

ANU RADIOCARBON DATE LIST I

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The Radiocarbon Dating Laboratory is installed in the Department of Geophysics and Geochemistry, Institute of Advanced Studies of the Australian National University. The Australian Institute of Aboriginal Studies has materially aided the establishment of the laboratory and is allocated a major proportion of the dating time over the next three years for samples in Australian Aboriginal archaeology. Beyond this the laboratory is to serve research needs within the University. To facilitate communication between collectors and laboratory a handbook on collection of specimens and interpretation of results has been prepared (Polach and Golson, 1966) and a radiocarbon sample record and an age determination sheet are in use.

Both methane gas counting and benzene liquid scintillation counting techniques are used in this laboratory.

For gas counting CDL-14 carbon-dating equipment was purchased from and installed by Beckman-Sharp in July 1965. Two detectors mounted within one multiple-anode guard ring are surrounded by 10 cm of boric acid and 10 cm of lead shielding. The two-energy-channel electronics are duplicated to allow simultaneous two-detector operation with automatic recording of all functions at preselected intervals (Sharp and Ellis, 1966). Dating started in April 1966 with preamplifiers and detectors redesigned in this laboratory and continued until July 1966, at which time it was interrupted to allow the installation and testing of new Beckman-Sharp preamplifiers. Dating resumed in September 1966.

Only one detector is operated for sample age determinations. It is of 0.5 L vol at STP and is filled for routine operations to 2 atm of purified CH_4 (4.0 KV). The background is nominally 2 counts/min and the net oxalic-acid standard rate is 7 cpm, giving a useful age range of up to 35,000 yr. The second detector situated within the guard has been used for continuous background monitoring since dating resumed in September 1966.

The methane preparation method used is similar to that described by Fairhall *et al.* (1961) with an additional radon purification step (Kruegers, pers. commun., 1966). Full details of the synthesis technique and apparatus are described by Polach and Stipp (1967). It is proposed to increase the working pressure of the sample detector to 5 atm (aprox. 7VK). Tests carried out in this laboratory have shown SPRAGUE 30KV ceramics to be suitable high voltage holding and filtering capacitors which remain noise-free up to 9KV (ca. 8 atm operation).

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For liquid scintillation counting Stipp built in August 1966 a chemical line closely resembling the benzene synthesis system at Florida State University (Noakes *et al.*, 1965). The synthesis technique used follows Barker's (1963) CO₂ reaction with lithium with the significant change that only 10% excess Li is required, still maintaining a 98% acetylene yield. For the final acetylene-to-benzene synthesis activated vanadium catalyst is used (Noakes *et al.*, 1965) and the overall yield approaches 95% from sample carbon to counting-vial carbon. The production technique developed here and the equipment are described in detail by Polach and Stipp (1967).

The actual age determinations were carried out on a Packard model 3950 and a Beckman model 1650 liquid scintillation spectrometer. The 5-ml vials used were prepared from standard 20-ml glass vials and are mounted on black ebonite bases. Background is ca. 8 counts/min and the oxalic-acid standard net rate is 30 counts with an efficiency of ca. 70%, giving a useful dating range of ca. 35,000 yr. A normal sample for counting is 4 ml benzene plus 1 ml toluene with the appropriate PPO and POPOP scintillators.

The samples being currently dated are all either charcoal or wood and corrections for C¹³/C¹² ratio are not necessary. However, reproducibility of the oxalic-methane preparation has been tested mass-spectroscopically by comparing C¹³/C¹² ratios of 3 consecutive preparations. The results were within the limits of accuracy of the available equipment, namely $\pm 2\%$. Our technique of oxalic-CO₂ preparation follows closely the wet combustion used by Rafter (pers. commun., 1965) which normally yields CO₂ with $\delta C^{13} = -19\%$, the value stipulated by Craig (1961) for C¹⁴ dating work. Reproducibility of the benzene preparation has been checked by directly comparing our count rates of oxalic-benzene samples with samples supplied for test purposes by 3 other laboratories. Within statistical counting limits all yielded the same count rate per gram of sample in the same machines. This study, which will be reported in detail elsewhere, enabled us to achieve routine operations with benzene in a matter of two weeks. Thus the dating with liquid scintillation counters coincided with the second gas counting period (Sept.-Nov. 1966), characterized by continuous background monitoring as mentioned previously.

