

PHYSICAL RESEARCH LABORATORY RADIOCARBON DATES: CS II

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PRESENTED below are the ^{14}C dates on the Quaternary samples. Samples were measured as detailed earlier (Agrawal *et al.*¹, Agrawal *et al.*²). Ninety-five per cent activity of NBS oxalic acid was used as modern standard. All the samples were given HCl pretreatment.

The dates in years BP are given for each sample based on the half-life values of 5568 ± 30 and 5730 ± 40 years, the latter in parenthesis. Dates older than ten thousand years are given with 2σ errors. Errors are those of counting statistics only. Dates are not calibrated for $^{14}\text{C}/^{12}\text{C}$ variation. To convert the dates into AD/BC scale, 1950 AD should be used as reference year.

The ^{14}C dates on pollen sequence from Toshmaidan (PRL-2 to 5, PRL-7, PRL-9 to 10 and PRL-12) indicate that deglaciation in Kashmir valley started c. 15000 BP. A large number of samples from the eastern coast (PRL-58, -115, PRL-118 to 130) and from western continental shelf (PRL-153 to 156) were measured to study sea-level fluctuations.

Andada, Gujarat, India

PRL-146, Terrace deposit, 31830 \pm 4010
-2660

(32760 \pm 4120)
-2740

Lime caliche from upper terrace on river Narmada near Andada, District Broach, depth 3 m, sample submitted by N. Bedi, Geological Survey of India, Ahmedabad. Sender's sample No. GSI/NB/3.

Ankaleshwar, Gujarat, India

PRL-147, Terrace deposit, 3060 \pm 240
(3150 \pm 250)

Lime caliche from the upper terrace on river Narmada, west of Ankaleshwar, District Broach, depth 3 m, sample submitted by N. Bedi, Geological Survey of India, Ahmedabad.

Antisara, West Bengal, India

PRL-136, Fluvial deposit, 2890 \pm 120
(2970 \pm 120)

Wood from a pile of channel-fill sediment at Antisara quarry (Lat. $23^{\circ} 49' \text{ N.}$, Long. $88^{\circ} 1' \text{ E.}$), Dist. Hooghly, depth 9 m, sample submitted by the Director, Geochronology and Isotope Geology Division, Geological Survey of India, Calcutta.

Bombay, Maharashtra, India

PRL-42, Continental shelf sediment, 11120 \pm 316
304

(11440 \pm 313)
-326

Shelf sediment from 0.38 m long drill core off Bombay, sender's sample No. V3/H-1-1/P, sample submitted by B.S. Venkatachala, Palynology Laboratory, Dehra Dun.

Badalpur, Gujarat, India

PRL-88, Oyster bed, 24270 \pm 1630
-1360

(24980 \pm 1680)
-1400

Shells from Oyster bed along the old channel of river Saraswati near Badalpur (Lat. $20^{\circ} 53' \text{ N.}$, Long. $70^{\circ} 29' \text{ E.}$), altitude 48.3 m, District Junagadh, sample submitted by S. N. Rajaguru, Deccan College, Poona. *Comment*: Sample measured to date eustatic changes in the area.

Browns Creek, Australia

PRL-44, Coastal sediments Fr. A, 560 \pm 95
(575 \pm 100)

Fr. B, 300 \pm 120
(310 \pm 125)

Aragonite shells from boulder bed rising 1 m above the beach on the north-eastern side of mouth of Brown Creek, Otway Hills, Victoria, sample No. 13/1972. Samples submitted by E. D. Gill, Museum of Victoria, Victoria, Melbourne. *Comment*. Fraction A is CO_2 evolved from outer shell and fraction B from core.

Coastal Sediments, Eastern Coast, India

Samples collected by A. V. N. Sarma, Temple University, Philadelphia, samples submitted by the Director General, Archaeological Survey of India, New Delhi. *Comment*: Samples dated to study eustatic changes on the eastern coast of India.

PRL-58, Cape Comorin, Coastal Sediments,

33270 \pm 2435
-1845

(34240 \pm 2505)
-1895

Corals from Cape Comorin (Lat. $8^{\circ} 04' \text{ N.}$, Long. $77^{\circ} 34' \text{ E.}$), District Kanyakumari, Altitude \pm 6 m.

