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RADIOISOTOPES LABORATORY RADIOCARBON DATE LIST I

A J SUMODI
Dicar Corporation, Cleveland, Ohio 44116

INTRODUCTION

The Radioisotopes Laboratory was established in January 1972, in order to supply radiocarbon measurements of various samples to several institutions. Active analyses commenced in June following the testing and evaluation of equipment and known samples for accuracy and reproducibility. During this time, data was accumulated for the statistical establishment of counting accuracy, particularly for background activity.

The laboratory utilizes liquid scintillation counting techniques for radiocarbon analysis through conversion of sample carbon to benzene. The underlying principles in the synthesis techniques are those developed by Noakes *et al*, (1965; 1967; 1971) without major modifications. A vanadium-alumina catalyst (Task) is used at reduced temperature for the acetylene to benzene conversion.

The radiocarbon-containing benzene sample is mixed with the scintillator solution and counted in one of 3 Picker Nuclear Corporation Liquimat 220 liquid scintillation spectrometers. Counting time is dependent on estimates sample age and is usually 4000-5000 mins. Age calculations are routinely performed on a Wang Model 450 programmable electronic calculator.

LABORATORY OPERATIONS

Samples are routinely inspected under 20X illuminated magnification for obvious impurities (rootlets, leaves, bush bristles, etc) and are prepared for chemical removal of contaminants. Unless otherwise indicated, all samples are routinely pretreated even when no contamination is evident.

A charcoal or wood sample free of rootlets is broken into fragments 2 to 3cm long and 5 to 6mm thick, treated with 2.0N NaOH at room temperature and stirred for 24 hrs, filtered, washed and treated in boiling 2.0N NaOH for 3 hrs. Filtering and boiling are repeated with the sample receiving an additional final base soak at room temperature for 48 hrs. The sample is then stored in 2.0N HCl for 48 hrs for carbonate removal and minimization of atmospheric carbon dioxide uptake. Washing to neutrality with distilled water completes the procedure.

If rootlet contamination is suspected, the standard base treatment is augmented by slightly modified procedures (Michael and Ralph, 1970). The charcoal is placed in concentrated HCl (18M) followed by slow addition, with stirring, of NaOCl, and remains in solution overnight. Next follows thorough washing and nitration in a 1:1 mixture of concentrated HNO_3, H_2SO_4 for 2 hrs at room temperature. The residue is

washed to neutrality and extracted with $(CH_3)_2$ CO until no further soluble material remains. Washing in distilled water completes the process.

The same procedures used for charcoal are employed for wood, with decreased solution times and approximate doubling of sample quantities. The wood is oxidized for ½ hr while nitration is continued for a maximum of 20 mins. Longer duration reduces significant quantities of useful sample as discussed by Loudon (1969).

After establishing relative peat insolubilities in base solutions, samples are treated in 0.2N NaOH for 30 mins at room temperature, washed to neutrality, and placed in 1.0N HCl at room temperature for 15 mins. A final washing follows.

Prior to chemical pretreatment, shells are scoured with a stiff brush and ultrasonically washed for 5 mins when possible. Sample size permitting, ca 20% of outer shell layer is removed by acid leach using a quantity of concentrated HCl at room temperature equal to 0.33 times the weight of shell in grams (Loudon, 1973, pers. commun). The residue is then filtered and washed to neutrality in distilled water.

Bone is routinely processed and analyzed according to Krueger (1965) and Haynes (1967) for dating bone collagen with slight modifications. Whereas acid concentration is maintained at 1.0N bone decomposition continues under refrigeration at 10°C permitting recovery of more collagen. After filtration and washing, the residue is treated with cold 1.0N NaOH for 2 hrs prior to combustion.

Various types of foraminifera . . . shells and carbonate oozes are routinely treated with NaOCl at room temperature overnight after crushing. The submitter is asked to separate the core material to minimize contamination.

Table 1 gives the suggested minimum quantities for analysis.

TABLE 1

Minimum suggested sample quantities

Material	Amount (g)
charcoal	10
wood	10
peat	25-35
bone	300-500
shell	100-150
foram*	8-10

* sample weight less core material

Purified samples are routinely converted to benzene using the methods of Noakes *et al,* (1965) with ancillary improvements in techniques. Lithium is supplied by the Lithium Corporation of America (Lithcoa) in dry packed shot form, and refrigerated until used. The possibility of carbon dioxide decomposition to carbon is avoided as

indicated by Polach (1967) by permitting small quantities of the sample CO_2 to be "pulsed" into the lithium chamber. At no time is the pressure of the CO_2 allowed to build up. The lithium carbide mixture is heated to 900°C for 1 hr and evacuated to insure complete conversion and effective radon removal.

