

TATA INSTITUTE RADIOCARBON DATE LIST XI

D P AGRAWAL and SHEELA KUSUMGAR

Tata Institute of Fundamental Research, Bombay-400 005, India

This is the last installment of ^{14}C dates done at the Tata Institute; the lab has now shifted to the Physical Research Laboratory, Navarangpura, Ahmedabad-380 009, India.

The value $\tau_{1/2} = 5568$ yr has been used to calculate all BP dates. Dates were converted to AD/BC scale by using 1950 as the reference year. The NBS oxalic acid was used as the modern standard.

We have measured the ^{14}C activity of the methane samples in gas proportional counters. The samples were converted to methane by using a reactor described earlier (R, 1971, v 13, p 442-449).

This date list includes dates on some old mining areas, some important Stone Age dates, and some measurements of various Quaternary processes including eustatic studies on the W coast of India. The hydro-spheric samples include some dates done to study groundwater recharge problems in W India. The Pacific Ocean samples were measured to study the siltation and dissolution rates of calcareous particles in transit through a sea-water column. A series of Egyptian well-dated historic samples were measured to study the $^{14}\text{C}/^{12}\text{C}$ variations in the past.

*General Comment**: for the first time, an Upper Palaeolithic level has been dated to ca 20,000 BC (TF-1245) from U P. The microlithic occupation at Sarai Nahar Rai was dated ca 1000 BC (TF-1356, -1359) based on charred bones. Prehistoric deposits from a Ceylonese cave was dated to ca 6000 BC (TF-1074). A Painted Grey Ware, Iron age deposit from U P is dated ca 500 BC (TF-1228).

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SAMPLE DESCRIPTIONS

I. ANCIENT MINING SAMPLES

TF-1199. Kolar, India, old gold works **1260 ± 85**
AD 690

Charcoal from excavations of an old mine (12° 57' N, 78° 16' E), Dist Kolar. Subm by T G Varghese, Bhabha Atom Res Centre, Bombay.

Kumbaria old mining series, Gujarat

Kumbaria (24° 19' N, 72° 51' E), Dist Banaskantha. Subm by N C Shekhar, Min Expl Corp, Banaskantha. Samples assoc with slag of old smelting of copper, lead, silver, etc, lying on surface.

TF-1221. Charcoal **520 ± 90**
AD 1430
Charcoal extracted from slags.

* For these comments, dates are based on $\tau_{1/2} = 5730$ yr.

- TF-1222. Charcoal** **880 ± 85**
 Charcoal extracted from slags. **AD 1070**

II. ARCHAEOLOGIC SAMPLES

- TF-1245. R Belan, India, Gravel III** **19,160 ± 330**
17,210 BC
 Shells from Gravel III on R Belan (24° 54' N, 82° 2' E), Dist Allahabad. Subm by Dir Inst Archaeol, Allahabad. *Comment:* an Upper Palaeolithic industry is assoc with Gravel III.

- TF-1094. Beli Lena Athula, Ceylon, cave remains** **7640 ± 110**
5690 BC
 Carbonized kernels at .45m depth, from a prehistoric cave deposit (6° 56' 5" N, 80° 14' 5" E), near Maniyangama. Subm by Vishnu Mitre, Birbal Sahni Inst Palaeobot, Lucknow.

- TF-1162. Gharluli, Afghanistan, Late Neolithic** **Modern**
 Charcoal from Gharluli (35° 45' N, 65° 00' E), Dist Maimana, Trench 1, Cut 2d^c, 6m, Sample 16/2d-600/8-9-69. Subm by L Dupree, Pennsylvania State Univ, Philadelphia. *Comment* (L D): nomads dug pits at site up to modern times, disturbing underlying deposits.

- TF-1330. Inamgaon, India, Chalcolithic** **3090 ± 100**
1140 BC
 Wood charcoal from Inamgaon (18° 35' N, 74° 32' E), Dist Poona, a Chalcolithic site, Loc E7, Layer 4. Subm by Dir, Deccan College, Poona.

