[RADIOCARBON, VOL. 19, NO. 2, 1977, P. 229-236]

PHYSICAL RESEARCH LABORATORY RADIOCARBON DATE LIST II

D P AGRAWAL, R V KRISHNAMURTHY, SHEELA KUSUMGAR, and R K PANT

Physical Research Laboratory, Ahmedabad 380009, India

Presented below are dates from some important archaeologic and Quaternary sites. For the first time, a large number of dates have been reported here on the eustatic changes on the Eastern Indian coast. All dates are based on $\tau_{1/2} = 5568$ yr; to convert the radiocarbon dates for archaeological samples into AD/BC scale, 1950 has been used as base year as per resolution passed at the Ninth International Radiocarbon Conference, San Diego, 1976. The dates are not corrected for ^{13}C fractionation.

Samples were converted to methane for measuring ^{14}C activity in gas proportional counters. Detailed techniques were described earlier (R, 1971, v 13, p 442-449). All archaeologic samples were given NaOH pretreatment.

General Comment: 3 dates from Rajpura Dariba indicate that copper mines were being exploited even before the 1st millennium BC (PRL-208-210). PRL-220 and -221 confirm that the Jorwe culture extended up to the 1st millennium BC. Early dates from Koldihawa (PRL-224) and Bateshwar (PRL-200) probably indicate some unknown basal cultures in these regions.

ACKNOWLEDGMENTS

We thank M P K Kurup and K K Shivshankar for glass blowing and N B Vaghela for laboratory assistance.

SAMPLE DESCRIPTIONS

I. ARCHAEOLOGIC SAMPLES

PRL-186. Aligrama, Pakistan, Swat Protohistoric Vth period **3070 ± 230**

Charcoal from Aligrama (34° 49′ N, 72° 19′ E), Dist Swat, Loc Tr E, Layer 5b, depth 3.4m; subm by G Stacul, Trieste Univ, Italy.

Amaravati series, Andhra Pradesh

Amaravati (16° 34′ N, 80° 17′ E), a Buddhist site, Dist Guntur; subm by Dir Gen Archaeol, New Delhi.

PRL-157. Northern Black Polished Ware (NBP) deposits (?) **1700 ± 100**

Charcoal, Loc Tr YA-1/3, Layer 10A, depth 4.2m.

PRL-158. NBP deposits (?) **1880 ± 100**

Charcoal, Loc Tr YA-4/3, Layer 12, depth 3.7m.

PRL-165. Habitational layer coeval with early level of the Maha Stupa **1820 ± 130**
Charcoal, Loc Tr YA-3/3, Layer 10, depth 4.2m.

PRL-160. Early phase of Stupa complex **1900 ± 100**
Charcoal, Loc Tr YA-3/2, Layer 10, depth 3.6m.

PRL-162. Early level of the stupa **1950 ± 130**
Charcoal, Loc Tr YA-1/2, Layer 11, depth 4.1m.

PRL-53. Ambamata, India, old copper working **2050 ± 200**
Timber from ancient mine near Ambamata (24° 20′ N, 72° 51′ E), Dist Banaskantha, depth 70m. Coll by N C Shekar; subm by Dir, Min Expl Corp Ltd, Ambaji.

Banawali Sottar series, Haryana

Banawali Sottar, Dist Hissar, a Harappan site; subm by Dir Archaeol, Haryana, Chandigarh.

PRL-207. Harappa culture **3100 ± 100**
Charred grains, Loc Tr ZC2, Layer 6, depth .5 to .6m.

PRL-204. Harappa culture **3260 ± 120**
Charcoal, Loc Tr. ZB1, Layer 10, depth 1.1 to 1.3m.

PRL-203. Harappa culture **3800 ± 150**
Charcoal, Loc Tr ZB1, Layer 12, depth 1.3 to 1.6m.

PRL-205. Harappa culture **3810 ± 180**
Charcoal, Loc Tr ZB1, Layer 14, depth 1.7m.

