

UNIVERSITY OF PENNSYLVANIA RADIOCARBON DATES XXII

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INTRODUCTION

This date list includes most of the archaeological and geologic samples dated in this laboratory since publication of our last date list (R, 1981, v 23, p 227-240), as well as some samples dated previously which lacked adequate sample information.

All samples were pretreated with 3N HCl and some, where noted, were given additional pretreatment with 2% NaOH for the removal of possible humic acid contaminants.

The BP ages are relative to AD 1950, and have been calculated with the half-life value of 5568 yr using our mid-19th century AD calibration samples which have an average age of 145 yr. When corrected for this age, these calibration samples have ^{14}C contents equal to 95% of the NBS oxalic acid standard. $\delta^{13}\text{C}$, where included, has been measured on this laboratory's Micromass 622 mass spectrometer, reported with respect to PDB, and the results corrected accordingly for isotopic fractionation. All samples were counted at least twice for periods of not less than 1000 min each. Errors quoted for each sample include the sum of the statistical counting uncertainties in the measurement of the sample, the background, and several counts of our mid-19th century AD oak sample, but do not include the possible half-life errors.

In addition to our two 8L counters, a small 1L counter is employed for counting undersized samples. Larger errors associated with these dates are a direct result of small sample size and consequently reduced number of counts. Use of the small counter is indicated by an asterisk (*) after the uncertainty of the BP date. In all counters we continue to use pure CO_2 .

The calibrated dates which appear in the sample comments are designated either as *CRD-1 σ* or *Stuiver corrected*. *CRD-1 σ* refers to BC era dates calibrated with tables based on the same data base and statistical methods as found in "Calibration of radiocarbon dates: tables based on the consensus data of the Workshop on Calibrating the Radiocarbon Time Scale" (R, v 24, p 103-150) but where the range represents a 67% confidence interval instead of 95% confidence interval (Jeffrey Klein, unpub). *Stuiver corrected* refers to AD era dates that have been calibrated using "A high-precision calibration of the AD radiocarbon time scale" (R, v 24, p 1-26). Both of the above-mentioned calibrations include the uncertainties assoc with the counting statistics of the sample and those assoc with the calibration itself. Where there is no calibrated date in an individual sample comment, it is because that date is beyond the range of currently available correction factors (BP 7230, 5568 half-life). For those readers interested in an age calculated with the 5730 year half-life, the given radiocarbon age should be multiplied by 1.029.

SAMPLE DESCRIPTIONS

ARCHAEOLOGIC SAMPLES

*Mediterranean**Cyprus***Kalavassos-Tenta series**

Kalavassos-Tenta, 2.25km SSE of Kalavassos village, Larnaca Dist, Cyprus (34° 41' N, 33° 18' E), is stratified habitation site representing both Aceramic and Ceramic Neolithic phases (Todd, 1978; 1982a,b). Coll and subm 1977 and 1978 by I A Todd, Dept Oriental Studies, Brandeis Univ, Waltham, Massachusetts. For previous dates from this site, see P-2458 to -2555 (R, v 20, p 218-219).

General Comment: except for P-2780 all samples are from Aceramic Neolithic contexts.

P-2975. Sample K-T 21 6970 ± 310*

Soil and charcoal from Sq F11 C, E baulk, deposit no. 2.5. Deposit lies outside any structures and is quite close to top soil (possibly disturbed by plough); dates Aceramic occupation of lower S face of site. *Comment:* CRD-1σ: 6335 to 5390 BC.

P-2976. K-T 22 8870 ± 500*

Soil and charcoal from Sq F11 C, deposit no. 3.6, hearth outside structures and under caliche layer (from same basic area as P-2975, above, and est date probably similar).

P-2974. Sample K-T 10 8020 ± 90

Mud and charcoal from Sq G9 D, deposit 3.6, dates occupation of mud-brick Structure 58, at top of site.

P-2977. Sample K-T 23 6570 ± 290*

Soil and charcoal from Sq G10 A, deposit no. 4.1, from pit that post-dates and is dug into Structure 28 on top of site. *Comment:* CRD-1σ: 5830 to 5200 BC.

P-2973. Sample K-T 19 8010 ± 360*

Soil and charcoal from Sq G10 A/G10 C; sample from Structure 34 (dates actual mudbrick structure or period immediately after).

P-2972. Sample K-T 18 9240 ± 130

Soil and charcoal from Sq G11 C, deposit no. 13.2/16.1; from one of earliest pits in lower S area of site.

P-2781. Sample K-T 11 6300 ± 80

Charcoal from Sq G11 C, deposit no. 9.2, representing Aceramic Neolithic open-air hearth. *Comments:* CRD-1σ: 5350 to 5085 BC; (IAT): date unexpectedly young; should be similar to P-2552, -2553, and -2555 (R, 1978, v 20, p 218-219).

- 7600 ± 100**
- P-2782. Sample K-T 12** $\delta^{13}C = -21.2 \pm 0.2\%$
Charcoal from Sq G11 C, deposit no. 5.9, from Aceramic Neolithic open air area outside Structure 9; should be contemporaneous with P-2781 (above).
- P-2783. Sample K-T 13** **7130 ± 410***
Charcoal from Sq G11 C, deposit no. 5.5; Aceramic Neolithic open-air Area E of Structure 9 and contemporaneous with it.
- P-2784. Sample K-T 14** **7380 ± 100**
Charcoal from Sq G12A, deposit no. 5.8.
- P-2779. Sample K-T 9** **7120 ± 90**
Charcoal from Sq G12 D, deposit no. 4.2; dates to early phase of stone architecture. *Comment:* NaOH pretreatment: *CRD-1σ: 6235 to 5635 BC.*
- P-2785. Sample K-T 15** **8720 ± 400**
Charcoal from Sq G12 D, deposit 5.1, from hearth (hollow cut in bed-rock) S of E end of Aceramic Neolithic Structure 1 (Dikaïos' main wall).
- P-2978. Sample K-T 24** **7400 ± 260**
Soil and charcoal from Sq H12 A, deposit no. 2.4, open area, close to present ground surface in lower S part of site and close to inner face of wall (probable outer wall of settlement's early phase).
- 5830 ± 60**
- P-2780. Sample K-T 10** $\delta^{13}C = -27.5 \pm 0.3\%$
Charcoal from Sq B7 C, deposit no. 2.4, Ceramic Neolithic deposit. *Comments: CRD-1σ: 4755 to 4565 BC; (Frank Koucky): not archaeol in situ—deposited by water action.*
- P-2980. Kalavassos Village-Panayia Church, Sample 1** **4330 ± 80**
Charcoal found near Middle Bronze age vessel (no. 27), level 3/4 in Tomb 2 at site E of Panayia Church, Kalavassos Village (34° 46' N, 33° 18' E) from rescue excavation before new construction. *Comments: CRD-1σ: 3190 to 2865 BC; (IAT): vessel dates tomb to Middle Bronze age on Cyprus (ca 1925 to 1600 BC). Calibrated date is earlier than conventional dating for Early Bronze age, but note that calibrated date for Episkopi-Phaneromeni (Late Bronze age IA in Cyprus) also appears to be 500 yr too early (R, 1977, v 19, p 189).*

Greece

Voidokoilia series

Tholos Tomb of Thrasymedes, NW of town of Voidokoilia, near Pylos (30° 22' N, 21° 45' E), which contains Neolithic sherds, shows long and continuous use during Mycenaean period. Originally excavated by Spyridon Marinatos in 1956 and 1957, tomb was re-examined in 1977. Samples coll by G S Korres, Univ Athens and subm 1978 by H N Michael, Univ Mus, Univ Pennsylvania.

P-2846. Sample V-1978-2 5810 ± 410*

Six small samples of charcoal and soil from depth 0.53 to 1.75m in NE sec of *tholos*. *Comments*: CRD-1 σ : 5245 to 4325 BC; (GSK): stratum disturbed by digging in 1923.

P-2848. Sample V-1978-4 4810 ± 280*

Three small samples of charcoal and soil from interior of *tholos*. *Comment*: CRD-1 σ : 3895 to 3345 BC.

P-2850. Sample V-1978-5B 4360 ± 350*

Fourteen small samples of charcoal and soil from loci of *pithos* 1 and 5 in SE sec of *tholos*. *Comment*: NaOH pretreatment, CRD-1 σ : 3520 to 2620 BC.

P-2852. Sample V-1978-7 4000 ± 280*

Charcoal from vessel α (alpha) in *dromos*. *Comment*: CRD-1 σ : 2930 to 2155 BC.

P-2853. Sample V-1978-8 4090 ± 260*

Soil with charcoal and ash from vessel γ (gamma) from *dromos* interior. *Comment*: CRD-1 σ : 3035 to 2315 BC.

P-2854. Sample V-1978-9 4970 ± 270*

Charcoal and burned soil contained in vessel β (beta) from interior of *dromos*. *Comment*: CRD-1 σ : 4105 to 3495 BC.

P-2855. Papoulia Tumulus, Sample PAP-1978-1 3420 ± 60

Ash and charcoal from Papoulia Tumulus, a horseshoe-shaped structure of stone construction between villages of Platanos and Papoulia, in Pylos dist (30° 22' N, 21° 45' E). Sample from right-central part of interior in niche. Coll 1978 by G S Korres, Univ Athens and subm by H N Michael. *Comments*: CRD-1 σ : 1880 to 1675 BC; (GSK): date expected to be Middle Helladic (1900 to 1600 BC) or perhaps Early Helladic.