Sample preparation is preceded by very careful visual separation and cleaning. This is followed in all cases with an acid wash, but the alkali treatment to remove humic acid contaminants is applied only where indicated by conditions of burial and only if sample size permits. Individual treatment is not described in the date list, but is reported directly to the collector along with the dates obtained.

Ages are calculated using the Libby half life of 5568 yr and errors listed include errors in the determination of count rate of the modern standard, background and sample. The error is reported in terms of 1 standard deviation. The background and modern standard rates were

averaged over the individual counting periods (2 April-27 June and 1 Sept.-9 Nov. 1966) but errors applied to the samples were computed from 4000-min background and 3000-min modern count rates only. Calculated errors of less than 100 yr have been increased to that figure as a minimum. Some samples were counted several times or counted in all 3 machines as internal cross checks upon the validity of our age determinations. Also the known-age samples were bracketed between the unknowns at regular intervals to guard against any undetected interference.

Interference with counting operations and low-background determinations has occurred due to the operation by the Nuclear Physics Department, A.N.U., of a Van de Graaf Tandem Accelerator. An increase in background rate from the normal 2 counts/min value up to 3 to 5 counts/min was correlated with the detection of fast neutrons, produced when deuterons were accelerated above 6 MeV energy. This increase was readily monitored by the second gas detector, and interruption of dating operations was confined to the interference period. The data accumulated during the periods of interference are being currently analyzed and the mechanism of pick-up, shielding requirements, and the possibility of application of a correction factor are being assessed in a paper not yet submitted for publication (Polach and Stipp, 1966).

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The following list reports 80% of the determinations made during the counting periods specified above. The total counting time for each sample is noted. *Methane* means gas-proportional counting, *benzene* means liquid-scintillation counting.

SAMPLE DESCRIPTIONS

I. CHECK SAMPLES

TABLE 1
Interlaboratory cross checks

ANU Number	ANU Date	Other Number	Other Date	Reference
ANU-1	2350 ± 170	FSU- 62	2630 ± 135	Florida State I
ANU-2	2500 ± 150	GaK- 772	2820 ± 80	Taylor (collector; pers. commun.)
ANU-3	9800 ± 220	NPL- 64	9410 ± 100	National Physical Laboratory III
ANU-4a 4b 4c	8000 ± 300 8350 ± 200 *8500 ± 200	R1022/1 (NZ lab. no.)	9150 ± 150	Rafters, pers. commun.
ANU-5	11,700 ± 260			
ANU-6a 6b	7750 ± 280 *8600 ± 200	Tx - 140	8540 ± 120	Texas III
ANU-7a 7b 7c	14,550 ± 270 15,000 ± 600 *13,700 ± 300	W -1571	14,650 ± 500	Rubin, pers. commun.
ANU-8a 8b	5610 ± 130 *6100 ± 150	W -1579	5840 ± 300	Rubin, pers. commun.

* Benzene—liquid scintillation determinations.

Comment (H.A.P.): the table records satisfactory agreement with other laboratories in respect of both methods employed at A.N.U. The only real exceptions are ANU-4a to c, a discrepancy which is to be investigated.TABLE 2
Methane gas-proportional and Benzene liquid-scintillation cross checks

ANU Number	Methane Date	Benzene Date
ANU-4	{ 8000 ± 300 8350 ± 200	8500 ± 200
ANU-6	7750 ± 280	8600 ± 200
ANU-7	{ 14,550 ± 270 15,000 ± 600	13,700 ± 300
ANU-8	5610 ± 130	6100 ± 150
ANU-9	32,000 ± 3200	31,000 ± 1000
ANU-17	3140 ± 110	3100 ± 100

Comment (H.A.P.): each date listed represents an individual synthesis. The agreement is excellent. Details of ANU-9 and 17 are in the date list, ANU-4 to 8 are also interlaboratory cross checks listed in Table 1.