Bateshwar series, Uttar Pradesh

Bateshwar, Dist Agra, subm by Dir Gen Archaeol, New Delhi. *Comment*: dates show an erratic scatter indicative of stratigraphic disturbance.

PRL-197. Sunga levels **2410 ± 100**
Charcoal, Loc Tr BTR1 A1 Qd 1, Layer 14, depth 4.7m, Field BTR 1/3.

PRL-199. Mauryan levels **590 ± 130**
Charcoal, Loc Tr BTR2 A2, Qd 4, Layer 7A, depth 3m, Field BTR 2/6.

PRL-198. Black and Red Ware (BRW) and Painted Grey Ware (PGW) levels **2490 ± 90**
Charcoal, Loc Tr BTR1 A2, Qd 3, Layer 19, depth 6.6m, Field BTR 1/5.

PRL-200. Transitional phase **5130 ± 240**
Charcoal, Loc Tr BTR2 AW, Qd 4, Layer 8, depth 3.1m, Field BTR 2/7.

PRL-201. Sunga levels **2520 ± 160**

Charcoal, Loc Tr BTR1 A2, Qd 1, Layer 11, depth 4.2m, Field BTR 1/2.

Bharatpur series, West Bengal

Bharatpur (23° 24′ N, 87° 27′ E), Dist Burdwan; subm by Dir Gen, Archaeol, New Delhi. Samples date Chalcolithic levels.

PRL-187. Chalcolithic culture **3040 ± 150**

Charcoal, Loc Tr BRP-1/74 F3, Qd 3, Layer 6, depth 1.9m.

PRL-188A. Chalcolithic culture **2770 ± 140**

Charcoal, Loc Tr BRP-1/74 B3 Qd 1, hearth sealed by Layer 9, depth 2.4m.

Jodhpura series, Rajasthan

Jodhpura (27° 31′ N, 76° 5′ E), Dist Jaipur. Coll by Vijai Kumar, subm by Dir Archaeol and Mus, Rajasthan, Jaipur. Samples date BRW and PGW deposits.

PRL-212. BRW and PGW deposits **2270 ± 100**

Charcoal, Tr D, Layer 9, depth 2.6m.

PRL-213. PGW deposits **2210 ± 110**

Charcoal, Tr E, Layer 7, depth 3.5m.

Khed series, Maharashtra

Khed (18° 20′ N, 74° 50′ E), Dist Ahmednagar, a Jorwe culture site, coll by P Narayana Babu, subm by Dir Deccan College, Poona.

PRL-220. Jorwe culture **2900 ± 160**

Charcoal, Tr KHD-1, Layer 18, depth 2.2m.

PRL-221. Jorwe culture **3040 ± 90**

Charcoal, Tr KHD-1, Layer 7A, depth .9m.

Koldihawa series, Uttar Pradesh

Koldihawa (24° 54′ N, 82° 2′ E), Dist Allahabad; subm by G R Sharma, Allahabad Univ, Allahabad.

PRL-223. Transitional phase from Neolithic to Chalcolithic **3300 ± 120**

Charcoal, Loc Tr KDW-II/Z1, Layers 3 and 4, depth .6 to .9m, Field AU/ALD/KDW-II(DGT)/75-15.

PRL-224. Iron age deposits (?) **8280 ± 210**

Charcoal, Loc Tr KDW-II/Z1, Layer Z1/KM, debris sealed by 1, depth .2 to .4m, Field AU/ALD/KDW-II(DGT)/75-16. *Comment*: sample perhaps represents an earlier phase, compare PRL-100 and -101.

PRL-227. Iron age deposits **2050 ± 110**

Charcoal, Loc Tr KDW-I/E3, Layer E3/KM-VII, Depth .48 to .6m, Field AU/ALD/KDW-I(DGT)/75-20.

Rajpura Dariba series, Rajasthan

Rajpura Dariba (24° 57′ N, 74° 8′ E), ancient mining area, Dist Udaipur; subm by U S Khamesra, Hind Zinc Ltd, Dariba.

PRL-208a. Wood **2140 ± 100**

Wood from E Lode old working, depth 4 to 5m.