Ayios Stephanos series

Ayios Stephanos is settlement site on flat-topped hill with burials throughout, ca 45km SSE of Sparta, Laconia (22° 39' E, 36° 48' N). Samples coll 1973, 1974, 1977 and subm by Lord William Taylour (1972), Cambridge Univ, England (Rutter & Rutter, 1976).

P-2568. Sample 1 (1973) 3160 ± 60

Charcoal from Tr N (I) T.IA, Level 4, (20) ca 1.1m below surface. *Comments*: CRD-1 σ : 1570 to 1380 BC; (WT): potsherds dated Middle Minoan/Late Helladic I.

P-2569. Sample 2 (1973) 3070 ± 240*

Charcoal from Tr N (I) T.I, Level 5, Rm II (35), ca 1.2m below surface. *Comments*: CRD-1 σ : 1650 to 1085 BC; (WT): no potsherds later than end of MH.

P-2966. Sample 7 (1977) 4100 ± 230*

Charcoal and soil from Tr N/Γ1, Level 44-W, balk (56). *Comment: CRD-1σ: 2945 to 2515 BC.*

P-2969. Sample 12 (1977) 3510 ± 50

Charcoal from wooden plank, Tr N 1, threshold to apse of apsidal bldg. *Comments: CRD-1σ: 1970 to 1740 BC; (WT): should be appreciably older than bldg.*

P-2965. Sample 6 (1977) 4010 ± 230*

Charcoal and soil from Tr N.1, Level 44-SW (52). *Comments: CRD-1σ: 2890 to 2305 BC; (WT): sample found in apse, sealed by debris and collapsed bldg material, of large MH II apsidal bldg (burned). General context is similar to P-2966, -2969 (above) and P-2967 (below).*

P-2967. Sample 8 (1977) 3930 ± 50

Charcoal from Tr N 1, Levels 44-SE, 44-E, balk (53) (59). *Comments: CRD-1σ: 2555 to 2325 BC; (WT): sample from main rm of large MH II apsidal bldg (burned) and sealed by debris and thick layer of collapsed bldg material. General context similar to P-2965, -2966, and -2969.*

P-2790. Sample 8 (1974) 4150 ± 50

Carbon and soil from Tr N 2, Level 12 (44). *Comments: CRD-1σ: 2900 to 2650 BC; (WT): sample from MH III level, same level as P-2965. ¹⁴C date corresponds closely with pottery.*

P-2958. Sample 10 (1974) 4040 ± 210*

Charcoal from Tr N 2, Level 13 (45). *Comments: CRD-1σ: 2905 to 2315 BC; (WT): sample found inside almost complete *kantharos* from MH III level; almost certainly related to P-2959. ¹⁴C date corresponds closely with pottery.*

P-2959. Sample 9 (1974) 3720 ± 250*

Charcoal from Tr N 2, Level 13 (45). *Comments: CRD-1σ: 2435 to 1765 BC; (WT): sample found surrounding almost complete *kantharos* from MH III level; clearly related to P-2958.*

P-2964. Sample 5 (1977) 3470 ± 240*

Charcoal and soil from Tr N 2, Level 48 (48). *Comments: CRD-1σ: 2135 to 1580 BC; (WT): sample from fill of shaft above large MH III cist tomb (shaft grave). Tomb is sealed by floor on and above which P-2790, -2959, and -2958 were coll. Pottery dates tomb to MH III.*

P-2968. Sample 10 (1977) 3770 ± 210*

Charcoal from Tr N 2, Level 50 (58). *Comments: CRD-1σ: 2435 to 1910 BC; (WT): sample from fill above and on beaten earth floor due S of large MH II apsidal bldg. Assoc pottery is early MH II. Deposit and bldg are probably contemporaneous.*

P-2570. Sample 3 (1973) 3870 ± 210*

Charcoal from Tr H, Level 3, ca 50cm below surface, on level with infant Burials 7 and 8 (42). *Comments: CRD-1σ: 2655 to 2105 BC; (WT):* potsherds predominately MH and sample seems to agree.

P-2571. Sample 4 (1973) 3550 ± 220*

Charcoal from Tr H, Level 3 (47), found ca 80cm below surface, on level with infant Burial 10. *Comments: CRD-1σ: 2190 to 1680 BC; (WT):* pure MH stratum, but late, seems to be same date as P-2570, although from different sec of trench.

P-2962. Sample 4 (1977) 3900 ± 250*

Charcoal and soil from Tr Λ3/Λ4, Level XXXV (97). *Comments: CRD-1σ: 2865 to 2000 BC; (WT):* assoc with MH III yellow Minyan *kantharos* and late MH II grooved Minyan goblet.

P-2963. Sample 5 (1977) 3620 ± 60

Charcoal and soil from Tr Λ3/Λ4, Level XXXVI (98). *Comments: CRD-1σ: 2155 to 1890 BC; (WT):* sample found below Floor 9, dated by decorated Minyan goblet MH II (?late), and above deposit containing ladle, MH II (?early).

P-2961. Sample 4 (1977) 4080 ± 60

Charcoal from Tr I/II/III, Area *ep/ex* (120). *Comments: NaOH* pre-treatment; *CRD-1σ: 2870 to 2545 BC; (WT):* sample possibly from wooden post; latest pottery MH II. ¹⁴C date corresponds closely with pottery.

P-3046. Sample P:1 4200 ± 240*

Charred wood from Akrotiri, Thera, Santorini I. (36° 21' N, 24° 26' E). Sample from Middle Cycladian, Akrotiri region, N entrance delta, E side, E of LM house with broken staircase (House Delta); found with older pumice pebbles. Coll 1978 by W.L. Friedrich, Aarhus Univ, Denmark and H Pichler, and subm 1979 by P P Betancourt, Univ Pennsylvania. *Comment: CRD-1σ: 3075 to 2545 BC.*

*Near East**Egypt***E Karnak series**

E Karnak (Luxor) is in Nile Valley of Upper Egypt (25° 43' N, 32° 29' E). Site, town of ancient Thebes, possibly has cultural correlation with Kushite-Saite period, ca 750-350 BC (Redford, 1977; 1978; 1979). Coll and subm by D B Redford, Univ Toronto, Canada.

General Comment: all samples are wood (id by Rowena Gale, Jodrell Royal Botanic Gardens, Surrey, England) and from destruction of large and imposing bldg, possibly from roofing beams.

P-3113. Sample HA I (14) 2590 ± 60

Wood from black stratum beneath Stratum 7. *Comment: NaOH* pre-treatment; *CRD-1σ: 815 to 765 BC.*

- P-3111. Sample HA III (4)** **2550 ± 50**
 Wood (hazel, *Corylus* sp) from same loc. *Comment:* NaOH pretreatment; *CRD-1σ:* 800 to 740 BC.
- P-3114. Sample HA III (12)** **2550 ± 50**
 Wood (*Acacia* sp) from same loc. *Comment:* NaOH pretreatment; *CRD-1σ:* 800 to 740 BC.
- P-3112. Sample HA IV (9)** **2860 ± 40**
 Wood (*Tamarix* sp and palm) from same loc. *Comment:* NaOH pretreatment; *CRD-1σ:* 1125 to 1010 BC.
- P-3115. Sample HA IV (6)** **2210 ± 50**
 Wood (*Acacia* sp) from same loc. *Comment:* NaOH pretreatment. *CRD-1σ:* 400 to 175 BC.

*Iran***Eshkaft-e Gavi series**

Charcoal (probably wood) from Eshkaft-e Gavi, Fars prov (29° 52' N, 52° 45' E). Coll 1978 by Michael Rosenberg, Anthropol Dept, Univ Pennsylvania, and subm 1981 by R H Dyson, Jr, Univ Mus, Univ Pennsylvania. *General Comment* (MR): samples come from Upper Paleolithic levels and dates are consistent with artifact types.

- P-2861. Sample Lot 16** **>27,610***
 Charcoal; depth ca 95 to 105cm.
- P-2862. Sample Lot 17** **>27,970***
 Charcoal; depth ca 95 to 105cm.
- P-2863. Sample Lot 18** **24,240**
 Charcoal; depth ca 95 to 105cm. **+ 3010***
- 2180
+ 1630*
- P-2864. Sample Lot 19** **18,020**
 Charcoal; depth 105 to 113cm. **- 1360**
+ 1590*
- P-2865. Sample Lot 22** **19,230**
 Charcoal; depth 105 to 122cm. **- 1340**
- P-2866. Sample Lot 24** **>27,260***
 Charcoal; depth 122 to 135cm.

Tepe Hissar series

Tepe Hissar is loc at Damghan (36° 09' N, 59° 22' E). In 1931 and 1932, Erich Schmidt conducted excavations at this complex of mounds for Univ Mus, Univ Pennsylvania. Most artifacts and pottery discussed by Schmidt (1933; 1937) came from graves rather than occupation levels. This cemetery data formed the basis of his sequence. In 1976, a joint Hissar Restudy Proj was organized by Univ Mus, Turin Univ and Iran

Center for Archaeol Research. One major goal of this restudy was to examine stratigraphy of site in order to construct revised chronol linked directly to occupation levels. Samples reported here were coll 1976 and subm by R H Dyson, Jr, with significant revision of Schmidt's dating of architectural remains (Dyson & Howard, in press).

