Escapule formation).

1100 ± 110

SMU-47. Contention hearth (24-4) **AD 850**

Charcoal from hearth 1.5km below surface of 2.4m alluvial terrace along unnamed arroyo at Contention (31° 40′ N, 110° 12′ W) Cochise Co, Arizona. Coll and subm 1972 by N Johnson and C V Haynes. *Comment*: alluvium is equivalent to Unit G_{2b} at Murray Springs.

3070 ± 60

SMU-45. Contention hearth (24-3) **1120 BC**

Charcoal from rock hearth 1m below surface of 8m alluvial terrace of San Pedro R at Contention (31° 46′ N, 110° 12′ W) Cochise Co, Arizona. Coll and subm 1972 by N Johnson and C V Haynes. *Comment*: dates near end of deposition of intermediate of 3 alluvial fills equivalent to Unit G at Murray Springs.

1150 ± 50

SMU-46. Horsethief Draw hearth (24-9) **AD 800**

Charcoal from hearth with Hohokam potsherds 0.5m below surface of 3.7m terrace exposed by N bank Horsethief Draw (31° 31′ 30″ N, 110° 08′ 53″ W) Cochise Co, Arizona. Coll and subm 1972 by L Escapule and C V Haynes. *Comment*: equivalent to Unit G_{2b} at Murray Springs.

Winkelman Hearth (BB:2:13) series, Arizona

4490 ± 70

SMU-48. Hearth #3 (13-33) **2540 BC**

9.2m below terrace surface, N wall.

3940 ± 60

SMU-54. Hearth #2 (13-32) **1990 BC**

8.3m below terrace surface, S wall.

Charcoal from 13m alluvial terrace exposed in arroyo crossing Hwy 77 ca 14km S of Winkleman (32° 52′ N, 110° 43′ W) Pinal Co, Arizona. Coll and subm 1972 by J E Ayres and C Cronin. *Comment*: equivalent to Unit G_1 at Murray Springs.

930 ± 50

SMU-59. Escapule hearth **AD 1020**

Charcoal exposed in colluvium 0.3m below surface exposed by a rill 2.4km NW of Lewis Springs (31° 36′ N, 110° 10′ W) Cochise Co, Arizona. Coll and subm 1972 by L Escapule and C V Haynes.

390 ± 50

SMU-15. Boquillas hearth **AD 1560**

Charcoal from rock hearth on intermediate terrace 1.4km E of abandoned Boquillas RR sta (31° 47′ N, 110° 13′ W) Cochise Co, Arizona. Coll and subm 1970 by L Escapule and C V Haynes.

B. Colorado

Frazier site series

9550 ± 130

SMU-32. Humates, 1st extraction **7600 BC**

9650 ± 130

SMU-31. Humates, 2nd extraction **7700 BC**

Average 9600 ± 130

Buried dark gray organic soil horizon on gray sandy clay exposed in W wall of ravine cutting through Frazier Agate Basin site (Loc 2) on Kersey terrace 2km NW Kersey (40° 22′ N, 104° 35′ W) Weld Co, Colorado. Coll and subm 1966 by C V Haynes. *Comment*: date is probably minimum for Agate Basin horizon.

C. Florida

37,880 ± 2000

SMU-14. Aucilla peat **35,930 BC**

Lower 1/3 of 5m core from bottom of Aucilla R 1.6km SW of Nutall Rise (30° 08′ N, 83° 95′ W) Jefferson Co, Florida. Numerous bones of extinct Pleistocene animals and artifacts, some paleo-Indian, were on river bottom 5 to 10cm depth. Coll and subm 1972 by R Ohmes, Chairs, Florida, and L Workman and A R Saltus, Jr, Florida Dept of State, Tallahassee. *Comment* (CVH): sample predates fauna and culture.

D. Missouri

7870 ± 90

SMU-78. Philips Spring **5920 BC**

Wood fragments from clayey peat 310cm below surface of 8m alluvial terrace of Pomme de Terre R at Philips ford (38° 03′ 37; N, 93° 19′

10″ W) Hickory Co, Missouri. Coll and subm 1973 by C V Haynes. *Comment*: dates upper part of alluvium correlated with that at Rodgers Shelter (Wood & McMillan, 1974).

E. Nebraska

Hudson-Meng series

SMU-49. Bone carbonate CO_2 #1 **115.3 ± 1.0% modern**

SMU-50. Bone carbonate CO_2 #2 **109.8 ± 1.4% modern**

SMU-51. Bone apatite CO_2 #1 **8520 ± 110 / 6570 BC**

SMU-52. Bone apatite CO_2 #2 **8990 ± 190 / 7040 BC**

Bone from extinct bison at Hudson-Meng paleo-Indian site 22km NW of Crawford (42° 49′ N, 103° 36′ W) Sioux Co, Nebraska. Bone treated to separate successive stages of CO_2 first from secondary calcite and then from apatite. Coll and subm 1971-73 by L D Agenbroad, Chadron State College. *Comment*: each successive stage is older suggesting that last stage is less contaminated.