- TF-1228. Khalaua, India, P G Ware level** **2420 ± 95**
470 BC
 Charcoal from Khalaua (27° 6' N, 77° 52' E), Dist Agra, Loc Khl-L, II-IV(a), Layer 9, depth 2.6m to 2.75m. Subm by Dir Gen, Archaeol, New Delhi.

- TF-1356,** **2860 ± 120**
TF-1359. Sarai Nahar Rai, India Microlithic(?) **910 BC**
 Charred and semi-charred bones from Sarai Nahar Rai (25° 48' N, 81° 50' E), Dist Pratapgarh, a Mesolithic site, Hearth 1/A3 and 2/B4, depths 2 to 4cm to 5 to 6cm. Subm by Dir, Inst Archaeol, Allahabad. *Comment:* date younger than uncharred bones dated earlier (TF-1104: 10,050 ± 110).

- TF-1301. Surkotada, India, Harappa culture** **3840 ± 130**
1890 BC
 Charcoal from Surkotada (23° 37' N, 70° 50' E), Dist Kutch, a fortified Harappan site, Loc B1, Qd 3, Layer 17, depth 5.65m. Subm by Dir Gen Archaeol, New Delhi.

III. EGYPTIAN HISTORIC SAMPLES

General Comment: these samples were measured to determine $^{14}\text{C}/^{12}\text{C}$ variations in the past. Though $\delta^{13}\text{C}$ values are given, dates are not corrected for this effect.

Egyptian Series I

Samples subm by W F Libby.

TF-562. Sneferu **4310 ± 105**
2360 BC
 $\delta^{13}\text{C} = -21.28\text{‰}$

Wood from tomb of Sneferu at Meydum. *Comment:* sample same as C-12 (Libby, 1965).

TF-563. Hemaka **4580 ± 60**
2630 BC
 $\delta^{13}\text{C} = -25.63\text{‰}$

Wood from tomb of Vizir Hemaka, contemporary of King Udimu, First Dynasty, at Sakkara. Average of 3 measurements: 4510, 4575, and 4610 yr. *Comment:* sample same as C-267.

TF-564. Sesostris III **3570 ± 75**
1620 BC
 $\delta^{13}\text{C} = -19.40\text{‰}$

Wood from funerary ship from tomb of Sesostris III. Average of 2 measurements: 3560 and 3570 yr. *Comment:* sample same as C-81.

TF-567. Zoser **4180 ± 80**
2230 BC
 $\delta^{13}\text{C} = -24.54\text{‰}$

Piece of *Acacia* wood from Zoser's Step Pyramid at Sakkara. Average of 2 measurements: 4135 and 4205 yr. *Comment:* sample same as C-1.

TF-568. Zoser **4130 ± 50**
2180 BC
 $\delta^{13}\text{C} = -26.41\text{‰}$

Piece of Sycamore wood from Zoser Step Pyramid at Sakkara. Average of 4 measurements: 4305, 4220, 4090, and 3830 yr.

Egyptian Series II

Well-dated historic samples from Egypt. Subm by Chairman, AEC, UAR.

TF-1208. Reeds **3840 ± 135**
1890 BC

Reeds from tomb of Ones Re, No. 463, Old Kingdom, Luxor. *Comment:* archaeologic date ca 2100 BC.

TF-1209. Reeds **3010 ± 80**
1060 BC

Reeds from wall of store room of temple Ramseum, Rameses II. *Comment:* archaeologic date ca 1250 BC.

TF-1211. Cloth **2600 ± 100**
650 BC
Cloth, 22nd Dynasty, Luxor.

TF-1212. Wood **2620 ± 125**
670 BC
Door of tomb Mono Mhat, No. 34, Assasee of 26th Dynasty. *Comment*: archaeological date ca 700 BC.

IV. QUATERNARY SAMPLES

Quaternary sediment series, W Rajasthan

Samples subm by R P Dhir, Cent Arid Zone Res Inst, Jodhpur.