PRL-209. Wood **1790 ± 120**

Wood from E Lode old working, depth 263m.

PRL-210. Wood **3040 ± 150**

Wood from Main Lode old working, depth 100m.

PRL-190. Sanghao cave, Pakistan, cave deposits **210 ± 140**

Charcoal from Sanghao cave (34° 28′ N, 72° 12′ E), Loc Tr 1963 E sec, Layer 9, depth 3.6m; subm by Mohmmad Salim, Inst Archaeol, London. *Comment*: sample may merely represent a recent shepherd's fire.

Ulu Leang 1 Cave series, Indonesia

Ulu Leang 1 cave (5° S, 119° 40″ E) a Late Stone age site, Dist Maros; subm by I C Glover, Inst Archaeol, London.

PRL-230. Late Toalian culture **3550 ± 130**

Charcoal, Tr C2, Layer 2, depth .1 to .2m.

PRL-231. Late Toalian culture **4390 ± 110**

Charcoal, Tr C2, Layer 3, depth .2 to .3m.

II. QUATERNARY SAMPLES

PRL-147. Ankleshwar, India, R terrace deposit **68.68 ± 2.05 % modern**

Lime caliche from upper terrace on R Narmada W of Ankleshwar, Dist Broach, coll by N Bedi; subm by Dir Geol, Ahmedabad. *Comment*: caliche is not a well understood material for dating, hence expressed as % modern.

PRL-136. Antisara, India, fluvial deposit **2890 ± 120**

Wood from a pile of channel-fill sediment at Antisara quarry (23° 49′ N, 88° 1′ E), Dist Hooghly, depth 9m; subm by Dir Geochron Isotope Geol Div, Calcutta.

PRL-88. Badalpur, India, oyster bed **24,300 $^{+1700}_{-1400}$**

Shells from Oyster bed along old channel of R Saraswati near Badalpur (20° 53′ N, 70° 29′ E), alt +8.43m, Dist Junagadh; subm by S N

https://doi.org/10.1017/S0033822200003544 Published online by Cambridge University Press

Rajaguru, Deccan College, Poona. *Comment*: sample measured to date eustatic changes in the area.

PRL-44. Browns Creek, Australia, coastal sediments a) **560 ± 95** b) **300 ± 120**

Aragonite shells from boulder bed rising 1m above the beach NE side of mouth of Browns Creek, Otway Hills, Victoria, Sample 13/1972. Subm by E D Gill, Nat Mus Victoria, Melbourne. *Comment*: fraction a is CO_2 evolved from outer shell and fraction b from core.

Coastal sediment series, India

Samples coll by A V N Sharma, Temple Univ, Philadelphia; subm by Dir Gen, Archaeol, New Delhi.

General Comment: samples were measured to date sea-level changes on E coast of India between Madras and Cape Comorin.

PRL-58. Cape Comorin, coastal sediments **33,300 $^{+2500}_{-1900}$**

Corals from Cape Comorin (8° 4′ N, 77° 32′ E), Dist Kanyakumari, alt +6m.

PRL-115. Illankalanvadi, coastal sediments **4200 ± 100**

Lagoon shells from Illankalanvadi (8° 5′ N, 77° 32′ E), Dist Kanyakumari, alt +5m.

PRL-118. Chinna Nattathi, coastal sediments **>40,000**

Lagoon shells from Chinna Nattathi (8° 38′ N, 78° 1′ E), Dist. Tirunelveli, alt +11m.

PRL-119. Pandiya Tivu, coastal sediments **1020 ± 80**

Coral from Pandiya Tivu (old Hare's I.) (8° 45′ N, 78° 13′ E), alt +3m.

PRL-121. Tuticorin Harbour, coastal sediments **28,400 $^{+2600}_{-1900}$**

Marine shells from Tuticorin New Harbour (8° 44′ N, 78° 13′ E), Dist Tirunelveli, Borehole Z, alt −11.6m.

PRL-122. Tuticorin Harbour, coastal sediments **>40,000**

Lime stone with shells from Borehole L, alt −12.7m.