TABLE 3
Methane gas-proportional counting-period cross checks
April-June and Sept.-Nov. 1966

ANU Number	Methane I April-June	Methane II Sept.-Nov.
ANU-7	15,000 \pm 600	14,550 \pm 300
ANU-27	2040 \pm 120	2250 \pm 150
ANU-28	8500 \pm 500	9950 \pm 300

Comment (H.A.P.): methane samples stored in stainless steel cylinders. Agreement in countrate is excellent showing that modifications to equipment did not affect its reliability and that radon removal procedures are adequate. ANU-28 is held over for publication and does not appear in this date list.

II. GEOLOGIC SAMPLES

A. New Guinea

Kosipe, Central District, Papua

See ANU-21.

B. New Zealand

ANU-9. Manukau Harbour, Mangere, Auckland **31,000 \pm 1000** **29,050 B.C.**

Wood from fossil forest exposed on shore platform beneath bedded tuffs covered by lavas from Ihumatao (Maungataketake) cone (37° 00' S Lat, 174° 45' E Long). Sample from same context, coll. by E. J. Searle, Univ. of Auckland, has been dated to 29,000 \pm 1500 (27,050 B.C.), NZ-215 (Searle, 1959). Purpose of recollection was to confirm maximum radiocarbon age of basalt for use in possible cross checking by potassium-argon dating. Coll. Oct. 1965 and subm. by J. J. Stipp, A.N.U. Methane, 3-day count 32,000 \pm 3200. Benzene, 2-day count 31,000 \pm 1000. *Comment* (J.J.S.): determinations confirm NZ-215.

III. ARCHAEOLOGIC SAMPLES

A. Australia

Lapstone Creek series, New South Wales

Lapstone Creek sandstone rockshelter, ca. 35 mi W of Sydney on E flanks of Blue Mountains (33° 45' S Lat, 150° 38' 30" E Long), was dug in 1936 and reported in 1948. With maximum depth of deposit of 55 in., it provided first stratified sequence of industries in Australia E of Dividing Range. On it McCarthy (1948) based his division of later eastern New South Wales prehistory into an earlier Bondaian and a later Eloueran phase. McCarthy's picture has been amplified and refined by later work, for which there are a number of radiocarbon dates available, particularly for Bondaian phase (McCarthy, 1964; McBryde, 1965; Megaw, 1965, 1966; Gakushuin V, GaK-564 to 572; Victoria I, V-10 and

11, 24 to 26, 33 to 36, 39 to 45). It is interesting now to have dates for this important type site. Samples collected in glass bottles by F. D. McCarthy on occasion of original excavations in Dec. 1936. Subm. by Australian Inst. of Aboriginal Studies.

ANU-10. Lapstone Creek, Section 3, 36 in. below surface **3650 ± 100
1700 B.C.**

Charcoal from homogeneous ash-rich deposit. In sec. 3 of excavation bondi points were distributed between 28 in. and 48 in. from surface. Sample therefore should date a midpoint in Bondaian occupation. Benzene, 2-day count. *Comment* (F.D.McC.): date falls early in time range presently established by radiocarbon dating for Bondaian in eastern N.S.W.

ANU-11. Lapstone Creek, Section 3, 20 in. from surface **2300 ± 100
350 B.C.**

Charcoal from homogeneous ash-rich deposit. In Sec. 3 of excavation elouera were distributed between 7 in. and 30 in. depth. Sample should date therefore just before midpoint of Eloueran occupation. Benzene, 2-day count. *Comment* (F.D.McC.): this seems an early date for disappearance of bondi points. At Curracurrang, also in immediate Sydney district, Megaw (1965) has a date, I-1135, 1580 ± 130 (A.D. 370), for a midpoint in Bondaian layer. Northern N.S.W. bondi points persist well into present millennium (Gakushuin V, GaK-569 to 572).