General Comment: samples measured to study onset of dessication in W Rajasthan.

TF-1214. Concretionary deposit **+ 1985**
27,880
- 1605
25,930 BC

Calcium carbonate from 15km of Pokran, concretionary layer at 38 to 100cm below aeolian sand.

TF-1215. Concretionary deposit **14,080 ± 170**
12,130 BC
Calcium carbonate, Dodo-hill, piedmont slope, concretionary layer over rhyolite zone of weathering.

TF-1089. Panambur Harbour Area, India, coastal sediments **+ 4960**
37,380
- 3100
35,430 BC

Carbonized wood from tree root, depth 12m, ancient coastal sediment (12° 56' N, 74° 50' E), Dist S Kanara. Subm by E V Nielson, Port Trust, Cochin. *Comment*: sample dated to study coastal siltation rates.

Coastal sediments series, Maharashtra

Samples subm by D P Agrawal and S Guzder, TIFR, Bombay.

General Comment: samples measured to study Quaternary eustatic changes on W coast, India (Agrawal *et al*, 1972). Wherever depths have been given below surface, there still is uncertainty about their exact relationship with HWL.

TF-555. Kolthara-Dabhol, coastal sediments **1520 ± 90**
AD 430
Shells from Kolthara-Dabhol (17° 39' 10" N, 73° 10' 50" E), Dist Ratnagiri, depth -1.8m, 105m inland from sea.

TF-556. Kolthara-Dabhol, coastal sediments **2500 ± 85**
550 BC
Shells, depth -3.8m.

- TF-557. Kolthara-Dabhol, coastal sediments** **1930 ± 100**
AD 20
Shells, depth -4.25m.
- TF-558. Harnai, coastal sediments** **2370 ± 80**
420 BC
Shells from Harnai (17° 49' 10" N, 73° 8' 0" E), Dist Ratnagiri,
0.5m above HWL.
- TF-560. Harnai, coastal sediments** **1860 ± 90**
AD 90
Shells, 1.7m above HWL.
- TF-1365. Damle Wadi Guhagar, coastal sediments** **2710 ± 105**
760 BC
Shells from Damle Wadi Guhager (17° 29' 55" N, 73° 13' 35" E),
Dist Ratnagiri, depth -1.1m, 50 m inland from beach.
- TF-1366. Damle Wadi Guhagar, coastal sediments** **2160 ± 90**
210 BC
Shells, depth -2.20m.
- TF-1367. Damle Wadi Guhagar, coastal sediments** **2070 ± 125**
120 BC
Shells, 4m below surface.
- TF-1368. Khare Wadi Guhagar, coastal sediments** **3890 ± 110**
1940 BC
Shells from Khare Wadi Guhager (17° 29' 25" N, 73° 13' 40" E),
Dist Ratnagiri, 4.9m below surface.
- TF-1371. Devgad, coastal sediments** **1950 ± 100**
AD 0
Shells from Devgad (16° 22' 30" N, 73° 24' 50" E), Dist Ratnagiri,
3 to 4m above HWL.
- TF-1372. Malvan, coastal sediments** **1080 ± 105**
AD 870
Shells from Malvan, Kolamb Bridge (16° 4' 5" N, 73° 30' 30" E),
Dist Ratnagiri, 1.4m above HWL.
- TF-1374. Malvan-Vaiyri, coastal sediments** **2190 ± 145**
240 BC
Shells from Malvan-Vaiyri (16° 1' 35" N, 73° 31' 50" E), Dist Rat-
nagiri, 3m below surface.
- Coastal sediments series, Australia**
Samples subm by E D Gill, Nat Mus Victoria, Melbourne.
- TF-1381. S Coast of New South Wales, coastal** **150 ± 80**
sediments **AD 800**
Aragonitic shells from shell grit zone of headland between Nor-
rawallee beach and Norrawalle inlet, off Ulladulla, ca 2m above MSL,
covered with soil, No. 11/1772.