General Comment (RHD): samples were selected from four parallel sequences of site: Main Mound, N Flat, S Hill, and Twins. These should agree horizontally and be internally consistent. The following represent 1976 results:

Period I (earliest levels reached in 1976: later painted pottery (Schmidt IC (IIA)) 1st half, 4th millenium bc (P-2622, -2774, -2519, -2623, -2764).

Period II (earliest levels with majority of gray pottery (largely Schmidt IIB)) 2nd half, 4th millennium bc (P-2703, -2617, -2706, -2698, -2615, -2700, -2704, -2699, -2715, -2773, -2766, -2759, -2767, -2708, -2710, -2621, -2707, -2711, -2709, -2760). Lapis lazuli working and copper smelting fully documented in this time range.

Period III (later gray pottery levels (Schmidt (IIIB)), 2nd half, 3rd millennium bc (P-2618, -2701).

Period III (end of sequence (Schmidt IIIC)), 1st quarter, 2nd millennium bc (P-2620).

Chronology indicates date in 2nd half of 3rd millennium bc for Burned Bldg and redates exposed architecture of Main Mound (Bldgs 1, 2, and 3) to Period II (originally dates IIIB by Schmidt (1937)). In 1976 revision, use of Schmidt's A, B, C subdivisions has been dropped since they were not defined on basis of actual stratigraphy at site. Schmidt's Periods and 1976 Revision Stages will be reported as SP and RS, respectively. Comments on S Hill samples by Maurizio Tosi (MT), ISMEO, Rome.

Samples from Main Mound

P-2620. Sample H76-CS6 3610 ± 70

Charcoal, CG90 Balk [P] (1), Lot 4, Feature 1. *Comments: CRD-1σ: 2150 to 1885 bc.* (RHD): assoc with Wall 42, CG90 Balk 1. Highest preserved stratum, SP-IIIC, RS-A (= Period III).

P-2618. Sample H76-CS75 3950 ± 60

Charcoal and soil, DG20. *Comments: NaOH pretreatment. CRD-1σ: 2640 to 2390 bc.* (RHD): immediately below row of four hearths, SP-IIIB, RS-B/C (= Period III).

P-2708. Sample H76-CS51 4440 ± 50

Charcoal, CG90 [11] Lot 31 (DG01). *Comments: CRD-1σ: 3360 to 2995 bc;* (RHD): burned storeroom floor, relates to Bldg 3a SP-IIIB, RS-D (= Period II).

P-2710. Sample H76-CS30 4380 ± 70

Charcoal, CG90 [7] Lot 37, Rm [7], Floor 2. *Comments: NaOH pretreatment, CRD-1σ: 3175 to 2920 bc;* (RHD): Rm [7] built slightly later

than Kitchen [1] and Kiln [3]. (Rm 7 is actually in DG 00), SP-IIIB, RS-D (= Period II).

P-2621-A. Sample H76-CS10 **4550 ± 70**

Charcoal, CG90 [2] Lot 23. *Comments:* NaOH pretreatment, *CRD-1σ:* 3380 to 3160 BC; (RHD): alley between Kitchen [1] and Kiln [3], under uppermost surface, SP-IIIB, RS-D3 (= Period II).

P-2707. Sample H76-CS31 **4530 ± 60**

Charcoal and soil, CG90 (3) Lot 35. *Comments:* *CRD-1σ:* 3375 to 3150 BC; (RHD): Kiln [3] floor, contemporary with Kitchen [1], SP-IIIB, RS-D3 (= Period II).

P-2709. Sample H76-CS4 **4540 ± 60**

Charcoal, CG90 [1] Lot 11. *Comments:* NaOH pretreatment, *CRD-1σ:* 3380 to 3155 BC; (RHD): Kitchen [1] floor contemporary with Kiln [3], SP-IIIB, RS-D3 (= Period II).

P-2711. Sample H76-CS29 **4570 ± 60**

Charcoal, CG90 [3] Lot 35. *Comments:* NaOH pretreatment, *CRD-1σ:* 3385 to 3165 BC; (RHD): Kiln [3] floor, contemporary with Kitchen [1], SP-IIIB, RS-D3 (= Period II).

P-2622. Sample H76-CS73 **5060 ± 320***

Charcoal and soil, DF09 [12] Lot 12, Balk 13 (12). *Comments:* *CRD-1σ:* 4345 to 3515 BC; (RHD): trash lenses against lowest exposed walls below Bldg 2 which is contemporary with CG90 Kitchen [1] and Kiln [3], SP-I, RS-F (= Period I).

P-2774. Sample H76-CS72 **5750 ± 60**

Charcoal and soil, DF09 Lot 5, Balk 13 (9). *Comments:* *CRD-1σ:* 4590 to 4545 BC; (RHD): sample was strat above P-2622 and should have been younger. It is below Bldg 2 (Stage D), SP-I, RS-E (= Period I).

P-2760. Sample H76-CS20 **4530 ± 50**

Charcoal, CG90 Balk [P] (4) Lot 15. *Comments:* NaOH pretreatment, *CRD-1σ:* 3375 to 3150 BC; (RHD): sample was below P-2620, RS-Period II.

Samples from N Flat

P-2703. Sample H76-CS14 **4270 ± 60**

Charcoal, CF37-38, below Burned Bldg [4]. *Comments:* *CRD-1σ:* 3030 to 2875 BC; (RHD): below P-2701, cf P-2617.

P-2701. Sample H76-CS13 **3860 ± 60**

Charcoal, CF47, gray ash layer below W compound. *Comments:* *CRD-1σ:* 2420 to 2290 BC; (RHD): walls assoc with early Burned Bldg, SP-IIIB, RS-Period III.

P-2617. Sample H76-CS2 4420 ± 50

Charcoal, CF37, below Burned Bldg [1]. *Comments:* NaOH pretreatment, *CRD-1σ:* 3355 to 2955 bc; (RHD): sample was below P-2701, cf P-2703 (above), RS-Period II.

P-2706. Sample H76-CS18 4240 ± 70

Charcoal, CF58 (3) [2]. *Comments:* NaOH pretreatment, *CRD-1σ:* 3000 to 2855 bc; (RHD): burned roof collapse in room attached to But-tressed Bldg, cf P-2615, -2698, -2700 (below), RS-Period II.

P-2615. Sample H76-CS53A 4350 ± 50

Charcoal, CF38 (3) [2]. *Comments:* NaOH pretreatment, *CRD-1σ:* 3165 to 2905 bc; (RHD): burned roof collapse in room attached to But-tressed Bldg, cf P-2698, -2700, RS-Period II.

P-2698. Sample H76-CS53 4280 ± 70

Charcoal, CF58 (3) [2]. *Comments:* NaOH pretreatment, *CRD-1σ:* 3040 to 2880 bc; (RHD): burned roof collapse in room attached to But-tressed Bldg, cf P-2615, -2700, -2706, RS-Period II.

P-2700. Sample H76-CS26 4370 ± 70

Charcoal, CF58 (3) [3]. *Comments:* NaOH pretreatment, *CRD-1σ:* 3170 to 2915 bc; (RHD): burned roof collapse in room attached to But-tressed Bldg, cf P-2615, -2698, RS-Period II.

P-2704. Sample H76-CS16 4340 ± 60

Charcoal, CF57 [16]. *Comments:* NaOH pretreatment, *CRD-1σ:* 3160 to 2900 bc; (RHD): 2nd bldg level below ash and W compound walls (P-2701); lower than P-2701, higher than P-2699, RS-Period II.

P-2699. Sample H76-CS67 4410 ± 60

Charcoal and soil, CF57 [16]. *Comments:* NaOH pretreatment, *CRD-1σ:* 3355 to 2945 bc; (RHD): burned floor of niche in SW room of sq; lower than P-2704, higher than P-2619, RS-Period II.

P-2619. Sample H76-CS69 4830 ± 60

Charcoal and soil, CF57 [16], base of Lot 3. *Comments:* NaOH pre-treatment, *CRD-1σ:* 3685 to 3525 bc; (RHD): ash in deep test trench along W balk; lower than P-2699, higher than P-2623, RS-Period I.

P-2623. Sample H76-CS15 5200 ± 70

Charcoal and soil, CF57 [16]. *Comments:* NaOH pretreatment, *CRD-1σ:* 4120 to 3875 bc; (RHD): from deepest ash level in SW corner of CF57; lower than P-2619, RS-Period I.

*Samples from S Hill***P-2715. Sample H76-CS48 4450 ± 60**

Charcoal, DG61 [15], from burned fill sealed in blocked door of re-used burned structure at E end of S Hill. *Comments:* NaOH pretreat-ment, *CRD-1σ:* 3365 to 3010 bc; (RDH): cf P-2773, RS-Period II.

P-2773. Sample H76-CS60 4500 ± 50

Charcoal and soil, DG80 [W] (2). *Comments:* NaOH pretreatment, CRD-1 σ : 3370 to 3050 BC; (MT): lapis working debris, cf P-2715, RS-Period II.

P-2766. Sample H76-CS65 4700 ± 50

Charcoal and soil, DF89 [3], top of (3) sec, open areas S of buttressed stairway bldg, above yellow phase (5-6). *Comments:* CRD-1 σ : 3650 to 3370 BC; (MT): Cu/lapis working area, RS-Period II.

P-2759. Sample H76-CS52 4790 ± 60

Charcoal and carbonized wood, DF89 [10]. *Comment:* NaOH pretreatment, CRD-1 σ : 3670 to 3500 BC.