Benzene yields may be improved if a dry ice-isopropyl alcohol bath is placed around the catalyst column during acetylene introduction. This results in a negligible production of ethylbenzene and a more uniform utilization of the entire catalyst column during trimerization. These techniques have been found to yield 1 to 3.0g pure benzene from an 8g carbon sample.

The sample benzene is placed in tared, low potassium vials, from the Packard Corporation (Packard) and adjusted to a final volume of 10ml with spectrophotometric grade benzene. Four ml aliquots of a scintillation solution containing 6.250g PPO and 0.624g POPOP in 500ml spectrophotometric grade benzene is added to the sample and dark adapted for 30 mins prior to counting. Sample counts are accumulated for 4 to 6000 mins depending upon estimated sample age.

Sample activity is determined in 1 of 3 Picker dual channel liquid scintillation spectrometers operated in the coincidence mode and maximized for exclusion of tritium counts. Discriminator settings are adjusted for ^{14}C activity isolation and calibrated to accept a moderate range of quenching action through external standards channels ratio. Although it has been found that little, if any, ^{14}C quench occurs, samples are routinely checked and compared with background information for any significant discrepancy. Table 2 gives the pertinent information for each counter.

TABLE 2

Property	Counter I	II	III
^{14}C activity ($cm^{-1}\ g^{-1}$)	6.629	7.025	6.631
Efficiency (%)	60.58	59.65	60.28
Figure of merit*	452	440	421
Window**	350-625	300-600	325-600
^{3}H efficiency	26.23	23.09	24.11
Window**	0.050-0.114	0.040-0.116	0.050-0.120
Average background ($cm^{-1}\ g^{-1}$)	8.430 ± 0.029	8.011 ± 0.027	8.481 ± 0.028

* Defined as E^2/B where E = efficiency, B = background.
** Lower and upper discriminator settings, respectively.

Fluctuations in the number of accumulated counts due to vial activity are minimized by counting "background" in the same vial with

the same volume composition as used for sample analysis. Thorough cleaning prevents any interference from residual sample activity. Backgrounds are accumulated for 2 to 3000 mins and averaged with the accumulated total for age calculations. Table 3 gives the average monthly background activity as presently established.

TABLE 3

Average monthly background activity
(in cpm)

Month	Counter I	Counter II	Counter III
1972–Oct	8.860 ± 0.043	7.927 ± 0.026	8.420 ± 0.025
Nov	8.890 ± 0.026	8.266 ± 0.017	8.738 ± 0.026
Dec	8.657 ± 0.020	8.591 ± 0.025	8.654 ± 0.023
1973–Jan	8.178 ± 0.027	8.262 ± 0.040	8.429 ± 0.039
Feb	8.105 ± 0.041	7.273 ± 0.024	8.597 ± 0.030
Mar	8.172 ± 0.022	7.573 ± 0.033	8.590 ± 0.022
Apr	8.151 ± 0.023	8.140 ± 0.022	8.644 ± 0.029
Average	8.430 ± 0.029	8.011 ± 0.027	8.581 ± 0.028

A slight adjustment was made with the discriminator settings of Counter II in February and again in April to analyze certain characteristics of the photomultiplier tubes. For this reason the apparent changes in averaged monthly background counts are shown in the table.

Calculations are affected using 95% activity of NBS 1950 oxalic acid with an accepted half-life of 5568 ± 30 yr as recommended by the editors of RADIOCARBON. The associated error of each age includes the uncertainty in sample, background, and standard counts but does not include the half-life uncertainty. Numbers are reported to the nearest decade.

Benzene conversion of the oxalic acid standard is effected by "wet" oxidation techniques with, at present, no corrections made for isotope fractionation. Determination of standard specific activity is routinely performed once a month and averaged with an associated background accumulation of the existing data.

Submitted reports involve the printer tabulation of accumulated sample and background counts, a duplicate report detailing chemical pretreatment and procedures steps, and a calculation sheet detailing age determinations based on 2σ criterion. For date list publications, these values have been converted to 1σ.

