

**SYDNEY UNIVERSITY NATURAL  
RADIOCARBON MEASUREMENTS II**

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This list describes samples dated in this laboratory from January to November, 1972. Operating principles are as previously reported (Gillespie *et al.* 1972) using synthesized benzene for liquid scintillation counting. Ages are calculated using 0.95 NBS oxalic acid standard with reference to A.D. 1950 using Libby 5570 year half-life.

Since we were not able to measure  $C^{12}/C^{13}$  ratios, estimates based on group mean values as reported by Polach (1969) were: organic carbon  $-24 \pm 2\%$ , marine shells  $-2 \pm 2\%$ , freshwater shells and carbonate concretions  $-5 \pm 2\%$ . The estimated  $\delta C^{13}$  values were used to correct the measured  $\delta C^{14}$ .

Organic carbon samples are boiled for 10 min in 1M HCl, washed dist.  $H_2O$ , extracted with cold 0.1M NaOH/ $Na_4P_2O_7$  or hot 2% NaOH solution, washed with 1M HCl then with dist.  $H_2O$  to neutral. For carbonates, ca. 10% is removed with dilute HCl before processing. Where insufficient  $CO_2$  is produced, the sample is diluted with cylinder  $CO_2$  of known activity, reported with the counting time.

A further series of cross-check samples were made; results are shown in Table 1. Comments were supplied by submitters.

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TABLE 1  
Interlaboratory cross checks and duplicates

| Lab. no. | SUA date         | Other no. | Other date       | Ref.                           |
|----------|------------------|-----------|------------------|--------------------------------|
| SUA-4/1  | 710 $\pm$ 70     | R2553/2   | 675 $\pm$ 40     | Rafter, pers. commun.          |
| SUA-4/2  | 760 $\pm$ 65     |           |                  |                                |
| SUA-5/1  | 1100 $\pm$ 70    | R2671/1   | 1045 $\pm$ 40    | Rafter, pers. commun.          |
| SUA-5/2  | 1070 $\pm$ 70    |           |                  |                                |
| SUA-13/2 | 760 $\pm$ 80     | SUA-13    | 1150 $\pm$ 80    | Gillespie <i>et al.</i> , 1972 |
| SUA-14/2 | 24,540 $\pm$ 500 | SUA-14    | 24,290 $\pm$ 400 | Gillespie <i>et al.</i> , 1972 |
| SUA-14/3 | 25,180 $\pm$ 500 |           |                  |                                |
| SUA-14/5 | 22,900 $\pm$ 900 |           |                  |                                |

## SAMPLE DESCRIPTIONS

## I. ARCHAEOLOGIC SAMPLES

*A. Australia***Ord Valley series**

Samples coll. May and Oct. 1971 by C. E. Dortch, Western Australian Mus., from rock shelters with evidence of occupation.

**SUA-54. Kununurra 1** **1030 ± 80**  
**A.D. 920**

Charcoal from 28cm below surface of rock shelter 11km N of Kununurra, W. A. (15° 41' S Lat, 128° 45' E Long) assoc. with aboriginal stone industrial sequence with biface and uniface points, backed points, leilira blades, adze-flakes, burins, flaked and ground axes and grindstones. (1000 min count.)

**SUA-55. Kununurra 2** **1940 ± 80**  
**A.D. 10**

Charcoal from same site as SUA-54, 57cm below surface, 10cm above a flaked and ground axe. (1000 min count.)

**SUA-56. Kununurra 3** **3110 ± 85**  
**1160 B.C.**

Charcoal from same site as SUA-54, 100 to 120cm below surface, assoc. with a bifacially flaked point. (1000 min count.)

**SUA-57. Monsmont** **1730 ± 80**  
**A.D. 220**

Charcoal from 65 to 75cm below surface of rock shelter (16° 17' S Lat, 128° 43' E Long) now submerged by Ord Reservoir. Assoc. with aboriginal stone industry, and, as yet, unanalyzed fauna. Dilution, 1000 min count.

**SUA-58. Canyon** **680 ± 75**  
**A.D. 1270**

Charcoal from 60cm below surface of rock shelter (16° 07' S Lat, 128° 45' E Long now submerged by Ord Reservoir. Assoc. with stone industrial assemblage containing thick chunky scrapers, notched flakes, a few atypical points and blades, and many flakes. (1000 min count.)

**Devils Lair series**

Samples coll. by C. E. Dortch, D. Merrilees *et al.* as part of study of aboriginal occupation in a small cave in SW Western Australia (34° 09' S Lat, 115° 04' E Long). Depths are all below same surface datum.