- PRL-115, Illankalanvadi, coastal sediments,
 4200 ± 100
 (4320 ± 100)
 Lagoon shells from Illankalanvadi (Lat. 8° 5' N., Long. 77° 32' E.), District Kanyakumari, altitude +5 m.
- PRL-118, Chinna Nattathi, coastal sediments, > 40,000
 (>45,000)
 Lagoon shells from Chinna Nattathi (Lat. 8° 38' N., Long. 78° 1' E.), District Tirunelveli, altitude + 11 m.
- PRL-119, Pandiya Tivu, coastal sediments, 1020 ± 80
 (1050 ± 80)
 Coral from Pandiya Tivu (old Hare's Island) (Lat. 8° 45' N., Long. 78° 13' E.), altitude + 3 m.
- PRL-120, Pandiya Tivu, coastal sediments, 2070 ± 100
 (2130 ± 100)
- PRL-121, Tuticorin Harbour, coastal sediments,
 28360 + 2605
 - 1860
 (29180 + 2675)
 - 1915)
 Marine shells from Tuticorin, New Harbour (Lat. 8° 44' N., Long. 78° 13' E.), District Tirunelveli, Borehole Z, altitude - 11.6 m.
- PRL-122, Tuticorin Harbour, coastal sediments,
 >40,000
 (>45,000)
- Limestone with shells from Borehole L, altitude - 12.7 m.
- PRL-123, Tuticorin Harbour, coastal sediments,
 32070 + 2060
 - 1690
 (33000 + 2125)
 - 1740)
- Calcareous material from Borehole B, altitude - 11.4 m.
- PRL-124, Dubash Chetti, coastal sediments, 5310 ± 110
 (5470 ± 110)
 Marine shells from Dubash Chetti (8° 50' N., Long. 78° 8' E.), District Tirunelveli, 4 km inland and 5.6 km N. of Tuticorin, altitude + 6 m.
- PRL-125, Dubash Chetti, coastal sediments, 5550 ± 280
 (5710 ± 290)
 Marine shells from Dubash Chetti, altitude + 3 m.
- PRL-126, Kamarajapuram, coastal sediments,
 2710 ± 150
 (2790 ± 150)
 Lagoon shells from Kamarajapuram (Lat. 8° 41' N., Long. 78° 6' E.), District Tirunelveli, 4 km inland, altitude + 6 m.
- PRL-127, Surangadu, coastal sediments, 420 ± 140
 (430 ± 150)
 Shells from Surangadu (Lat. 8° 43' N., Long. 78° 7' E.), altitude + 3 m.
- PRL-128, Korkai, coastal sediments, 3710 ± 100
 (3820 ± 110)
 Shells from Korkai (Lat. 8° 38' N., Long. 78° 4' E.), District Tirunelveli, 8 km inland, altitude + 6.5 m.
- PRL-129, Ayyaniruppu, coastal sediments,
 22050 + 1060
 - 940
 (22690 + 1095)
 - 965)
 Shells from Ayyaniruppu (Lat. 8° 46' N., Long. 78° 5' E.), District Tirunelveli, 9 km inland, altitude + 7 m.
- PRL-130, Pudukkottai, coastal sediments,
 29050 + 3525
 - 2345
 (29900 + 3625)
 - 2415)
 Lagoon shells from Pudukkottai tank (Lat. 8° 44' N., Long. 78° 4' E.), a swamp edge on Sawayerpuram Road, District Tirunelveli, 16 km inland, altitude + 14 m.
- Continental Shelf, West Coast, India**
 Corals from continental shelf off Bombay, samples submitted by R. R. Nair, National Institute of Oceanography (NIO), Panaji. *Comment* : Samples measured to date sea-level changes on western continental shelf.
- PRL-153, Continental shelf sediments, 8700 ± 190
 (8960 ± 200)
 Oolitic limestone from continental shelf floor obtained by dredging off Bombay (Lat. 19° 31' N., Long. 70° 34' E.), water depth 82 m, sender's sample No. 49-08.
- PRL-154, Continental shelf sediments, 11010 + 375
 - 355
 (11330 + 385)
 - 365)
 Oolite concentrate from continental shelf floor obtained by grabbing off Bombay (Lat. 19° N., Long. 70° 15' 6" E.), water depth 80 m, sender's sample 51-10.
- PRL-155, Continental shelf sediments, 10100 + 380
 - 335
 (10400 + 390)
 - 345)
 Oolite concentrate from continental shelf floor obtained by grabbing off Kathjavar (Lat. 24° N.,

Long. 69° 41' E.), water depth 65 m, sender's sample 43-04.

PRL-156, Continental shelf sediments, 9670 ± 160
(9960 ± 160)

Oolite concentrate from continental shelf floor obtained by grabbing off Kathiawar (Lat. 19° 58' N, Lat. 70° 46' E.), water depth 80 m, sender's sample 47-08.

Dahanu, Maharashtra, India

PRL-75, Raised beach 3540 ± 120
(3640 ± 120)

Shells from raised beach, near Dahanu (Lat. 19° 59' N., Long. 72° 44' E.), Maharashtra, altitude +5 to +6 m, submitted by Bridget Allchin, Cambridge, U.K. *Comment*: Sample measured to study sea-level changes in western India.