TF-1382. SW of Boggaley Creek, coastal sediments**340 ± 85
AD 610**

Mollusk shells from cemented calcarianite beach rock overlying a pebble bed, at SW end of a small prograded embayment SW of Boggaby Creek, Victoria, No. 12/1972.

V. HYDROSPHERIC SAMPLES

Gujarat groundwater series

Samples subm by B S Sukhija, TIFR, Bombay, to study recharge of aquifers in region.

Sample no.	Location	Well type	Depth	$\delta^{14}\text{C}$ % modern	Aquifer no.
TF-1184	Maktapur, Dist Mehsana (23°42'N, 72°30'E)	Tube-well	320m to 326m	37.4 ± 0.9	Single aquifer tapped
TF-1185	Sipor, Dist Mehsana, (23°40'N, 72°50'E)	-do-	65m	72.8 ± 0.9	Recharge area

Rajasthan groundwater series

Samples subm by V N Nijampurkar, TIFR, Bombay, to study aquifer recharge in area.

Sample no.	Location	Well type	Depth	$\delta^{14}\text{C}$ % modern	Aquifer no.
TF-1122	Ajar, Dist Jaisalmer (27°15'N, 71°43'E)	Tube-well	100m to 117m	33.8 ± 0.8	Second
TF-1151	Chandan, Dist Jaisalmer (26°59'N, 71°18'E)	Tube-well	285m	56.6 ± 0.7	Mixed
TF-1154	Neron, Dist Jaisalmer (26°48'N, 71°28'E)	Dug-well	38m	85.3 ± 1.2	Mixed
TF-1155	Undu, Barmer (26°18'N 71°40'E)	Tube-well	118m	54.8 ± 1.5	

Pacific Ocean series

Subm by B L K Somayajulu, TIFR, Bombay.

General Comment: calcareous material trapped in spongin matrix from Pacific waters at depths 2300 to 3500m. The ratio $^{14}\text{C}/^{12}\text{C}$ corresponds to values observed in surface water in recent years resulting from additional man-made ^{14}C , thus indicating that calcareous particles resulted from recent biologic productivity. Results are related to mean settling rates and sizes and dissolution rates of biogenic calcareous particles in transit through a seawater column.

Sample no.	Location	Date	Depth at which water was flushed (m)	Weight of sponges (kg)	Volume of CO_2 (L)	$\delta^{14}\text{C}$ ‰	$\Delta^{14}\text{C}$ ‰
TF-812	Nova III (Sta 7) (16°00'N, 179°05.7'W)	6/22/67	2200-2300	4	1.20	149 ± 13	92 ± 12
TF-865	Nova VI (Sta 1) (31°41'S, 177°16.2'W)	9/21/67	3400-3500	5	3.00	57 ± 13	4.2 ± 12

Coral X-radiography series

Coral was analyzed to determine growth rates of several coral species. Comparison of growth rates with X-radiographs of same samples lends added evidence that bands observed are seasonal and may therefore be used as growth rate indicators. Subm by S Krishnaswamy, TIFR, Bombay.

Sample no.	Locality	Depth in vertical slice of coral	$\delta^{14}\text{C}$ ‰ modern
TF-1317	Jamnagar	G1, 0-1cm	121.3 ± 2.0
TF-1318	"	" 1-2cm	124.0 ± 1.9
TF-1321	"	" 2-3cm	119.0 ± 1.4
TF-1322	"	" 3-4cm	111.6 ± 1.7
TF-1323	"	" 4-5cm	107.6 ± 1.6
TF-1324	"	" 5-6cm	107.2 ± 1.6
TF-1325	"	" 6-7cm	100.4 ± 1.7
TF-1326	"	" 7-9cm	100.9 ± 1.6
TF-1334	Sikai	G2, 0-1cm	121.9 ± 1.5
TF-1335	"	" 1-2cm	122.8 ± 1.4
TF-1336	"	" 2-3cm	121.6 ± 1.5

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