**SUA-103. Devils Lair N** **12,050 ± 140**  
**10,100 B.C.**

Charcoal from Trench 5, ca. 80cm from pocket of "cave earth" in flowstone complex. (1100 min count.)

- 11,960 ± 140**  
**10,010 B.C.**
- SUA-102. Devils Lair M**  
Charcoal from Trench 5, 78 to 95cm, in “first orange brown earthy layer”, believed stratigraphically below SUA-103. (1100 min count.)
- 19,000 ± 250**  
**17,050 B.C.**
- SUA-101. Devils Lair L**  
Charcoal from Trench 5, 201 to 212cm below a thin flowstone in “light earthy layer” and assoc. with a bone point. Dilution, 1140 min count.
- 20,400 ± 1000**  
**18,450 B.C.**
- SUA-32. Devils Lair B**  
Charcoal from trench (adjoining Trench 5), 249 to 267cm, in “second orange-brown earthy layer.” Dilution, 1040 min count.
- 24,600 ± 800**  
**22,650 B.C.**
- SUA-31. Devils Lair A**  
Charcoal from Trench 2, ca. 340cm, in “fourth orange-brown earthy layer” the deepest level reached in 1972 excavation, still with artifacts. Dilution, 1040 min count.
- 17,400 ± 350**  
**15,450 B.C.**
- SUA-34. Devils Lair D**  
Charcoal from Trench 6 (3m downslope from Trenches 2 and 5), 245 to 259cm, in “brownish earthy layer” believed stratigraphically between SUA-101 and -102 as date confirms. Dilution, 1140 min count. *General Comment* (D.M.): dates reveal considerably old human occupation of SW corner of Australia, and are assoc. with abundant faunal remains not yet analyzed. The deposit appears older than previously thought, but full depth and greatest age are not yet known (Dortch and Merrilees, 1972; 1973).
- Padstow series**  
Samples coll. and subm. Aug. 1971, by J. P. White, Dept. Anthropol., Univ. Sydney, from a rock shelter on Henry Lawson Drive, Padstow, N.S.W. (33° 55' S Lat, 151° 20' E Long). Excavation report on file with Dept. Nat. Parks and Wildlife.
- 870 ± 95**  
**A.D. 1080**
- SUA-59. HLD K5/10**  
Charcoal from base of shell midden, assoc. with backed artifacts, scaler cores, and use-polished flakes. Date is compatible with other Bondaian material from this region. (1000 min count.)
- 5240 ± 100**  
**3290 B.C.**
- SUA-60. HLD BS/7**  
Charcoal from 35cm below surface of talus in front of shelter, below large roof collapse, assoc. with backed blade from same material as those inside shelter and other artifacts different in material and type.

Date documents pre-existing shelter, blade may therefore be intrusive or early Bondaian type. (1000 min count.)

*B. Sudan*

**Sudan series**

Samples coll. and subm. by M. A. J. Williams and D. A. Adamson, Macquarie Univ., N.S.W., as part of preliminary survey of pre-Islamic occupation sites in Central Sudan.

**SUA-67. Sudan 4**

**4500 ± 130  
2550 B.C.**

Freshwater shells from base of midden at Jebel et Tomat (13° 34' N Lat, 32° 44' E Long) 40 to 80cm below surface, assoc. with proto-historic pottery and stone artifacts not yet analyzed. Dilution, 1000 min count.

**SUA-70. Sudan 7**

**3030 ± 80  
1080 B.C.**

Freshwater shells from 50 to 65cm below surface of sandy alluvial island in White Nile near Tagra (13° 56' N Lat, 32° 21' E Long) assoc. with proto-historic artifacts and skeletons. (1180 min count.)

*C. New Zealand*

**Moa hunter series**

Samples coll. and subm. by D. W. Orchiston, Dept. Anthropol., Univ. Sydney as part of survey of occupation sites and test of relative reliability of datable materials.

**SUA-61. Waitaki 1**

**600 ± 80  
A.D. 1350**

*Euryapteryx* sp. moa bone from sub-surface oven near mouth of Waitaki R. (44° 58' S Lat, 171° 08' E Long). Date within expected range for occupation of region. Dilution, 1060 min count.

**SUA-62. Waihao 1**

**ca. 133% modern**

*Dinornis Robustus* moa bone from sub surface oven near mouth of Waihao R. (44° 46' S Lat, 171° 10' E Long). Dilution, 1060 min count.

**SUA-63. Waihao 2**

**730 ± 75  
A.D. 1220**

Charcoal from same site as SUA-62. (1000 min count.)

**SUA-64. Waihao 3**

**4100 ± 85  
2150 B.C.**

*Chione Stutchburyi* shells from same site as SUA-62 and -63. Bone and shell dates diverge markedly from charcoal date, which is within expected occupation range for region.