P-2763. Sample H76-CS63 4870 ± 70

Charcoal, DF79 [1] (2) from kiln debris. *Comments:* NaOH pretreatment, CRD-1 σ : 3790 to 3635 BC; (RHD): date is Period I, but context needs clarification.

P-2765. Sample H76-CS59 5020 ± 70

Charcoal, DF88 [5] (7), narrow space between N wall of buttressed stairway bldg and storeroom DF88 [1]. *Comments:* NaOH pretreatment, CRD-1 σ : 3895 to 3765 BC; (MT): bottom of fill, below metal working area, RS-Period I.

*Samples from the Twins***P-2767. Sample H76-CS40 4410 ± 60**

Charcoal, FF94 (3). *Comments:* CRD-1 σ : 3355 to 2945 BC; (RHD): early gray pottery levels above painted pottery levels; RS-Period II.

P-2764. Sample H76-CS38 4910 ± 70

Charcoal, FF95 (13), N of burned wall. *Comments:* CRD-1 σ : 3860 to 3650 BC; (RHD): dates terminal burned structure of painted pottery period, RS-Period I.

*Israel***Haifa series**

Suspected shipwreck from underwater rescue excavation, off coast of Haifa (32° 50' N, 34° 90' E). Est age ca 1200 BC (Wachsmann & Raveh, 1981). Coll and subm 1981 by Robert Maddin, Univ Pennsylvania.

P-3099. Sample M23 2560 ± 360*

Charcoal. *Comment:* CRD-1 σ : 1120 to 375 BC.

P-3226. Sample Hahotrim-M23 2500 ± 110*

Wood or charred wood. *Comment:* CRD-1 σ : 800 to 420 BC, smaller uncertainty than that for P-3099 is due to extended counting period.

Jordan

Baq'ah Valley series

Series of Late Bronze age burial caves are assoc with settlement at Khirbet Umm ad-Dananir, Baq'ah Valley (35° 40' 20" N, 32° 40' 10" E) (McGovern, 1979; 1980; 1981a,b; 1982; McGovern, Harbottle, & Wnuk, 1982; McGovern, Piggott, & Notis, 1982). Coll and subm 1981 by P E McGovern, MASCA, Univ. Mus.

General Comment (PMcG): there are no previous ¹⁴C dates for Late Bronze age on Transjordan plateau. Cultural sequence may be staggered *vis-a-vis* W Bank and Israel. Pottery sequence, 1600 to 1100 BC.

P-3209. Sample B3.41/8 & B3.51/8 3200 ± 60

Charcoal from Cave B3, Jebel al-Qesir, Basket B3.41, Loc 8, area along back W wall of cave upper burial layer. *Comments*: NaOH pretreatment, *CRD-1σ*: 1655 to 1405 BC; (PEMcG): Late Bronze II (ca 1400 to 1200 BC).

P-3210. Sample B3.46/8 3350 ± 70

Charcoal from Cave B3, Jebel al-Qesir, Basket B3.46, Loc 8, upper burial layer along back W wall of cave, S of Crania 1 and 2. *Comments*: *CRD-1σ*: 1760 to 1590 BC; (PEMcG): same context at P-3209.

P-3216. Sample V2.54/18-1 3440 ± 60

Charcoal from Khirbet Umm ad-Dananir, Field V, upper ashy layer covering and S of Wall 20, Area 2, Basket V2.54, Loc 18. *Comments*: *CRD-1σ*: 1890 to 1685 BC; (PEMcG): fill mixed with potsherds of Late Bronze I (ca 1600 to 1400 BC) and Iron Age IIC (ca 650 to 500 BC) from strat settlement site of Late Bronze age to Byzantine and Ottoman periods.

P-3217. Sample V2.54/18-2 3770 ± 70

Charcoal from Khirbet Umm ad-Dananir, Field V, lower ashy layer covering and S of Wall 20, Area 2, Basket V2.54, Loc 18. *Comment*: *CRD-1σ*: 2335 to 2135 BC.

P-3218. Sample V2.13/6 250 ± 50

Dessicated wood from Khirbet Umm ad-Dananir, Field V, surface of Loc 6, S side of Area 2, Basket V2.13. *Comments*: *Stuiver corrected*: AD 1795 to 1540; (PEMcG): Surface 6 is ca 1m above ashy layer, Loc 18 of P-3217. Probably Ottoman (ca AD 1500 to 1900) floor, with re-use of Early Roman III (ca 4 BC to AD 73) bldg.

P-3219. Sample V2.55/19-5 3580 ± 70

Charcoal from Khirbet Umm ad-Dananir, Field V, Area 2, Loc 19, Basket V2.55, carbonized beams covering burned animal bones and pottery. *Comments*: NaOH pretreatment, *CRD-1σ*: 2120 to 1865 BC; (PEMcG): pit is just below ashy layer, Loc 18 of P-3217.

*Lebanon***Sarafand series**

Sarafand (ancient Sarepta) (33° 28' N, 35° 18' E) is adjacent to harbor of village of Sarafand, ca 12.87km S of Sidon on road to Tyre. Site represents most extensive and best strat remains of Phoenician civilization yet excavated. Coll and subm 1974 by J B Pritchard (1975), Univ Mus. For previous dates from this site, see P-1944 to -1948, -1950, and -1951 (R, 1974, v 16, p 222-223).

P-2857. Sample II-A-2, Level 4-4 **2480 ± 40**

Charcoal from Hellenistic stratum. *Comment:* NaOH pretreatment, *CRD-1σ:* 780 to 540 BC.

P-2858. Sample II-A-8, Level 7 **2930 ± 50**

Charcoal from Late Bronze age level. *Comments:* NaOH pretreatment, *CRD-1σ:* 1265 to 1045 BC.

P-2859. Sample II-A-9, Level 7 **3030 ± 250***

Charcoal from Late Bronze age level. *Comment:* *CRD-1σ:* 1655 to 1010 BC.

P-2860. Sample II-A-9, Level 8 **2950 ± 40**

Charcoal from Late Bronze age level. *Comment:* NaOH pretreatment, *CRD-1σ:* 1335 to 1095 BC.

*USSR**Turkmenian SSR*

P-3079. Sumbar Cemetery, Sample I.I 977 **4860 ± 60**

Charcoal and feces from bottom of Grave 174, depth 1.2m, catacomb tomb in Sumbar Cemetery, Kara Kala township, Kara Kala region (38° 30' N, 50° 10' E). Cemetery related to Gray Ware, pottery culture of N Iran (Late Bronze-Early Iron age) (Dolukhanov, 1979; Khlopin, 1977; Okladnikov, 1956). Coll 1976 by I N Khlopin and subm 1978 by P M Dolukhanov, Inst Archaeol, Leningrad. *Comments:* NaOH pretreatment, *CRD-1σ:* 3790 to 3555 BC; (PMD): est age: 1300 to 1000 BC.

Djebel Cave series

Djebel Cave is near town of Djebel, Krasnovodsk Oblast' (39° 40' N, 50° 10' E). Site was originally excavated in 1956 by A P Okladnikov. Cave is cut in Upper Cretaceous limestone, S extremity of Great Balkan Ridge. Coll 1976 and subm 1978 by P M Dolukhanov. For previous date from this site, see Le-1, 6030 ± 240 (R, 1965, v 7, p 226).

General Comment (PMD): strat deposits of Mesolithic-Early Neolithic age. Sequence reflects evolution of local Neolithic tradition based on food gathering; more or less contemporaneous with early agricultural civilization of Djeitoun, further E.

P-3080. Sample Djebel 1 **2170 ± 210***

Charcoal and one feces from depth 0.2 to 0.25m. *Comment:* *CRD-1σ:* 420 BC to AD 20.

P-3083. Sample Djebel 2 **1360 ± 180***

Charcoal from depth 0.3m. *Comment: CRD-1σ: AD 450 to 880.*

P-3082. Sample Djebel 3 **4520 ± 240***

Charcoal and feces from depth 0.4m. *Comment: CRD-1σ: 3650 to 2905 BC.*

P-3081. Sample Djebel 4 **6140 ± 80**

Charred twigs from depth 0.8 to 0.85m. *Comment: CRD-1σ: 5255 to 4940 BC.*

Far East

India

Dimapur, Nagaland series

Dimapur is medieval site ca 77km NW of Kohima, Nagaland (25° 54' N, 93° 45' E to 94° 0' E). Samples coll 1980 by Vikuosa Nienu, Univ California, Berkeley and subm 1982 by George Dales, Dept S and SE Asian Studies, Univ California, Berkeley.

P-3124. Sample, Layer 4 **1530 ± 180***

Charcoal from 1.2cm below surface level. *Comments: Stuiver corrected: AD 270 to 660; (VN): Medieval period.*

P-3125. Sample, Layer 5 **1300 ± 180***

Charcoal from 1.35cm below surface level. *Comments: Stuiver corrected: AD 570 to 940; (VN): Medieval period.*

Puraka, Nagaland series

Puraka is Neolithic-Iron age site located in Meluri Block, Phek dist, ca 25km from Meluri, Nagaland (25° 45' N, 94° 40' E). Coll 1980 by Vikuosa Nienu and subm 1982 by George Dales.