PRL-123. Tuticorin Harbour, coastal sediments **32,100 $^{+2100}_{-1700}$**

Calcareous material from Borehole B, alt −11.4m.

PRL-124. Dubash Chetti, coastal sediments **5310 ± 110**

Marine shells from Dubash Chetti (8° 50′ N, 78° 8′ E), Dist Tirunelveli, 4km inland and 5.6km N of Tuticorin, alt +6m.

PRL-125. Dubash Chetti, coastal sediments **5550 ± 280**
Marine shells alt +3m.

PRL-126. Kamarajapuram, coastal sediments **2710 ± 150**
Lagoon shells from Kamarajapuram (8° 41′ N, 78° 6′ E), Dist Tirunelveli, 4km inland, alt +6m.

PRL-127. Surangadu, coastal sediments **420 ± 140**
Shells from Surangadu (8° 42′ N, 78° 7′ E), Dist Tirunelveli, alt +3m.

PRL-128. Korkai, coastal sediments **3710 ± 100**
Shells from Korkai (8° 38′ N, 78° 4′ E), Dist Tirunelveli, 8km inland, alt +6.5m.

PRL-129. Ayyaniruppu, coastal sediments **22,100 $^{+1100}_{-1000}$**
Shells from Ayyaniruppu (8° 46′ N, 78° 5′ E), Dist Tirunelveli, 9km inland, alt +7m.

PRL-130. Pudukkottai, coastal sediments **29,050 $^{+3500}_{-2400}$**
Lagoon shells from Pudukkottai tank (8° 44′ N, 78° 4′ E), a swampy edge on Sawayerpuram rd, Dist Tirunelveli, 16km inland, alt +14m.

Continental shelf series, W India

Corals from continental shelf off Bombay; subm by R R Nair, Nat Inst Oceanog (NIO), Panaji. *Comment*: samples measured to date sea-level changes on W continental shelf.

PRL-153. Continental shelf sediments **8700 ± 190**
Oolitic limestone from continental shelf floor obtained by dredging off Bombay (19° 30′ N, 70° 34′ E), water depth 82m, sender's Sample 49-08.

PRL-154. Continental shelf sediments **11,010 ± 240**
Oolite concentrate from continental shelf floor obtained by grabbing off Bombay (19° N, 70° 15′ E), water depth 80m, sender's Sample 51-10.

PRL-155. Continental shelf sediments **10,100 ± 230**
Oolite concentrate from continental shelf floor obtained by grabbing off Kathiawar (24° N, 69° 41′ E), water depth 65m, sender's Sample 43-04.

PRL-156. Continental shelf sediments **9670 ± 160**
Oolite concentrate from continental shelf floor obtained by grabbing off Kathiawar (19° 58′ N, 70° 46′ E), water depth 80m, sender's Sample 47-08.

PRL-75. Dahanu, India, raised beach **3540 ± 120**

Shells from raised beach, alt +5 to +6m near Dahanu (19° 59′ N, 72° 44′ E), Maharashtra; subm by Bridget Allchin, Cambridge, UK to study sea-level changes in W India.

PRL-143. Dhamner, India, R sediment **10,130 ± 250**

Shells from Dhamner, Dist Satara, 7 to 10m above bed level of R Krishna, Field No. 1; subm by S N Rajaguru, Deccan College, Poona. *Comment*: sample measured to study Late Quaternary fluvial activity of R Krishna. Deposit yielded few rolled chalcedony Middle Palaeolithic flakes.

PRL-86. Deoghat, India, cemented gravel III **25,070 $^{+810}_{-730}$**

Shells from cemented gravel III near Deoghat on R Belan (24° 54′ N, 82° 2′ E), Dist Allahabad; subm by G R Sharma, Allahabad Univ, Allahabad.

Geneva Lake series, lake sediments

Samples from drill core, 1.44m length, subm by V N Nijampurkar, PRL, Ahmedabad to study sedimentation rate in Geneva Lake, Switzerland.