## II. GEOLOGIC SAMPLES

## A. Australia

**Euramoo series**

Samples coll. and subm. May, 1968 by A. P. Kershaw, Dept. Biogeog., A.N.U. Piston core taken from swamp edge, beneath floating root mat, at Lake Euramoo, NE Queensland (17° 09' S Lat, 145° 38' E Long).

**SUA-52.** **920 ± 75**  
**A.D. 1080**

Top 20cm of core 450cm long; pollen analysis indicates rain forest similar to that of present day. (1380 min count.)

**SUA-53.** **3640 ± 85**  
**1690 B.C.**

Bottom 20cm of same core as SUA-52. Pollen analysis indicates more complex rain forest than present, possibly with increased temperature and precipitation. (1400 min count.)

**Maroochydore series**

Wood from tree stump *in situ* exposed during excavation in Kuran St. Maroochydore, Queensland. Species similar to present day *Eucalyptus resinifera*, well preserved in black marine mud sediment ca. 5m below present sea level. Coll. and subm. Feb. 1972 by Geol. Survey Queensland.

**SUA-84A.** **7580 ± 110**  
**5630 B.C.**

Portion of stump wood boiled in 1M HCl, then extracted 3 times with boiling 2% NaOH and washed to neutral. (1080 min count.)

**SUA-84B.** **7480 ± 110**  
**5530 B.C.**

Alkali extract of SUA-84A reprecipitated with acid. (1060 min count.) Report on excavation and dates by Wood (1972).

**North Coast series**

Samples coll. and subm. March 1972 by P. M. den Exter, Dept. Geog., Univ. New England, N.S.W., as part of study of Quaternary events on N.S.W. coast.

**SUA-91.** **33,200 ± 1150**  
**31,250 B.C.**

Wood from Inner Barrier swale peat, 1 to 2m above HWM, exposed by wave action at entrance to Lake Cathie (31° 33' S Lat, 152° 52' E Long). Sample deposited following Inner Barrier formation, date is minimum for this event. (2480 min count.)

**SUA-92.** **1540 ± 75**  
**A.D. 410**

*Anadara Trapezia* shells from aboriginal midden on seaward margin of Inner Barrier 2.5km W of Crowdy Head (31° 51' S Lat, 152° 44' E

Long). Species indicates estuarine environment and dates abandonment of former outlet channel of Manning R. delta from which shells were derived. (1380 min count.)

**SUA-94.**

**17,050 ± 210**  
**15,100 B.C.**

Peat from layer 130 to 140cm below surface of dune near Crowdy Head (31° 51' S Lat, 152° 43' E Long). Predates movement of transgressive dunes to this site. (1380 min count.)

**SUA-93.**

**5750 ± 90**  
**3800 B.C.**

Sandrock from same site as SUA-94, 90 to 105cm below surface. This horizon formed within transgressive dune system during period of rising water table. (1120 min count.)

*General Comment (P.M.E.):* SUA-91 was intended to determine whether Inner Barrier is of interstadial or interglacial age; date is inconclusive since formation predates sample deposition by unknown period. If development of transgressive dunes was caused by freeing of Inner Barrier sand during the Holocene sea-level transgression, then SUA-94 dates the onset, and SUA-93, the close of this event.

**SUA-30. King River**

**6810 ± 110**  
**4860 B.C.**

Soft organic matter with decayed wood fragments from 3m below surface of tidal flat near Wyndham, Western Australia (15° 30' S Lat, 128° 0.5' E Long). Coll. and subm. by B. Thom, Dept. Geomorphol., A.N.U. Date estimates rate of tidal flat accretion and age of mangrove growth when sea level was lower than at present. (1040 min count.)

**SUA-41. Smiths Lake**

**8850 ± 115**  
**6900 B.C.**

Charcoal coll. and subm. by B. Thom from sand bar N of Bungwahl, N.S.W. (32° 25' S Lat, 152° 33' E Long). Date supports hypothesis that coastal dunes were forming and blanketing bedrock and older dunes during Holocene sea level transgression. (1200 min count.)

**SUA-21. 71/C/22**

**5660 ± 500**  
**3710 B.C.**

Charcoal coll. and subm. Nov. 1971 by W. N. Holland, Dept. Geog., Univ. Sydney, from base of valley fill 155cm below surface of North Katoomba Creek, N.S.W. (33° 41' S Lat, 150° 19' E Long). *Comment (W.N.H.):* this date, and others (Holland, 1973) suggests that Blue Mountain headwater valley fills were deposited after 17,000 B.P. Dilution on 9% sample. (1040 min count.)