ANU-12. Sandy Hollow rockshelter, Hunter Valley, New South Wales **1300 ± 100
A.D. 650**

Charcoal from 23 in. to 24 in. depth just inside dripline of small rockshelter in upper Hunter Valley (32° 21' S Lat, 150° 33' E Long). At deepest, cultural materials extend to 3.5 ft. They consist of cooking and workshop waste and artefacts of Bondaian cultural type. Sample dates midpoint of deposit and the most prolific horizon. Coll. Mar. 1966 by D. R. Moore, Australian Mus., Sydney; subm. by Australian Inst. of Aboriginal Studies. Benzene, 3-day count. *Comment* (D.R.M.): date falls in later part of Bondaian phase in eastern New South Wales and may be compared with dates reported for Miss McBryde's excavations in New England 200 mi N (McBryde, 1965; Gakushuin V, GaK-564 to 572; Victoria I, V-10 and 11, 24 to 27, 39 to 45).

ANU-13. Durras, North, South Coast, New South Wales **680 ± 160
A.D. 1270**

Charcoal from thin occupation horizon in sand, 85 cm below ground surface and 25 cm above bedrock sandstone, adjacent to N shore of coastal lagoon (Durras Lake) and near its mouth (35° 38' 30" S Lat, 150° 18' 10" E Long). Two edge-ground axes came from same horizon, which is at about present lake level. Coll. Aug. 1965 by R. J. Lampert, A.N.U.; subm. by Australian Inst. of Aboriginal Studies. Benzene dilution, 1-day

count. *Comment* (R.J.L.): date is close to that for earliest occupation of sea cave 1 km N along beach, GaK-873, 480 ± 80 (A.D. 1470) (Lampert, 1966).

ANU-14. Platform Gallery rockshelter **6120 \pm 150**
Cooktown, Queensland **4170 B.C.**

Charcoal from 10.5 ft. depth in sandstone rockshelter ca. 20 mi NW of Cooktown ($15^{\circ} 14' S$ Lat, $145^{\circ} 4' E$ Long). Sample dates first appearance of cultural material at site in form of a single chalcedonic flake. Excavation was continued through sterile deposit to depth of 12 ft. Coll. Apr. 1965 by F. P. Woolston; subm. by Australian Inst. of Aboriginal Studies. Benzene, 2-day count. *Comment* (F.P.W.): will be valuable for comparison with major excavation carried out by R. V. S. Wright, Univ. of Sydney, at Laura shelter in same region.

Yarar series, Port Keats, Northern Territory

Yarar rockshelter, 11 mi S of Port Keats ($14^{\circ} 24' S$ Lat, $120^{\circ} 34' 30'' E$ Long), was excavated in 1958 by W. E. H. Stanner, A.N.U., and produced over a depth of ca. 27 in. a rich stone-point industry which was analyzed in 1966 by Mrs. J. M. Flood, A.N.U. Samples coll. 1958 by Stanner; subm. by Australian Inst. of Aboriginal Studies.

ANU-15. Yarar rockshelter, Square 2J, **450 \pm 100**
6 in.-12 in. deep **A.D. 1500**

Charcoal dating period of maximum occupation of shelter, with large numbers of unifacial and bifacial points and lowest occurrence of edge-ground axes at site. Methane, 1-day count.

ANU-16. Yarar rockshelter, Square 2J, **1620 \pm 100**
18 in.-24 in. deep **A.D. 330**

Charcoal dating early stage in occupation of site, with a point industry similar to higher level. Methane, 2-day count. *Comment* (J.M.F.): both age estimations fall within expectation, ANU-16 may be compared with date for a comparable industry at Ingaladdi, 125 mi SE, GX-103, 1545 ± 75 (A.D. 405) (Geochron I).