P-3122. Sample, Layer 2 **1390 ± 200***

Charcoal from 25cm below surface level. *Comments: Stuiver calibrated: AD 430 to 780; (VN): from post hole, Neolithic or Iron age.*

P-3123. Sample, Layer 3 **2580 ± 200***

Charcoal from 85cm below surface level. *Comments: CRD-1σ: 900 to 420 BC; (VN): Neolithic; traits of Hoabinhian culture are also present.*

Thailand

Sites of Ban Chiang, Ban Tong, Ban Phak Top, Don Klang, Ban I Loet, Ban Puan Phu, and Non Khaw Wong were excavated 1974 through 1978 by NE Thailand Archaeol Project under joint auspices of Univ Mus, Univ Pennsylvania and Thai Fine Arts Dept.

Ban Chiang series

Ban Chiang, on N Khorat Plateau, Changwat (Prov) Udon Thani (17° 24' N, 103° 15' E) was excavated by NE Thailand Archaeol Proj in 1974 and 1975 under joint direction of late Chester Gorman, Univ Mus,

and Pisit Charoenwongsa, Thai Fine Arts Dept (Gorman & Charoenwongsa, 1976; White, 1982). Comments by Joyce White, Univ Mus.

General Comment (JW): this site is important in establishing broad chronol framework for settlement of N Khorat Plateau and for socio-cultural development of lowland agrarian socs in region (pre-metal, bronze, and iron using periods). Two seasons of excavation, designated BC (1974) and BCES (1975), were conducted at non-adjacent parts of mound. Burials were numbered consecutively beginning with Burial 1 for each season. Since each square of each season was excavated as separate unit, layer nos. do not necessarily correspond. Archaeol discussions of dates in individual sample comments are based on calibrated dates.

P-2240. BC Bag 907 **3120 ± 220***

Charcoal and soil from BC Sq B5, Layer 10, depth 1.58m while exposing Burial 20. *Comments: CRD-1σ: 1675 to 1220 BC; (JW):* Burial 20 had unique assemblage of bone artifacts (White, 1982, p 24).

P-2265. BC Bag 987 **4830 ± 310***

Soil and charcoal from BC Sq B6, Layer 14, in soil matrix near, but apparently not assoc with Burial 25, depth 2.2 to 2.33m at beginning of sterile soil horizon. *Comments: CRD-1σ: 3915 to 3340 BC; (JW):* with P-2452 (below) may date to initial settlement of site.

P-2262. BC Bag 1019 **2090 ± 230***

Soil and charcoal from BC Sq C3, SW quad, surface of Layer 7, depth 1.5m, Burial 19. *Comments: CRD-1σ: 400 BC to AD 55; (JW):* assoc with red painted pottery. Date consistent with P-2241 and -2244 (*cf* below), also assoc with Late Period painted pottery.

P-2242. BC Bag 1102 **3790 ± 240***

Charcoal and soil from BC Sq C3, SE quad, Layer 8, from excavation of artificial 10cm split. *Comments: CRD-1σ: 2550 to 1950 BC; (JW):* Burial 34 and curvilinear incised infant burial jar with serpentine appliqué was found ca 20cm beneath surface of Layer 8. Samples P-2245, -2271, and -2456 (*cf* below) produced comparable dates from contexts which overlie or are closely assoc with curvilinear incised pottery.

P-2406. BC Bag 500 (?) **1720 ± 190***

Charcoal from BC Sq C4, SE quad, surface of Layer 4. *Comments: Stuiver calibrated: AD 35 to 570; (JW):* charcoal probably assoc with collapsed sherds of untyped pot. This is most recent date from site.

P-2241. BC Bag 756 **2090 ± 40**

Charcoal and soil sandwiched between stacked sherds projecting out from E baulk BC Sq C4, SE quad, Layer 7, Feature 1, depth 1.01m. *Comments: CRD-1σ: 190 to 10 BC; (JW):* sherds of painted ware; date consistent with P-2244 (*cf* below) and P-2262 (*cf* above) which are also assoc with red painted ware.

P-2243. BC Bag 1202 3020 ± 40

Charcoal and soil from BC Sq C4, SE quad, surface of Layer 14, depth 2.07 to 2.1m. *Comments: CRD-1σ: 1395 to 1230 BC; (JW):* possible hearth area with unclear relationship to burial sequence. Apparent insect and root activity and possibility of old erosion surface may account for somewhat late date relative to depth.

P-2245. BC Bag 1205 3570 ± 230*

Soil and charcoal from BC Sq C4, SW quad, surface of Layer 14, depth 1.86 to 2.08m. *Comments: CRD-1σ: 2205 to 1685 BC; (JW):* assoc with Burial 40, curvilinear incised infant jar (White, 1982, p 23). Date inconsistent with P-2242 (*cf* above), -2271, and -2456 (*cf* below) which also overlie or are closely assoc with curvilinear incised pottery.

P-2266. BC Bag 1335 4590 ± 300*

Soil and charcoal from BC Sq C4, SW quad, Layer 14, depth 1.96m. *Comments: CRD-1σ: 3680 to 2910 BC; (JW):* assoc with Burial 40 (curvilinear incised burial jar). However, since P-2245 (*cf* above), also excavated in assoc with Burial 40, is more consistent with other samples assoc with curvilinear incised pottery such as P-2271 (*cf* below), P-2266 may derive from matrix into which Burial 40 intruded.

P-2246. BC Bag 1018 3040 ± 50

Charcoal and soil from BC Sq C5, SW quad, Layer 10, depth 1.73m, possibly assoc with Burial 23. Grave goods include bronze bangles, bronze adze head, baked clay pellets, and cordmarked pot with painted and incised design (White, 1982, p 42). *Comments: CRD-1σ: 1405 to 1240 BC; (JW):* field records indicate that this sample and P-2261 (*cf* below) are assoc with Burial 23, but continued excavation in area and subsequent lab analysis revealed that Burial 23 cut into Burial 31 (P-2264, *cf* below) and possibly another burial feature from earlier cultural phase which casts doubt on exact relationship of samples and reported feature assoc. Date of P-2246 is, however, consistent with P-2272 (*cf* below) which is assoc with burial of similar orientation and ceramics to Burial 23. See P-2454 (*cf* below) which also has burial and ceramic style related to Burial 23.

P-2261. BC Bag 1083 3270 ± 230*

Charcoal and mud from BC Sq C5, S quads, Layer 11, depth 1.73 to 1.92m, possibly assoc with Burial 23. *Comments: CRD-1σ: 1865 to 1365 BC; (JW):* same doubtful sample relationship as for P-2246 (*cf* above). This date is however same as that for P-2454 (*cf* below) which is assoc with burial and ceramic style related to Burial 23.

P-2264. BC Bag 1211 3130 ± 210

Soil and charcoal from BC Sq C5, NW quad, Layer 11, depth 1.86m. *Comments: CRD-1σ: 1680 to 1225 BC; (JW):* assoc with Burial 31 which was cut by Burial 23. See comments for P-2246 and -2261.

P-2244. BC Bag 681 2110 ± 40

Charcoal from BC Sq C6, NW quad, Layer 8, depth 0.62 to 0.74m. *Comments: CRD-1σ: 195 to 20 bc; (JW):* assoc with Burial I and red painted ceramics. Date consistent with P-2241 and -2262 (*cf* above), also assoc with Late Period red ceramics.

P-2247. BC Bag 918 3610 ± 230*

Soil and charcoal from BC Sq C6, SE quad, Layer 10, depth 1.02m. *Comments: CRD-1σ: 2315 to 1710 bc; (JW):* sample found 10cm N of Burial 14 jaw which included red painted pottery, high tin wire necklaces, and opaque glass beads. Date unacceptably old in comparison with other samples assoc with comparable pottery; see P-2241, -2244, and -2262 (*cf* above). Burial was extensively disturbed by insects and roots.

P-2272. BC Bag 1167 2950 ± 210*

Charcoal and soil from BC Sq C6, SE quad, surface of Layer 15, depth 1.54m. *Comments: CRD-1σ: 1430 to 865 bc; (JW):* assoc with Burial 35; includes cordmarked and painted pottery comparable to Burial 23; see P-2246 and -2261 (above).

P-2271. BC Bag 1374 3570 ± 230*

Soil and charcoal from BC Sq C6, N quads, surface of Layer 18, depth 1.97m, 10cm from right arm of Burial 43. *Comments: CRD-1σ: 2205 to 1685 bc; (JW):* large curvilinear incised and appliqué pot found over burial. Date consistent with samples overlying, or in assoc with curvilinear incised pottery; see P-2245 (above) and -2263, -2456 (below).

P-2263. BC Bag 1377 4250 ± 290*

Soil and charcoal from BC Sq C6, N quads, Layer 19, depth 2.06m. *Comments: CRD-1σ: 3365 to 2535 bc; (JW):* charcoal concentration between Burials 43 and 45, interred one atop the other. Curvilinear incised appliqué pot found directly above Burial 43; see P-2271 (above).

P-2664. BCES Bag 1383, 1785, and 1794 2300 ± 50

Charcoal and soil from BCES Sq D4, SE quad, surface of Layer 17 to surface of Layer 19, in general assoc with Burial 19. *Comments: CRD-1σ: 420 to 380 bc; (JW):* Burial 19 overlay and had disturbed parts of Burial 24 (assoc with bronze-iron spearpoint) (White, 1982, p 80). Date appears inconsistent with P-2665 (*cf*).