Dhamner, Maharashtra, India

PRL-143, River sediment, $10130 + 530$
- 230

($10430 + 540$)
- 240)

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

PRL-86, Cemented gravel III, $25070 + 810$
- 730

($25790 + 830$)
- 760)

Shells from cemented gravel III, Locality VI near Deoghat on river Belan (Lat. 24° 54' N., Long. 82° 2' E.), District Allahabad, submitted by Prof. G. R. Sharma, Allahabad University, Allahabad.

Dungarpur, Gujarat, India

PRL-191, Miliolite deposit, $19780 + 850$
- 950

($20360 + 880$)
- 980)

Miliolite from 'Dungarpur, District Junagarh, depth 12.3 m, sample submitted by D. P. Agrawal, PRL, Ahmedabad. *Comment*: Samples dated to study miliolite formation.

Geneva Lake, Switzerland

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

Sample	Core depth in meter	Date
PRL-31	0.3	$12120 + 323$ - 310 ($12475 + 332$) - 319)
PRL-32	0.3 to 0.56	$13325 + 340$ - 327 ($13710 + 350$) - 336)
PRL-33	0.56 to 0.9	7010 ± 110 (7215 ± 115)
PRL-34	0.9 to 1.2	$15435 + 408$ - 401 ($15885 + 420$) - 413)
PRL-35	1.2 to 1.44	$13240 + 290$ - 293 ($13625 + 299$) - 302)

Kaldevanhalli, Karnataka, India

PRL-79, Pebble conglomerate, $1560 + 120$
(1600 ± 120)

Shells from a pebbly conglomerate bed exposed along nullah cliff section near Kaldevanhalli (Lat. 16° 29' N, Long. 76° 33' E.), District, Gulbarga, depth 3 to 4 m, sample collected by K. Paddayya and submitted by the Director, Deccan College, Poona. *Comment*: The conglomerate yielded Middle Stone Age artifacts.

Katral Hill, Gujarat, India

PRL-152, Miliolite deposit, $24610 + 3145$
- 2465

($25320 + 3240$)
- 2530)

Miliolite shells from Katral Hill, District Kutch, 13 km from Bhuj Mandvi Road, altitude +137 m, Field No. 11/94, depth 15 m, submitted by S. K. Biswas, Oil and Natural Gas Commission, Baroda.

Kavaratti Atoll, Lakshadweep, India

Kavaratti Atoll (Lat. 10° 33' N., Long. 72° 36' E.), samples collected by V. N. Sankaranarayanan, submitted by R. R. Nair, National Institute of Oceanography, Goa. *Comment*: Samples measured to date the atoll formation.

PRL-71, Atoll formation, 2585 ± 110
(2660 ± 110)

Algal and coral limestone from Atoll formation, altitude +5 m.

PRL-72, Atoll formation, 2130 ± 130
(2190 ± 140)

PRL-73, Atoll formation, 2740 ± 130
(2820 ± 140)

Algal and coral limestone from Atoll formation, altitude + 5 m.

Navunda, Karnataka, India

Navunda village (Lat. $13^{\circ} 45' N.$, Long. $74^{\circ} 38' E.$, District South Canara, samples submitted by Sri P. S. N. Murthy, National Mineral Development Corporation Ltd., Mangalore. *Comment* : Samples measured to study lignitic stratigraphy.

PRL-103, Lignite deposit, > 40000
(> 45000)

Lignite from a 6 m deep well and 1.5 m below water level.

PRL132, Lignitised wood deposit, $38295 + 5330$
- 3145
($39410 + 5480$)
- 3240)

Fragments of lignitised wood 9.4 m below surface and 1.2 m below water level. *Comment* : Finite age indicates probable contamination.

Panetha, Gujarat, India

PRL-145, Terrace deposit, 6470 ± 180
(6660 ± 190)

Pedocal with lime-caliche from upper terrace on river Narmada near Panetha, District Broach, depth 2.5 m, sample collected and submitted by N. Bedi, Geological Survey of India, Ahmedabad, sender's sample No. GSI/NB/2.

PRL-148, River terrace, 5490 ± 120
(5650 ± 120)

Caliche from upper terrace on river Narmada at Pardi, District Broach, depth 2.5 m, sample submitted by N. Bedi, Geological Survey of India, Ahmedabad, sender's sample No. GSI/NB/5.