ANU-17. Padyadiy rockshelter, Oenpelli, **3120 \pm 100**
Northern Territory **1170 B.C.**

Charcoal on bedrock at base of shell midden forming earlier phase of occupation in rockshelter in sandstone residual on plains 4.5 mi W of East Alligator River and 12.5 mi SW of Oenpelli Mission ($12^{\circ} 26' S$ Lat, $132^{\circ} 54' E$ Long). Sample will provide maximum age for jaw fragment of Tasmanian devil (*Sarcophilus harrisi*) found in same midden 4 cm above bedrock, 20 to 25 cm below surface of deposit. This is first find of Tasmanian devil in tropical Australia. Coll. July 1965 by Carmel White, A.N.U.; subm. by Australian Inst. of Aboriginal Studies. Date is average of two determinations: methane, 3-day count, 3140 ± 110 , ben-

zene 2-day count, 3100 ± 100 . *Comment* (C.W.): find extends range for Tasmanian devil to tropical Australia and date shows its relatively recent persistence there.

**ANU-18. Tyimede (Jeemeri) 2, Oenpelli, 6650 \pm 500
Northern Territory 4700 B.C.**

Charcoal specks from remains of hearth (?) in greyish brown sand 60 to 70 cm from surface of deposits at mouth of large waterworn cavern in sandstone in valley in Arnhem Land escarpment 14 mi E 20° S of Oenpelli Mission ($12^\circ 24'$ S Lat, $133^\circ 15'$ E Long). Dates upper part of a scraper and ground-axe industry, which extends from 60 to 80 cm below surface of deposit and underlies a bifacial point industry extending from 0 to 50 cm below surface. Coll. Oct. 1965 by Carmel White; subm. by Australian Inst. of Aboriginal Studies. Methane dilution with dead gas, 2-day count. *Comment* (C.W.): the date conflicts with GaK-632, $10,790 \pm 200$ (8840 B.C.), for early stage of bifacial point industry at Tyimede 1, a rockshelter 300 ft N, ($12^\circ 24'$ S Lat, $133^\circ 15'$ E Long, revised position) (Gakushuin V). Because of this and problems discussed under ANU-19 below, further dating needed.

**ANU-19. Malangangerr rockshelter, Oenpelli, 18,000 \pm 400
Northern Territory 16,050 B.C.**

Charcoal from remains of hearth (?) in yellowish brown sand 104 to 114 cm from surface of deposit in rockshelter in a detached block of sandstone on plains 11 mi SW of Oenpelli Mission and 0.5 mi W of East Alligator River ($12^\circ 27'$ S Lat, $132^\circ 57'$ E Long). Associated with scraper and ground-axe industry distributed from 60 to 180 cm depth in area of collection and overlain by bone and bifacial stone point industry in shell midden. Sample was submitted to investigate archaeological problem raised by GaK-628 (150 to 154 cm in deposit), $19,600 \pm 550$ (17,650 B.C.), and GaK-629 (138 cm deep), $22,700 \pm 700$ (20,750 B.C.), which gave surprisingly old ages for ground-stone axes in Australia (Gakushuin V). Coll. Aug. 1965 by Carmel White; subm. by Australian Inst. of Aboriginal Studies. Methane, 2-day count. *Comment* (C.W.): ANU-19 confirms GaK-628 and 629 on antiquity of charcoal samples and archaeological problem remains. Geomorphological and archaeological work at site subsequent to receipt of dates confirmed *in situ* position of stone axes and revealed no process whereby old carbon could have contaminated the site.

B. New Guinea

**ANU-20. Kafivana rockshelter, southern Asaro
valley, Eastern Highlands District ≥ 9500**

Charcoal from 250 to 270 cm depth in deposit in calcareous siltstone rockshelter, 12 mi S 15° E of Goroka, alt ca. 4500 ft ($6^\circ 14'$ S Lat, 145°