P-2665. BCES Bags 1279, 1667, 1705, and 1714 2520 ± 50

Soil and charcoal from BCES Sq D4, SE quad, surface of Layer 17, Feature 3, from sherd scatter overlying Burial 19. *Comments: CRD-1σ: 795 to 585 bc; (JW):* due to greater coherence of combined sample proveniences, assoc of P-2665 with Burial 19 seems at least as acceptable as P-2669 (*cf* above). Date assoc with Middle Period scatter burial with white carinated pots and carinated pots with incised and painted shoulders (White, 1982, p 68). Date overlies Burial 24 and assoc bronze-iron spearpoint, oldest iron recovered from excavation.

P-2457. BCES Bag 2162 3240 ± 50

Charcoal and soil from BCES Sq D4, SE quad, 10cm spit into Layer 24. *Comments:* NaOH pretreatment; *CRD-1σ:* 1675 to 1430 BC; (JW): three cordmarked and appliquéd infant burial jars were found in Layer 27 of D4, SE quad, ca 20cm under Layer 24.

P-2634. BCES Bag 2110 2780 ± 50

Charcoal and soil from BCES Sq D4, NW quad, Layer 21, depth 272cm. *Comments:* NaOH pretreatment, *CRD-1σ:* 930 to 825 BC; (JW): sample coll from remnants of red-brown soil as it was removed from surface of gray soil stratum; may date beginning of red-brown soil stratum and possibly initiation of ritual involving shattering of white carinated pots over body (White, 1982, p 25).

P-2455. BCES Bag 2248 2830 ± 50

Charcoal from BCES Sq D4, SE quad, Layer 26. *Comments:* NaOH pretreatment, *CRD-1σ:* 1115 to 875 BC; (JW): sample is from charcoal feature in SE quad, possibly hearth, but date is somewhat recent for depth (see P-2457, above). It is possible that sample derived from base of post hole cut down from surface of gray stratum (Levels 21 and 22) directly over and to same depth (299cm) as so-called hearth. If this is so, P-2455 is consistent with P-2634 (*cf* below) from interface of red/gray strata.

P-2454. BCES Bag 2306 3270 ± 180*

Soil and charcoal from BCES Sq D4, SW quad, surface of Layer 27, Feature 12, grave cut of Burial 59. *Comments:* NaOH pretreatment, *CRD-1σ:* 1865 to 1365 BC; (JW): Burial 59 includes globular cordmarked pot, style of which is related to that of BC Burial 23 (P-2246 and -2261, above); and is stratified over Burials 69 (P-2405, below) and 65 (P-2404, below).

P-2405. BCES Bag 2656 3240 ± 210*

Soil and charcoal from BCES Sq D4, SW quad, surface of Layer 29, Feature 23, excavated during removal of skeleton from Burial 69. *Comments:* *CRD-1σ:* 1765 to 1340 BC; (JW): Burial 69 cuts flexed Burial 65 (P-2404, below) and is under Burial 59 (P-2454, above).

P-2404. BCES Bag 2678 3000 ± 200*

Soil and charcoal from BCES Sq D4, S quads, surface of Layer 29, within grave cut of Burial 65. *Comments:* *CRD-1σ:* 1545 to 1015 BC; (JW): grave is flexed burial cut into yellow sterile soil matrix, and is cut by Burial 69 (see P-2405, above) and overlain by Burial 59 (P-2454, above). Date appears somewhat recent for strat position.

P-2452. BCES Bag 2111 4750 ± 240*

Charcoal and soil from BCES Sq D5, NW quad, Layer 27, removal of 10 to 20cm spit. *Comments:* NaOH pretreatment: *CRD-1σ:* 3785 to 3355 BC; (JW): sample from top of yellow sterile soil horizon, may date early settlement of site (see P-2265, above).

P-2456. BCES Bag 2030 3650 ± 220*

Soil and charcoal from BCES Sq D5, W quads, surface of Layer 27, Feature 37, grave cut of Burial 45. *Comments: CRD-1σ: 2340 to 1755 BC; (JW):* Burial 45 contained straight-sided, flat-bottomed, footless cord-marked pots with everted rim, probably contemporary with Beaker-style pot found in Burial 76 (P-2398, below). Burial 45 lies directly over Burial 57 which contains curvilinear incised pot and is disturbed.

P-2453. BCES 2285 7180 ± 70

Charcoal and soil from BCES Sq D5, NW quad, surface of Layer 30, Feature 3. *Comments: NaOH pretreatment; CRD-1σ: 6290 to 5705 BC; (JW):* possible hearth; surrounding area is basically sterile soil matrix with no assoc sherds. Hearth is sealed by Burial 57 which contained curvilinear incised pot. This is oldest date and may derive from brief use of this site possibly by mobile group of people prior to settlement in 4th millennium BC by more sedentary population; see P-2265 and -2452 (above).

P-2451. BCES Bag 2322 3580 ± 240*

Soil and charcoal from BCES Sq D6, NE quad, surface of Layer 31, grave cut of Burial 60. *Comments: CRD-1σ: 2215 to 1690 BC; (JW):* Burial 60, cut into sterile soil, appears badly disturbed, as only skull and small incised pot were present.

P-2450. BCES Bag 2651 2410 ± 210*

Charcoal and soil from BCES Baulk D6/D7, surface of Layer 16, Feature 1 cut from surface of Layer 14. *Comments: NaOH pretreatment, CRD-1σ: 800 to 375 BC; (JW):* date supports likelihood that sample derived from red layer (over gray layer). P-2634 and probably P-2455 (above) are dates from red/gray interface.

P-2668. BCES Bag 2770 2800 ± 50

Soil and charcoal found while exposing Burial 31, from BCES Baulk D6/D7, Layer 20. *Comments: CRD-1σ: 1100 to 840 BC; (JW):* sample, along with P-2633 (below), appears unacceptably young for strat context well within gray stratum, its Early Period grave style and ceramics which, based on overall chronol picture, should antedate ca 1500 BC. Burial 31 overlies Burial 76 (P-2398, below).

P-2633. BCES Bag 2773 2600 ± 60

Soil and carbon from BCES Baulk D6/D7, surface of Layer 21, Burial 31. *Comments: CRD-1σ: 820 to 765 BC; (JW):* see comment for P-2668 (above).

P-2398. BCES Bag 2834 2480 ± 240*

Charcoal and soil from BCES Baulk D6/D7, surface of Layer 27, Feature 5 from under pelvic area of Burial 76, flexed burial cut into sterile soil and assoc with bronze spearpoint and Beaker-type jar (White, 1982, p 35). *Comments: CRD-1σ: 820 to 395 BC; (JW):* date seems unaccount-

ably young for context and grave style; see P-2633 and -2668 (above). Based on overall chronol sequence, grave should antedate ca 1500 BC, and possibly 2000 BC; see P-2456 (above).

Petchabun Piedmont Survey

Archaeol survey and three test excavations (Ban Puan Phu, Non Khaw Wong, and Ban I Loet) were conducted 1978 in area along piedmont of Petchabun Mts which form W border of Khorat Plateau, NE Thailand (Penny, ms), revealing relatively shallow and homogeneous archaeol deposits (excluding some apparently intrusive hist artifacts in Ban Puan Phu excavation). Most ceramics from excavations were similar to each other, to prehist surface collns from this survey, and to three surface collns from contiguous area of Pa Mong Survey (Bayard, 1980), but not similar to ceramics from other available sites on Khorat Plateau. Above three sites also had similar array of other artifacts including iron and iron slag.

Ban Puan Phu series

Ban Puan Phu site is in NE Thailand (17° 5' N, 101° 48' E). Coll 1978 by J S Penny, Center Archaeol Investigations, Southern Illinois Univ at Carbondale and subm 1978 by late C F Gorman.

General Comment (JSP): site is apparently late "metal age" and hist.

P-2938. BPP Bag 446 **2440 ± 50**

Single large piece of charcoal from fired clay feature of unknown function from NEQ, Level 6, Feature 3. *Comment*: NaOH pretreatment, *CRD-1σ*: 630 to 415 BC.

P-2939. BPP Bag 427 **2680 ± 210***

Charcoal from SEQ, Level 7, Burial 1. *Comments*: NaOH pretreatment, *CRD-1σ*: 1105 to 745 BC; (JSP): strat relation of date to deposit is not precisely known, but there does not appear to be any possibility that date relates to earlier (pre-iron) level, since none apparently exists at site.

Non Khaw Wong series

Non Khaw Wong site is in NE Thailand (16° 39' N, 101° 47' E). Coll 1978 by J S Penny and subm 1978 by late C F Gorman.

General Comment (JSP): pre- or proto-hist "metal age" with possibility of pre-iron basal level.

P-2943. NKW Bag 258 **1980 ± 180***

Charcoal and soil from Feature 3, NE half, Level 14. *Comments*: *CRD-1σ*: 195 BC to AD 230; (JSP): this feature contained probable lid which is strikingly similar to painted lids from Don Klang (below) (Schauffler, 1976, Figs 3 and 4).

P-2944. NKW Bag 195 **2210 ± 190***

Charcoal and soil coll from Level 7, arbitrary level near bottom of cultural deposit. *Comment*: *CRD-1σ*: 435 to 5 BC.

P-2945. NKW Bag 202 **2070 ± 170***

Charcoal and soil from Level 7, arbitrary level near bottom of cultural deposit. *Comments: CRD-1σ: 275 BC to AD 45; (JSP): this date and P-2944 overlap quite well at 1σ.*

Ban I Loet series

Ban I Loet site is in NE Thailand (16° 57' N, 101° 50' E). Coll 1978 by J S Penny and subm by late C F Gorman.