Prabhas Patan, Gujarat, India

PRL-30, Oyster shell bed, $20825 + 670$
- 540
($21430 + 690$)
- 560)

Shells from oyster bed on river Hiran, District Junagarh, sample submitted by D. P. Agrawal, PRL, Ahmedabad. *Comment* : Bed yielded Middle Palaeolithic tools.

Sankhu, Nepal

Sankhu (Lat. $27^{\circ} 43' N.$, Long. $88^{\circ} 28' E.$), District Kathmandu, samples submitted by Vishnu Mittre, Birbal Sahni Institute of Palaeobotany, Lucknow. *Comment* : Samples were measured to date pollen sequence.

PRL-192, Carbonaceous clay deposit, $16900 + 1010$
- 900
($17400 + 1040$)
- 920)

Peaty clay II from exposed section, depth 11.3 m, sender's sample No. Sankhu Boudh 1.

PRL-193, Carbonaceous clay deposit, > 40000
(> 45000)

Peaty clay III from exposed section, depth 13.75 m, sender's sample No. Sankhu Boudh 2.

PRL-194, Carbonaceous clay deposit, > 40000
(> 45000)

Peaty clay III from exposed section, depth 14.15 m, sender's sample No. Sankhu Boudh 3.

PRL-195, Carbonaceous clay deposit, > 40000
(> 45000)

Peaty clay III from exposed section, depth 14.45 m, sender's sample No. Sankhu Boudh 4.

PRL-196, Carbonaceous clay deposit, > 40000
(> 45000)

Peaty clay III from exposed section, depth 14.75 m, sender's sample No. Sankhu Boudh 5.

Toshmaidan, Jammu and Kashmir, India

Toshmaidan (Lat. $33^{\circ} 56' N.$, Long. $73^{\circ} 31' E.$), District Srinagar, sample submitted by Dr. G. Singh, Australian National University, Canberra and Dr. D. P. Agrawal, PRL, Ahmedabad. *Comment* : Samples were measured to date pollen sequence in a bog.

Sample	Serial number	Depth (m)	Material	Sieve fraction	Pollen stage	Date
PRL-2B	II	0.15 to 0.35	Peat	420	g	2790 ± 160 (2870 ± 165)
PRL-3	III	0.55 to 0.7	Peat	420	d	9650 ± 245 (9930 ± 255)
PRL-4B	IV	0.75 to 0.90	Peat	420	d	10005 ± 340 - 380 (10295 ± 350) - 390)

Sample	Serial number	Depth (m)	Material	Sieve fraction	Pollen stage	Date
PRL-5	V	1.25 to 1.4	Peat	420	d	11360+585 -600 (11690+605) -615)
PRL-7	VII	2.05 to 2.2	Fine Organic Mud	..	c	13980+520 -565 (14390+535) -580)
PRL-9	IX	2.8 to 2.95	Clay mud	..	c	15250+760 -820 (15690+780) -840)
PRL-10	X	3.17 to 3.27	Clay mud	..	ab	14760+1015 -925 (15190+1045) -950)
PRL-12	XII	3.37 to 3.5	Blue grey lacustrine clay	..	ab	13830+900 -785 (14230+925) -810)

Vembanad, Kerala, India

PRL-60, Lake sediment, 8385 ± 135
(8630 ± 140)

Decayed wood from Vembanad Lake, District Kottayam, depth 25.9 m below lake bed, water depth 4.5 m, Field No. 278, sample submitted by Sri P. S. N. Murty. *Comment*: Sample measured to compute sedimentation rate in the lake.

Visakhapatnam, Andhra Pradesh, India

PRL-21, Continental shelf, 13685 + 302
- 326
(14080 + 311)
- 335)

CaCO₃ from 1 m drill core off Visakhapatnam (Lat. 17° 2' N, Long. 83° 3' E.), water depth 206 m, Field No. 452, sample submitted by Sri P. S. N. Murty. *Comment*: Samples measured to date terrigenous sediment deposition on the slope region.

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1. Agrawal, D. P., Kusumgar Sheela and Lal, D., *Curr. Sci.*, 1965, 34 (13), 394.
2. —, Gupta, S. K. and Kusumgar Sheela, *Radiocarbon*, 1971, 13 (2), 442.

SYMPOSIUM ON THE ROLE OF INDUCED MUTATIONS IN CROP IMPROVEMENT

A Symposium on the Role of Induced Mutations in Crop Improvement organized by the Food and Agriculture Committee of the Department of Atomic Energy will be held at the Department of Genetics, Osmania University, Hyderabad, from September

10-12, 1979. Prof. G. M. Reddy will be the local Secretary. Further information regarding this Symposium can be obtained from Dr. C. R. Bhatia, Biology and Agriculture Division, Bhabha Atomic Research Centre, Bombay 400 085.