25' E Long). Cultural materials occur to depth of 380 cm and in two main concentrations, at 20 to 120 cm and 210 to 300 cm. Fragments of ground-stone tools occur deeper than 300 cm. Charcoal scarce throughout site and ANU-20 is combination of three small collections of carbon spicules from three adjacent square-metre excavation units. Coll. Apr. 1965 and subm. by J. P. White, A.N.U. Benzene dilution, 2-day count. *Comment* (H.A.P.): sample was very small, yielding only 0.18 g of benzene, but because of its importance to archaeologist, attempt was made to give at least the measure of antiquity of the sample. Age is consequently reported as not younger than 9500 *with a 95% probability*. *Comment* (J.P.W.): this indication that a ground-stone technology was present in Highlands by 9500 B.P. should be compared with Mrs. Bulmer's results from Kiowa rockshelter at Chuave, 21 mi NW of Kafiavana. Here appearance of ground axes is bracketed by Y-1370, 6100 ± 160 (4150 B.C.), and Y-1317, 4840 ± 140 (2890 B.C.) (Bulmer, 1964). Samples of animal bone from immediately above and below ANU-20 have been submitted for dating.

4050 \pm 500

ANU-21. Kosipe, Central District, Papua

2100 B.C.

Charcoal from site on sloping crest of a spur, alt ca. 6100 ft, at Kosipe Mission, 11 mi NNW of Waitape Govt. Station, Central Dist., Papua ($8^{\circ} 30'$ S Lat, $147^{\circ} 20'$ E Long). Sample occurred as scattered lumps in B horizon of a soil developed from volcanic ash fall overlying older, more weathered volcanic ash with similar soil profile. From this older ash mortars, waisted blades and ground stone axes have been recovered (White, 1965). Older ash is dated by GaK-624, $16,300 \pm 1200$ (15,350 B.C.), and GaK-625, $19,350 \pm 600$ (17,400 B.C.) (Gakushuin IV); dates also provide maximum age for artefacts. ANU-21, taken ca. 4 m W of GaK-625, provides minimum age for younger ash fall and artefacts beneath it. Coll. Aug. 1966 by K.A.W. Crook (Geology); subm. by J. P. White (Anthropology), A.N.U. Benzene dilution, 1-day count. *Comment* (J.P.W. and K.A.W.C.): Kosipe series provides first dates for mortars in New Guinea. Earliest waisted blades at Mrs. Bulmer's Kiowa site in Eastern Highlands District are bracketed by Y-1370 and Y-1371 (see comment on ANU-20). Two volcanic ashes are believed to derive from Mt. Lamington and may represent two of ash showers described by Ruxton (1966). Mineralogical investigations into question are proceeding.

C. Oceania

ANU-22. Te Aka village site, Ocean Island Modern <200

Partly carbonized wood from post of earliest building phase of sequence of four excavated on site of *maneaba* (meeting house) at Te Aka village site ($0^{\circ} 51' 50''$ S Lat, $169^{\circ} 35' 15''$ E Long). Coll. Feb. 1965 and subm. by R. J. Lampert, A.N.U. Wood penetrated by roots which

were carefully removed before dating. Benzene, 1-day count. *Comment* (R. J. L.): as there is evidence for village buildings still standing early this century, modern date for previous phase of village is not altogether surprising.

Tongatapu series, Tonga

Two samples from a series collected by J. I. Poulsen, A.N.U., in the course of archaeological fieldwork on Tongatapu in 1963-4. Four major sites were excavated, Tonga 1, 2, 5 and 6, in the main refuse dumps with abundant shell and pottery but little charcoal. Dates available are:

K-904.	2770 ± 100	(820 B.C.)	shell	Tonga 1
K-961,	420 ± 100	(A.D. 1530)	charcoal	Tonga 1
NZ-597,	464 ± 82	(A.D. 1486)	charcoal	Tonga 1
NZ-635,	1620 ± 60	(A.D. 330)	charcoal	Tonga 2
NZ-636,	2380 ± 51	(430 B.C.)	charcoal	Tonga 6
NZ-637,	1600 ± 87	(A.D. 350)	charcoal	Tonga 5

Coll. Aug. 1964; subm. by J. I. Poulsen.