General Comment (JSP): pre- or proto-hist "metal age."

P-2940. BIL Bag 311 **2340 ± 230***

Charcoal from Level 8, arbitrary level near base of excavation. *Comment: CRD-1σ: 650 to 175 BC.*

P-2941. BIL Bags 332 and 337 **2460 ± 210***

Charcoal from Feature 2, Levels 10 and 11 at base of excavation. *Comments: CRD-1σ: 815 to 390 BC; (JSP): this feature apparently separated from higher deposits by erosion surface.*

Ban Phak Top series

Ban Phak Top is ca 30km W of Ban Chiang, Changwat (Prov) Udon Thani (17° 19' N, 103° 2' E). Coll and subm 1975 by W M Schauffler (1976), Univ Mus.

P-2407. Bag S188 (C14-26) **3900 ± 70**

Charcoal (from burned log or piece of wood) and soil from Layer 13. *Comment: CRD-1σ: 2435 to 2310 BC.*

P-2445. Bag S127 (C14-16) **2760 ± 170***

Charcoal and soil from NEQ and SEQ, Layer 8a. *Comment: CRD-1σ: 1120 to 790 BC.*

P-2446. Bag S134 (C14-17) **3050 ± 60**

Charcoal and soil from NWQ and SWQ, Layer 8a. *Comment: NaOH pretreatment, CRD-1σ: 1410 to 1245 BC.*

P-2686. Bags S120 (C14-12), S121 (C14-13), S122 (C14-14), and S124 (C14-15) **3090 ± 50**

Charcoal and soil from Layer 8 NEQ, SEQ, NWQ, and SWQ. *Comment: NaOH pretreatment, CRD-1σ: 1440 to 1275 BC.*

P-2726. Bag S178 (C14-24) **3510 ± 210***

Charcoal and soil from Layer 12, SWQ soil matrix. *Comment: CRD-1σ: 2165 to 1660 BC.*

P-2731. Bag S66 (C14-5) **3170 ± 300***

Charcoal from surface of Layer 5, Feature 2. *Comment: CRD-1σ: 1865 to 1090 BC.*

P-2732. Bag 106 (C14-9) 3240 ± 50

Charcoal and soil from Layer 7, SWQ. *Comments:* NaOH pretreatment, *CRD-1σ:* 1675 to 1430 BC.

Don Klang series

Don Klang site is SW of Ban Chiang, Changwat (Prov) Udon Thani (16° 58' N, 102° 32' E). Coll and subm 1975 by W M Schauffler (1976).

General Comment (WMS): first material from site to be reported.

P-2416. Bag S427 (C14-54) 2140 ± 60

Charcoal and soil underlying Burial 8. *Comment:* *CRD-1σ:* 255 to 145 BC.

P-2417. Bag S337 (C14-44) 1870 ± 190*

Charcoal and soil from EQ, Layer 5. *Comments:* *CRD-1σ:* 155 BC to AD 380; (WMS): assoc with pot near E corner.

P-2448. Sample 38 1900 ± 200*

Soil and charcoal from NQ, Layer 5. *Comments:* *CRD-1σ:* 165 BC to AD 260; (WMS): sample recovered during removal of half of Burial 2.

P-2674. Bag S500 (C14-60) 2440 ± 50

Soil and charcoal from WQ, Layer 8, and surface of Layer 9, Feature 3. *Comment:* *CRD-1σ:* 630 to 415 BC.

P-2675. Bag S308 (C14-33) 1920 ± 50

Soil and charcoal from Layer 4, NQ. *Comment:* *CRD-1σ:* 5 BC to AD 75.

P-2694. Bag S380 (C14-46, -47, -48, -49) 2040 ± 50

Charcoal and soil from NQ, Layer 6. *Comment:* *CRD-1σ:* 170 BC to AD 20.

Ban Tong series

Ban Tong is in Changwat (Prov) Udon Thai (17° 22' N, 103° 16' E). Coll and subm 1975 by W M Schauffler (1976).

P-2418. Bag S1613 (C14-135) 2860 ± 250*

Charcoal from Layer 18, NEQ and SEQ, Burial 2. *Comment:* *CRD-1σ:* 1400 to 795 BC.

P-2419. Bag S1640 (C14-142) 4360 ± 240*

Charcoal from Layer 20, SEQ. *Comment:* *CRD-1σ:* 3365 to 2800 BC.

P-2447. Bag S1614 (C14-138) 2460 ± 170*

Charcoal and soil from Layer 18, NEQ, and SEQ, Burial 2. *Comment:* *CRD-1σ:* 800 to 400 BC.

- P-2691. Bags S1571 (C14-121), S1578 (C14-123), S1580 (C14-120, -122), S1584 (C14-124), S1588 (C14-125), and S1589 (C14-126, -127)** **3130 ± 50**
Soil and charcoal from Layer 16. *Comment: CRD-1σ: 1550 to 1360 BC.*
- P-2723. Bags S1026 (C14-78) and S1060 (C14-81, -82)** **2670 ± 170***
Charcoal and soil from NEQ 6 assoc with B1 and Feature 2. *Comment: CRD-1σ: 915 to 765 BC.*
- P-2724. Bag S1362 (C14-105)** **3220 ± 200***
Charcoal and soil from Layer II, SEQ. *Comment: CRD-1σ: 1750 to 1270 BC.*
- P-2725. Bag S1472 (C14-113)** **3080 ± 180***
Charcoal and soil from Layer 14, NWQ. *Comment: CRD-1σ: 1655 to 1095 BC.*
- P-2727. Bags S1322 (C14-99) and S1323 (C14-100)** **3360 ± 200***
Charcoal and soil from SWQ, coll from entire sq (not localized area). *Comment: CRD-1σ: 1945 to 1420 BC.*
- P-2730. Bags S1161 (C14-85), S1163 (C14-86), and S1167 (C14-87)** **3040 ± 190***
Charcoal and soil from Layer 8, NEQ. *Comment: CRD-1σ: 1575 to 1035 BC.*

*Central America**Belize***Santa Rita Corozal series**

Santa Rita Corozal site, 1.6km from Chetumal Bay, outside modern Corozal (18° 23' N, 88° 23' E), is possible regional capital in N Maya Lowlands (Chase, 1982a). Coll and subm by D Z Chase, Dept Anthropol, Univ Pennsylvania.

General Comment: wood id by Jodrell Lab, Royal Botanic Gardens, Surrey, England.

- P-3076. Sample P6F/9-1** **880 ± 190***
Charcoal (family *Leguminosae*), Excavation P6F, 46cm below surface, Structure 77, from later context in same trench as P-3074. Late phase of Late Postclassic (AD 1425 to 1550) (Sidrys, 1976). *Comment: Stuiver corrected: AD 980 to 1290.*
- P-3074. Sample P6F/33-2** **650 ± 40**
Charcoal (family *Burseraceae*) from Excavation P6F, at least 1.2m below surface, Structure 77. Early phase of Late Postclassic (AD 1325 to

1425) sealed by several floor levels and covering contemporaneous midden deposit containing bone and pottery. *Comments:* NaOH pretreatment. *Stuiver corrected:* AD 1290 to 1390.

P-3073. Sample P8C/9-1 **740 ± 50**

Charcoal from Excavation P8C, ca 40cm below surface, Structure 81. Sample may represent construction beam, Late Postclassic (AD 1425 to 1550). *Comments:* NaOH pretreatment. *Stuiver corrected:* AD 1260 to 1290.

P-3075. Sample P8C/9-1 **700 ± 50**

Charcoal (family *Meliceae*) from Excavation P8C, within altar area, ca 90cm below surface, Structure 81. Sample assoc with individual burial from early phase of Late Postclassic (AD 1400) and may represent construction beam. *Comment:* *Stuiver corrected:* AD 1265 to 1375.

P-3077. Nohmul, Sample P1E/20-3 **1300 ± 40**

Nohmul, N Maya-Lowlands (18° 14' N, 80° 35' E), is island site with relatively long hist of occupation (Chase, 1982a; 1982b; Chase & Chase, 1982). Charcoal from Excavation P1E, in Terminal Classic/Early Postclassic (AD 900 to 1200) structures ca 3.2m below surface. *Comments:* *CRD-1σ:* AD 615 to 785. Early Postclassic (AD 900 to 1200).

Guatemala

Quirigua series

Quirigua, Dept Isabel (15° 16' N, 89° 03' W) is Classic Maya site (Ashmore & Sharer, 1978; Sharer, 1978; Sharer & Ashmore, 1979). Subm 1979 by R J Sharer, Univ Mus. Previous dates for samples from this site are reported in R, 1978, v 20, p 210-233.

General Comment (RJS): samples relate to Maya calendric dates and should add to calendric correlation as well as expand known sequence of construction and occupation at Quirigua.

P-3084. Sample 16A/16 **1310 ± 40**

Carbon sealed in construction 4.6 to 4.8m below summit of Structure 1A-11 (N side of Ballcourt Plaza in site core). *Comments:* NaOH pretreatment, *Stuiver corrected:* AD 660 to 765; (RJS): est date, 7th to 9th century AD.

P-3085. Sample 19R/2-1 and 2 **1830 ± 170***

Carbon from hole dug by vandals under disturbed "altar", assoc with platform of Structure 3C-14. *Comments:* *Stuiver corrected:* AD 15 to 405; (RJS): est date, ca AD 500.