F. New Mexico

Sandia Cave series

SMU-76. Wood (*Pinus* sp) **2250 ± 50 / 300 BC**

SMU-77. Charcoal **1890 ± 90 / AD 60**

Samples from rodent deposit within older deposits of Sandia Cave (35° 15′ 30″ N, 106° 24′ W) 28km NW of Albuquerque, Sandoval Co, New Mexico.

G. Texas

North Sulphur River series

Samples from alluvium underlying flood plain of N Sulphur R in vicinity of Ben Franklin, Delta Co, Texas. Coll and subm by M Rainey, Southern Methodist Univ. Previous investigations by Slaughter and Hoover (1963).

SMU-62. Mussel shells **2840 ± 60 / 890 BC**

Shells from Unit B_2 1.6m above contact with Unit B_1 exposed in right bank Sulphur R 2.4km NE of Ben Franklin (33° 20′ 35″ N, 95° 45′ 10″ W).

SMU-70. Charcoal **660 ± 70 / AD 1290**

Dispersed charcoal from late alluvium exposed by left bank of Ghost Creek 2.2km NW of Ben Franklin (33° 30′ N, 95° 40′ W).

SMU-71. Charcoal **1790 ± 50**
AD 160

Dispersed charcoal from base of Unit B_1 on truncated soil exposed in right bank Sulphur R 1.3km N of Ben Franklin (33° 29′ 40″ N, 95° 45′ 55″ W).

H. Egypt

Bir Sahara series

Sediments containing Pleistocene faunas and artifacts exposed in a deflation basin at Sahara well in Western Desert 375km W of Abu Simbal on the Nile R (22° 52′ N, 28° 36′ E). Carbonate fraction of mollusk shells analyzed. Coll 1973 by C V Haynes and subm. by F Wendorf.

SMU-75. Pelecypod shells **30,870 ± 1000**
28,920 BC

From desert surface and underlying lacustrine silt at Loc BS-15.

SMU-79. Gastropod shells **>44,680**

High-spired snail shells from lacustrine silt of younger ponding interval 20 to 50cm below surface at Loc BS-15. *Comment*: date of SMU-79 indicates that shells from surface in SMU-75 were contaminated, probably by exchange with atmospheric CO_2, despite strong acid leaching prior to analysis. Aterian horizon at Bir Tarfawi 11km E is tentatively correlated with these beds.

SMU-80. From surface (BS-13) **32,780 ± 900**
30,830 BC

SMU-82. Coll by flotation (BS-16) **40,710 ± 3270**
38,760 BC

SMU-81. Hand picked large specimens (BS-16) **>41,450**

High-spired gastropod shells (*Melanoides?*) from marl of older ponding interval. Stratigraphically below silt of SMU-79. *Comment*: results indicate contamination by exchange and secondary calcification can be avoided if high-spired shells are crushed and fragments selected for ultrasonic cleaning and leaching. Series indicates both Aterian and Mousterian occupations were prior to 44,680 BP.

I. Ethiopia

The archaeology and Quaternary geology of the Gala Lakes region of the Ethiopian rift are under investigation by scientists from Belgium, Ethiopia, Poland and the United States with support from the Natl Sci Foundation (Grant GS-27325 to Fred Wendorf) and the Inst for the Study of Earth and Man at SMU.

Efforts are being concentrated on geochronology (Albritton, 1973; Laury and Albritton, in press) and paleolithic archaeology (Wendorf and Schild, 1973) of Quaternary volcanics and sediments around W half of Lake Ziway in Shoa Prov.

SMU-60. Modern *Bulinus* shells **149.7 ± 0.5% modern**

Snail shells from shore of Lake Ziway at village of Ziway (7° 56′ 18″ N, 38° 43′ 24″ E) Shoa Prov. Coll 1973 by R Daugherty and subm 1973 by C V Haynes. *Comment*: analysis reflects nuclear-age atmospheric content of ^{14}C, indicating that no age correction is necessary for dating fossil shells of same species.

Terrace III series

Shells (6VH73) from lacustrine volcanic ash 0.5 to 1m below surface of 3rd terrace above Lake Ziway 1.7km NE of Abosa village (8° 2′ 6″ N, 38° 44′ 6″ E). Several species from same deposit analyzed to cross check for age discrepancies between species and allow for correction via SMU-60. Coll and subm 1973 by C C Albritton, R L Laury, and C V Haynes.