330 ± 100

ANU-23. Tonga 5, near Veitongo village A.D. 1620

Charcoal from fire hollow D, 30 cm below surface of midden 1 m deep, 150 m from lagoon and ca. 1.5 m above its level (21° 11' S Lat, 175° 13' E Long). Should date later than NZ-637 from fire hollow B which is stratigraphically earlier, and by evidence of associated pottery styles should be of same order of age as upper levels of Tonga 1, that is later than K-961 and NZ-597. Methane, 3-day count. *Comment* (J.I.P.): date is in excellent agreement with the other evidence and marks late stage in development of Tongan prehistoric pottery.

2350 ± 200

ANU-24. Tonga 6, near Pea village 400 B.C.

Charcoal from fire hollow DN, in clay subsoil 90 to 100 cm from ground surface at base of midden, which lies on edge of raised coral just above Pea village (21° 10' 20" S Lat, 175° 14' 20" E Long). Pottery from site suggested that it belonged to late phase of Tongan prehistory, its lower levels equivalent to upper levels at Tonga 1 and Tonga 5 (see ANU-23). However NZ-636 from fire hollow K, dug into clay subsoil 1 m from present sample, gave much earlier date. Methane, 1-day count. *Comment* (J.I.P.): ANU-24 confirms NZ-636. Both dated fire hollows are in corner of excavated area at Tonga 6 and appear to belong to very early phase of occupation only just touched by excavations. Some of material excavated at site can tentatively be attributed to this early phase, which however stands prior to any stage of pottery sequence established by excavation for Tongatapu.

D. New Zealand

Kauri Point series, North Island

Kauri Point *pa* (fortified settlement), N53-54/5 in NZ Archaeol. Assoc. site records, is on small peninsula into Tauranga Harbour, western Bay of Plenty (37° 30' S Lat, 175° 58' E Long). Excavated over three seasons 1960-3 (Golson *et al.*, 1961; Ambrose, 1962). Excavations revealed evidence of multiphased occupation, with latest ditch and bank defences enclosing smaller area than the earliest.

495 ± 100**ANU-25. Kauri Point N defences****A.D. 1455**

Charcoal from layer of food refuse lying on artificial terrace and overlain immediately and without weathering interval by upcast from first of defensive ditches at site. Sample should therefore closely date construction of ditch. Coll. Jan. 1963; subm. by W. R. Ambrose, A.N.U. Date is average of two 1-day methane counts: 410 ± 110 and 580 ± 110.

**ANU-26. Kauri Point, Structure B,
Squares L29/30****230 ± 100****A.D. 1720**

Charcoal from fire hollow (? hearth) in floor of sunken rectangular pit on lowest of series of terraces within earliest defensive circuit but outside subsequent ones. For this reason expected to date close to ANU-25. Coll. Jan. 1961; subm. by W. R. Ambrose. Methane, 1-day count. *Comment* (W.R.A.): ANU-25 accords well with sample from associated site (Shawcross, 1962; 1963) in adjacent swamp: 398 ± 56 (A.D. 1552), NZ intralaboratory reference R 1418/1 (F. W. Shawcross, pers. commun.). ANU-26 is unexpectedly young in respect to ANU-25 and may indicate that structure B is later than terrace into which it is dug.

E. Malaya

2145 ± 100**ANU-27. Kampong Sungai Lang****195 B.C.**

Wood from site in mangrove swamps on lot 1670 at this village, Mukin Kelanang, Kuala Langat district, Selangor (2° 45' N Lat, 101° 30' E Long), associated with Dongson metal work. Coll. 1964 by B. A. V. Peacock, Univ. of Malaya; subm. by J. Golson, A.N.U. Date is average of two determinations: methane, 2-day count, period April to June 1966, 2040 ± 120, and methane, 2-day count, period Sept. to Nov., 2250 ± 150. *Comment* (J.G.): two other date are available:

GaK-684 1850 ± 90 (A.D. 100) on part of same sample as
ANU-27

GX-280 2435 ± 95 (485 B.C.) on sample from same site

On the whole dates tend to be somewhat older than would be expected on historical grounds. Dongson is contemporary, at least in part, with

Han dynasty (roughly 200 B.C.-A.D. 200) in its home regions (S. China, N. Vietnam) and its Malayan manifestations might be reasonably supposed to postdate this.

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