P-3086. Sample 6F/45 **1450 ± 50**

Charcoal from Acropolis, Tr 1, construction Stage 2. *Comments:* NaOH pretreatment, *Stuiver corrected:* AD 545 to 640; (RJS): *Kinich-Ahau*-wall platform construction or destruction of earlier wall, est date,

ca AD 737 to 810. Should be intermediate in date between: P-2536 (AD 590 \pm 50), P-2533 (AD 830-850 \pm 50), P-2535 (AD 860-880 \pm 180), P-2538 (AD 890 \pm 170), (R, 1978, v 20, p 230-232).

P-3087. Sample 6J/26 **1440 \pm 40**

Carbon abuts Structure 1B-6-2nd (E side of Acropolis) which underlies PRANCE feature, construction Stage 3. *Comments: Stuiver corrected: AD 570 to 640; (RJS): est date, ca AD 724 to 737.*

P-3088. Sample 6L/33-1 **1290 \pm 40**

Charcoal from Acropolis, redeposited midden on floor of Structure 1B-Sub 3, construction Stage 2. *Comments: Stuiver corrected: AD 1330 to 1250; (RJS): est date, ca AD 737 to 810.*

P-3089. Sample 19R/65-1 and 2 **1970 \pm 50**

Carbon directly underlying clay floor of cache (SD 21) and sealed within Structure 3C-14. *Comments: CRD-1 σ : 35 BC to AD 55; (RJS): est date, ca AD 500.*

P-3095. Sample 9B/22-1 and 2 **1800 \pm 50**

Charcoal from underlying Structure 1A-10 (E flank of Great Plaza). *Comments: Stuiver corrected: AD 130 to 320; (RJS): probably contemporary with or earlier than cache (SD 11); antedates construction of Structure 1A-10. Est date, ca AD 737 to 775.*

P-3096. Sample 6J/50-1 **1730 \pm 50**

Carbon from charcoal and sherd layer underlying Structure 1B-6-2nd (E side of Acropolis) and overlaying chamber burial (SD 14), construction Stage 4. *Comments: Stuiver corrected: AD 235 to 395; (RJS): est date, earlier than AD 724.*

P-3097. Sample 10K/23 **420 \pm 40**

Charcoal from within collapse debris of Structure 2, Group A. *Comments: NaOH pretreatment. Stuiver corrected: AD 1435 to 1485; (RJS): postdates abandonment (although carbon may have been in structure during use). Est date, 9th century AD.*

P-3098. Sample 18L/6-1 and 2 **1830 \pm 50**

Charcoal from ca 200m N of site-core (ditch Jn). *Comments: Stuiver corrected: AD 75 to 235; (RJS): probably bldg material or furnishing for stone construction feature. Est date, 5th to 6th century AD.*

P-3100. Sample 19R/12-1 **1970 \pm 50**

Carbon from disturbed summit of Structure 3C-14. Disturbance is ancient; deposit was sealed under more than 1m flood silts and later cultural materials. *Comments: CRD-1 σ : 35 BC to AD 55; (RJS): est date, 6th century AD.*

P-3101. Sample 19R/36-1 1970 ± 170*

Carbon from Structure 3C-14, outwash of use or abandonment debris/collapse, sealed by flood silts and later cultural deposits. *Comments: CRD-1σ: AD 175 to 220; (RJS): est date, 6th century AD.*

P-3102. Sample 19R/47 1910 ± 60

Carbon on earlier floor assoc with Structure 3C-14, sealed by later floor and postabandonment deposits. *Comments: Stuiver corrected: AD 5 to 205; (RJS): est date, ca AD 500, probably equivalent to P-3105 (below).*

P-3105. Sample 19R/48 2660 ± 190*

Carbon on earlier floor assoc with Structure 3C-14, sealed by later floor and postabandonment deposits. *Comments: CRD-1σ: 1095 to 590 BC; (RJS): est date, ca AD 500.*

P-3106. Sample 18F/1 1540 ± 210*

Charred wood from NNE of site-core (ditch En), from presumed occupation layer assoc with Structure 2 of Loc 141. *Comments: Stuiver corrected: AD 255 to 660; (RJS): est date, 8th century AD.*

P-3108. Las Quebradas, Sample 24C/14-1 1640 ± 50

Charcoal from Las Quebradas, Dept Izabal (15° 24' N, 88° 46' W). Sample sealed by construction of W side of Structure 1. Subm by Robert J Sharer, Univ Mus. *Comments: Stuiver corrected: AD 340 to 530; (RJS): Classic Maya site. Est date, ca 7th to 9th century AD.*

P-3062. Cenote, Peten, Sample T2A/6 1920 ± 40

Carbonized wood fragments from Cenote, Dept Peten (16° 80' N, 89° 57' E). Sample sealed by floor of Strata T4-2nd, 1.9 to 1.95m below ground surface (Chase, 1979; 1983). Coll 1971 by Miguel Orrego and subm 1980 by A F Chase, Univ Mus. Sample id as *Pinus* sp, white pine group, by R B Miller, Forest Prod Lab, US Dept Agric, Madison, Wisconsin. *Comments: NaOH pretreatment, CRD-1σ: 5 BC to AD 75; (AFC): Lowland Maya early Late Classic, ca 500 to 700 AD.*

P-3208. Sakajut, Alta Verapaz 2830 ± 190*

Carbon from Sakajut, Alta Verapaz (15° 25' N, 90° 20' E), small earthen mound of Preclassic date (Sedat & Sharer, 1972). Sample from interface of Feature 3 (occupation layer) and construction fill (Strata 3). Coll 1971 by D W Sedat and subm 1980 by R J Sharer. *Comments: CRD-1σ: 1385 to 815 BC; (RJS): few Preclassic sites are known from region and claims are often made of little or no occupation in region during this period. Sample should date to earliest occupation/construction of site, Early-Middle Preclassic, 900 to 400 BC.*

*South America**Chile***P-2702. Quebrada da Los Conchas, Sample 4 9400 ± 160**

Quebrada da Los Conchas is shell heap 9km to N of Antofagasta, 2^a

Region (23° 30' 3" S, 70° 31' 7" W). Coll and subm by Augustin Llagostera-Martinez, Mus Regional, Univ Norte, Sede Antofagasta. Charcoal from Layer 1, depth 40cm (Wassén & Bondeson, 1979/80; Llagostera-Martinez, 1979). *Comments*: NaOH pretreatment; (ALM): hearth at base of human occupation layer.

P-2588. Abtao-5, Sample 1 **2300 ± 50**

Abtao-5 is shell heap 18km from Quebrada da Los Conchas, on S side of Mejillones Peninsula, Prov Antofagasta, 2ª Region (23° 30' 3" S, 70° 31' 7" W). Coll and subm 1977 by Augustin Llagostera-Martinez (1979). Charcoal and soil from Layer 10C, depth, 205cm. *Comments*: CRD-1σ: 420 to 380 BC; (ALM): debris from hearth.

P-2587. Punta Blanco, Sample 2 **1720 ± 50**

Punta Blanco, area of shell heaps assoc with cemeteries, is 10km S of Tocopilla, Prov Antofagasta, 2ª Region (22° 10' S, 70° 15' N). Coll and subm 1977 by Augustin Llagostera-Martinez (1979). Charcoal from Layer 15, depth, 65cm. *Comment*: CRD-1σ: AD 220 to 405.

GEOLOGIC SAMPLES

Greece

Santorini Island series

Charred wood from Santorini I. from two loci, Millo region of Therasia (36° 26' N, 24° 21' E) and Akrotiri, Thera, near caldera rim (36° 21' N, 24° 26' E). Coll 1978 by W L Friedrich, Aarhus Univ, Aarhus, Denmark, and H Pichler, and subm 1979 by P P Betancourt, Univ Pennsylvania.

General Comment: represents so-called Akrotiri/Millo palaeosol at base of characteristic ignimbrite layer (Friedrich, Pichler, & Kussmaul, 1977).

P-3128. Sample IV, V, VIII **16,090 ± 920***

Charred wood from Milo region, Therasia, Akrotiri/Millo palaeosol, ca 20cm below ignimbrite.

P-3131. Sample XI **>39,100**

Charred wood with ignimbrite from Akrotiri region, Millo palaeosol.

P-3129. Samples VII, IXa, IXb **>38,900**

Charred wood from Akrotiri region, Millo palaeosol, 5m below Upper Pumice series (Bo).

United States

P-2970. Dutchess Quarry Cave #8, Samples 6 and 7 **7270 ± 410***

$\delta^{13}C = -24.5 \pm 0.1\%$

Dutchess Quarry Cave #8, Florida, Orange Co, New York (358° 41' N, 36° 74' W) is from Paleo-Indian period (Guilday, 1969; Funk *et al*, 1969). Charcoal mixed with calcite from bottom of Breccia 1, Unit B, depth, 2.3 to 2.4m. Coll and subm by J S Kopper, Dept Social & Anthro-

pol, Long Island Univ, Greenvale, New York. *Comment* (JSK): directly assoc with two "Clovis" type fluted points and caribou bone (*Rangifer* sp). Artifacts, food debris, and utilized cobbles indicate area was not living floor but occasional occupation site. Breccia probably deposited during warm, wet period—Two Creeks interstadial, ca 12,500 BP, or between Chocrane and Valdars readvances, ca 10,000 BP.

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