SMU-66. *Corbicula* shells **7880 ± 290**
5930 BC

SMU-68. *Melanoides* shells **5570 ± 90**
3620 BC

SMU-69. *Bulinus* shells **5370 ± 60**
3420 BC

Comment: SMU-60 indicates that *Bulinus* shell yields correct date and SMU-68 and -69 indicate *Melanoides* is within 2σ of correct age, but *Corbicula* shell can be 2500 yr too old.

Latrine pit series

Shells (5VH73) from upper 2 faunal zones in lacustrine volcanic ash 2m below surface of 4th terrace above Lake Ziway at S side of Abosa village (8° 01′ 18″ N, 38° 43′ 12″ E). Coll and subm 1973 by C C Albritton, R L Laury, and C V Haynes.

SMU-63. *Corbicula* shells **9090 ± 100**
7140 BC

SMU-64. *Melanoides* shells **9330 ± 100**
7380 BC

Comment: 2 species provide comparable ages despite discrepancy suggested by SMU-66 and -68.

SMU-65. *Bulinus* shells **4800 ± 70**
2850 BC

SMU-67. Same as SMU-65. **5050 ± 100**
3100 BC

Average 4930 ± 100

Shells (4VH73) from 10 to 30cm below surface in lacustrine volcanic ash exposed by rd to pantellerite quarry 3.25km W of Ziway (7° 56′ 30″ N, 38° 40′ 30″ E). Coll and subm 1973 by C C Albritton, R L Laury, and C V Haynes. *Comment*: dates are on 2 batches (splits) from same sample. Older value is probably closer to true age.

SMU-61. *Corbicula* shells **26,780 ± 440 / 24,830 BC**

Shells (1VH73) from lacustrine volcanic ash exposed 2 to 4m above channel in right bank of Bul Bulla R at missionary school 3.4km NE of Adamitullu (7° 53′ 24″ N, 38° 43′ 48″ E). Coll and subm 1973 by C C Albritton and C V Haynes. *Comment*: date is probably minimum because contamination by exchange with nuclear-age CO_2 is more critical with older samples.

SMU-72. Locality 19 **11,510 ± 110 / 9560 BC**

Charcoal (9VH73) from 80cm below surface in red soil developed in pumiceous lapilli deposit on hillside 9.6km SW of Adamitullu (7° 48′ 36″ N, 38° 37′ E). Coll and subm 1973 by R L Laury and C V Haynes. *Comment*: dates episode of ash fall and provides maximum age for soil development on ash.

Macho series

Samples from archaeologic sites in Macho area 9.3km WSW of Adamitullu (7° 50′ N, 38° 36′ 18″ E). Coll and subm 1973 by G K Humphreys, SMU.

SMU-83. Macho Site II **230 ± 50 / AD 1720**

Charcoal from fire pit dug through thin pumiceous lapilli deposit overlying yellowish-brown soil on underlying ash. *Comment*: postdates latest ash fall in Macho area.

SMU-84. Macho Site I **1540 ± 60 / AD 410**

Burnt stump in yellowish-brown soil in small erosional escarpment. *Comment*: dates lapilli fall that burned trees.

III. ARCHAEOLOGIC SAMPLES

A. New Mexico

Armijo Draw series

Samples from preceramic hearths exposed in pipeline trench crossing several tributaries of Armijo Draw near Cerrito Redondo, Sandoval Co, New Mexico. Coll and subm 1968 by P J Mehringer and C V Haynes. Archaeology of area is being studied by C Irwin-Williams (1968).

SMU-55. Hearth #2 humates **2210 ± 40 / 260 BC**

Hearth below surficial brown soil in eolian sand and 2.1km W of Cerrito Redondo (35 25′ 05″ N, 106° 53′ 50″ W).

SMU-56. Hearth #3 charcoal **3390 ± 200 / 1440 BC**

2770 ± 50

SMU-57. Humates from SMU-56 **820 BC**

Hearth on white sand below surficial brown soil 2.3km W of Cerrito Redondo (35° 25′ 20″ N, 106° 54′ W).

4000 ± 60

SMU-20. Hearth #6 charcoal **2050 BC**

3800 ± 220

SMU-21. Humates from SMU-20 **1850 BC**

Hearth with heating stones below truncated red soil in light brown fluvial sand 2km SW of Cerrito Redondo (35° 24′ 25″ N, 106° 53′ 20″ W). *Comment*: humates dates are consistently too young, hence SMU-55 is minimum for preceramic occupation of Armijo area.

3190 ± 80

SMU-58. Humates from charcoal **1240 BC**

Finely divided charcoal from hearth (11-1) in red soil in eolian sand on pediment surface 16km SE of Belen (34° 35′ N, 106° 40′ W) Valencia Co, New Mexico. Folsom and Bajada artifacts found on surface. Coll and subm 1966 by E Baker and C V Haynes. *Comment*: charcoal was insufficient for analysis and humate date is minimum for Archaic occupation.