Sample	Core depth (m)	Date
PRL-31	.3	12,120 ± 215
PRL-32	.3 to .56	13,330 ± 230
PRL-33	.56 to .9	7,010 ± 110
PRL-34	.9 to 1.2	15,440 ± 265
PRL-35	1.2 to 1.44	13,240 ± 195

PRL-79. Kaldevanhalli, India, pebble conglomerate **1560 ± 120**

Shells from a pebbly conglomerate bed exposed along nullah cliff sec near Kaldevanhalli (16° 29′ N, 76° 33′ E), Dist. Gulbarga, depth 3 to 4m. Coll by K Paddayya, subm by Dir Deccan Coll, Poona. Conglomerate yielded Middle Stone age artifacts.

PRL-152. Katral Hill, India, Miliolite deposit **24,600 $^{+3200}_{-2500}$**

Miliolite shells from Katral Hill, Dist Kutch, 13km from Bhuj Mandvi Rd, alt +137m, Field No. 11/94, depth 15m; subm by S K Biswas, Oil Nat Gas Comm, Baroda. *Comment*: date indicates Late Pleistocene origin of miliolite rocks.

Kavaratti Atoll series, India

Kavaratti Atoll (10° 33′ N, 72° 36′ E), Laccadive I., coll by V N Sankaranarayanan; subm by R R Nair, Nat Inst Oceanog, Goa. *Comment*: samples measured to date atoll formation.

PRL-71. Atoll formation **2585 ± 110**

Algal and coral limestone from atoll formation, alt +5m.

PRL-72. Atoll formation **2130 ± 130**

Algal and coral limestone from atoll formation, alt +5m.

PRL-73. Atoll formation **2740 ± 130**

Algal and coral limestone from atoll formation, alt +5m.

PRL-74. Atoll formation **1830 ± 140**

Algal and coral limestone from atoll formation, alt +5m.

PRL-218. Khimeshwar Temple, India, oyster bed **37,400 +11800 − 4600**

Lamellibranch shells from oyster bed, 1.5km N 75° E of temple of Kunchhidi (21° 40′ N, 69° 33′ E), Dist Junagadh, alt +2m, underlies 1m thick recent R clays; subm by U B Mathur. *Comment*: sample dated to study eustatic rise in sea level.

PRL-238. Kolara, India, R Terrace **1660 ± 110**

Peaty clay from R Terrace near Kolara (22° 30′ N, 88° 30′ E), Dist Howrah, depth 2.6m; subm by H P Gupta, Birbal Sahni Inst Palaeobot, Lucknow. *Comment*: samples were dated to study possible subsidence of forest in Bengal basin.

PRL-217. Odador, India, marine deposit **>40,000**

Coralline limestone 3km SE of Odador (21° 34′ N, 69° 40′ E), Dist, Junagadh, alt +3m, overlain by 4m thick aeolinite deposit, subm by U B Mathur, Geol Survey India, Jaipur. *Comment*: sample dated to study strand line.

PRL-148. Pardi, India, R terrace **50.2 ± 0.7 % modern**

Caliche from upper terrace on R Narmada at Pardi, Dist Broach, Field No. GSI/NB/5, depth 2.5m; subm by N Bedi, Geol Survey, Ahmedabad.

PRL-60. Vembanad, India, lake sediment **8385 ± 135**

Decayed wood from Vembanad Lake, Dist Kottayam, depth 25.9m below lake bed, Field 278, subm by P S N Murty. NaOH pretreatment. *Comment*: sample measured to compute sedimentation rate in lake.

PRL-21. Vishakapatanam, India, continental shelf **13,690 +300 −330**

$CaCO_3$ from 1m drill core off Vishakapatanam (17° 2′ N, 83° 3′ E), water depth 206m, Field 452; subm by P S N Murty. *Comment*: sample measured to date terrigenous sediment deposition on slope region.

REFERENCE

Agrawal, D P, Gupta, S K, and Kusumgar, Sheela, 1971, Tata Institute date list IX: Radiocarbon, v 13, p 442-449.