**SUA-22. 71/C/22**

**10,720 ± 130**  
**8770 B.C.**

Sandrock coll. and subm. Nov., 1971 by F. Turton, Dept. Geog., Univ. Sydney, from 38cm below surface of sand dune near Norah Head, N.S.W. (33° 18' S Lat, 151° 34' E Long) ca. 4m above present H.W.M.

*Comment* (F.T.): provides 1st evidence for late Pleistocene inner barrier sand ridge system in Tuggerah Lakes area.

*B. Sudan*

**Sudan lakes series**

Freshwater shells and carbonate concretions coll. Jan. 1972 by M. A. J. Williams, D. A. Adamson, and A. H. Medani; subm. by School of Earth Sci. Macquarie Univ., N.S.W. Samples form part of a continuing project on Upper Quaternary evolution of Blue and White Nile R. in Central Sudan.

**SUA-68. Sudan 5**

**8130 ± 225**

**6180 B.C.**

Shells from lacustrine silts near margin of former lake at Tagra site S72/1 (13° 56' N Lat, 32° 22' E Long), 120 to 140cm below surface. Compares favorably with date, 8370 ± 350, from 145 to 160cm in same pit reported by Williams (1966). Dilution, 1000 min count.

**SUA-69/1. Sudan 6**

**33,300 ± 1150**

**31,350 B.C.**

Hard carbonate concretion from same pit as SUA-68, 140 to 150cm. Shown to be dolomite by X-ray diffraction, probably allochthonous. (1880 min count.)

**SUA-69/2. Sudan 6**

**10,460 ± 160**

**8510 B.C.**

Soft calcite concretions picked out from same sample as SUA-69/1. Confirms that dolomite is derived from prior carbonate source and validates SUA-68. (1060 min count.)

**SUA-75. Sudan 12/13**

**11,250 ± 220**

**9300 B.C.**

Shells from Site S72/3 near Esh Shawal (13° 34' N Lat, 32° 44' E Long), embedded in olive-gray sandy loam overlain by 130cm dark gray, slightly calcareous, vertisolic clay. Compares favorably with date from similar site 1.5km NE of S72/3, 11,300 ± 400 as reported by Williams (1966). Dilution, 1040 min count.

**SUA-71. Sudan 8**

**7870 ± 140**

**5920 B.C.**

Shells from dry lake bed NW of Jebel Aulia, Site S72/4, Pit 2, 30 to 45cm (15° 25' N Lat, 32° 15' E Long). Dilution, 1200 min count.

**SUA-72. Sudan 9**

**8400 ± 160**

**6450 B.C.**

Shells from Jebel Aulia Site S72/6, Pit 4, 30 to 45cm. Dilution, 1040 min count.

**SUA-73. Sudan 10**

**6990 ± 100**

**5040 B.C.**

Shells from Jebel Aulia Site S72/5, Pit 3, 12 to 20cm. (1040 min count.)

**SUA-74. Sudan II**

**7620 ± 130  
5670 B.C.**

Shells from Jebel Aulia Site S72/6, Pit 4, 45 to 60cm. Dilution, 1040 min count.

*General Comment* (M.A.J.W.): dates confirm that between 8000 and 11,500 yr B.P., the White Nile formed an extensive lake or swamp stable at ca. 382m alt. Sudan evidence agrees with that of the Sahara, East Africa and Uganda (Williams, 1971).

REFERENCES

- Dortch, C. E. and Merrilees, D., 1972: A salvage excavation at Devils Lair, W.A.: Jour. Royal Soc. W. Australia, v. 54, p. 103-113.
- 1973: Late Pleistocene chronology from Devils Lair: Archaeol. and Phys. Anthrop. in Oceania, v. 7, in press.
- Gillespie, R., Polach, H. A., and Temple, R. B., 1972: Sydney University natural radiocarbon measurements I: Radiocarbon, v. 14, p. 413-417.
- Holland, W. N., 1973: Cultural sites and their environment in the Blue Mountains: ms. in preparation.
- Polach, H. A.: Optimization of liquid scintillation radiocarbon age determinations and reporting of ages: Atomic Energy in Australia, v. 12, no. 3, p. 15-23.
- Williams, M. A. J., 1966: Age of alluvial clays in Western Gezira, Sudan: Nature, v. 211, p. 270.
- 1971: Geomorphology and Quaternary geology of Adrar Bous: Geog. Jour., v. 137, p. 450.
- Wood, P. A., 1972: A possible Holocene shoreline at Maroochydore, Queensland: Qld. Govt. Mining Jour., p. 331.