B. Ethiopia

Waso series

Samples from archaeologic site on hill top 8.75km SW of Adamitullu (7° 48′ 48″ N, 38° 37′ 30″ E). Coll and subm 1973 by G K Humphreys.

1350 ± 40

SMU-85. Waso Site I **AD 600**

Burnt stump in red soil with root extending down from contact with overlying pumice lapilli deposit. *Comment*: dates ash fall that burned trees. Difference from SMU-84 is possibly due to different ages of trees.

10,330 ± 90

SMU-86. Waso Site III **8280 BC**

Charcoal from late Stone age site in red soil in volcanic ash and 10cm below contact with overlying pumice lapilli deposit. *Comment*: dates late Stone age occupation during ash deposition either before or during early stage of red soil development.

C. Israel

Aqev Spring series

Charcoal from a Late Levantine Upper Paleolithic site (E22D31), 4.5km SE of Midrasha Sde Boker (30° 49′ 02″ N, 34° 48′ 39″ E), Negev, Israel. Exposed in wadi terrace in tributary of Nahal Zin. Coll and subm 1971 by A E Marks, SMU.

17,890 ± 600

SMU-6. 30 to 40cm depth **15,940 BC**

SMU-8. 45 to 50cm depth **17,390 ± 560 / 15,440 BC**

SMU-5. 50 to 55cm depth **19,980 ± 1200 / 18,080 BC**

Comment (AEM): SMU-6 and -8 agree well with previous dates; I-5494 and -5495 (R, 1973, v 15, p 295). SMU-5 appears aberrant but overlaps with other dates at 2σ.

SMU-7. Ein Avdat **18,840 ± 680 / 16,890 BC**

Charcoal from fire pit at Geometric Kebaran "A" site (E22D5) on a terrace of Nahal Zin, near spring of Avdat, 0.8km SW of Midrasha Sde Boker (30° 51′ 24″ N, 34° 46′ 31″ E), Negev, Israel. Exposed at 30cm depth. Coll and subm 1971 by A E Marks. *Comment* (AEM): date is questionable given conflicts with previous dates; Tx-1121 (R, 1972, v 14, p 484) and I-5498 (R, 1973, v 15, p 296). No 2 dates are consistent.

Har Harif series

Charcoal from midden at Natufian site Rosh Horesha (E22G7) in Nahal Horesha, 26km WSW of Mitzpe Ramon (30° 30′ 50″ N, 34° 30′ 40″ E), Negev, Israel. Coll and subm 1971 by A E Marks.

SMU-9. Feature 13, 35 to 45cm **10,490 ± 430 / 8540 BC**

SMU-10. Features 15 & 16, 35 to 45cm **10,880 ± 280 / 8930 BC**

Comment (AEM): dates seem acceptable in light of other Natufian dates, indicating Natufian was not significantly later in Negev than in N, although typologically this site is not "Early Natufian". Dates are slightly younger than I-5496 (R, 1973, v 15, p 295) from same site.

SMU-3. Nahal Zin **8900 ± 180 / 6950 BC**

Charcoal from large fire pit in pre-Pottery Neolithic site Nahal Divshon (E22D1) in floor of Nahal Zin, 1km SSW of Midrasha Sde Boker (30° 50′ 30″ N, 34° 47′ 10″ E), Negev, Israel. Coll and subm 1971 by A E Marks. *Comment* (AEM): date agrees with I-5501 (R, 1973, v 15, p 296) and Tx-1123 (R, 1972, v 16, p 484) from same site.

D. Sudan

Wadi Halfa series

Charcoal from Site DIW-50 in post-Arkin formation silts along W bank of Nile R 4.0km N of Wadi Halfa (22° 00′ 30″ N, 31° 20′ 15″ E) Sudanese Nubia. Coll 1964 by W Chmielewska and subm 1971 by F Wendorf, SMU.

SMU-1. Trench 1, 5CH **5410 ± 150 / 3460 BC**

5880 ± 150
SMU-2. Trench 1, 7CH **3930 BC**

Comment (FW): previous dates for same cultural level are 5600 ± 200 (WSU-174). See Chmielewska, in Wendorf (1968).

7910 ± 120
SMU-4. Trench 10 CH (DIW-53) **5960 BC**

Charcoal from fire pit in post-Arkin formation silt along W bank Nile R 3.9km N of Wadi Halfa (22° 00′ 30″ N, 31° 22′ 12″ E) Sudanese Nubia. Coll 1964 by W Chmielewska and R Schild and subm 1972 by F Wendorf. *Comment* (FW): should be younger than 7440 ± 180 BC (WSU-175) and older than 3650 ± 200 BC (WSU-174). See Schild *et al*, in Wendorf (1968).

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