Analysis of samples dated by other sources, is a continuing activity and is performed whenever time and spectrometer availability permit. Table 4 presents the ages determined for various check samples from various sources as currently established.

TABLE 4

Results of check sample analyses

Radioisotopes laboratory			Other labs	
Sample	Sample no.	Age	Sample no.	Age
Charcoal	DIC-4	1645 ± 90	M-2217	1570 ± 110
			Wis-537	1640 ± 50
Wood	DIC-5	12,200 ± 200	UGa-441	12,275 ± 230
Wood	DIC-6	26,000 ± 800	UGa-442	26,620 ± 600
Wood	DIC-8	22,020 ± 650	UGa-443	21,120 ± 290

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SAMPLE DESCRIPTIONS

I. ARCHAEOLOGIC SAMPLES

A. United States

1. Michigan

765 ± 70

DIC-1. Indian Trails **AD 1185**

Human bone from ossuary, Late Woodland Younge tradition multiple reburial. Sample from Indian Trails site (20 MR 4), sand ridge (alt 180m) on S bank of Stoney Creek, Exeter Twp, Monroe Co, Michigan (42° 0′ 30″ N, 83° 47′ 30″ W). Sample is probably remains of 3 individuals (cranial, pelvic fragments) assoc with a sealed burial pit with ceramics of Macomb Linear and Springwells Net Impressed types. Coll by R Patton; subm by D Brose, Anthropol Dept, Case Western Reserve Univ, Cleveland, Ohio.

880 ± 100

DIC-13. Fisher Lake **AD 1070**

Human bone from Feature 2, Fisher Lake site, N shore of Big Glen Lake at outlet to Crystal R 3km S of Lake Michigan, Lelanau Co, Michigan (45° 0′ N, 83° 0′ W). Sample from sealed storage pit on low sand ridge. Matrix consists of fish bone, elk bone, and cultural material including small corner-notched points of local Eastport cherts and ceramics similar to Bois Blanc Braced Rim and Hein's Greek Corded–Stamped types. Coll and subm by D and B Brose.

900 ± 100

DIC-14. Pemco **AD 1050**

Human bone from salvage operation on S edge of Tuttle Hill site, Trench D, and composed of bluff top village and burial complex on W bank of Cuyahoga R, Cuyahoga Co, Ohio. Area should relate to Tuttle Hill site (Greenman, 1937) 200m N. Sample represents pit burial assoc with both small corner-notched and triangular points. Assoc ceramics include types analogous to Baum Cord-marked (Griffin, 1943), Anderson Incised (Griffin, 1943), Fairport Plain (Fitting, 1964), Mixter Dentate (Shane, 1967). Coll and subm by D Brose. *Comment*: pit represents earliest occupation of site.

740 ± 55

DIC-19. Chagrin River **AD 1216**

Tree branch, possibly red oak, from Chagrin R alluvium, Eastlake, Ohio, alt 200m, (40° N, 81° 26′ W) at depth 5m. Root ends oriented uniformly westward. Observed at center of E wall of excavation, overlain by silt, yellow river gravel and sand, black river gravel and sand. Subm by D Brose.

870 ± 60

DIC-21. Chagrin River **AD 1080**

Tree branch, possibly poplar, from Chagrin R alluvium, Eastlake, Ohio at depth 5m (*cf* DIC-19, above). Subm by D Brose. *Comment*: sample underlies Early Whittlesey phase occupation.

1930 ± 60

DIC-33. Gladieux site, Unit 1, Pit 1 **AD 20**

Charcoal, from bluff habitation site along N shore of Maumee R, Lucas Co, (41° 35′ N, 83° 37′ W), 25 to 31cm below surface of cultural pit from single component site, clay. Cultural material typically Western Basin Middle Woodland, similar to material from North Bass Island burial mound. Coll by E J Prahl; subm by D M Stothers, Anthropol and Sociol Dept, Univ Toledo, Toledo, Ohio.

Doctor's Site series

780 ± 60

DIC-40. Doctor's site, No. 1-C **AD 1170**

Charcoal from stratum representing single cultural occupation. Sample from test pit in midden deposit, 15 to 45cm below surface along S side of Ottawa Creek in Lucas Co, Point Place, USGS 7½′ quad (41° 42′ N, 83° 30′ W). Sample denotes Late Woodland provenience culturally related to Peter's phase of Cole horizon. Coll by E J Prahl; subm by D M Stothers.

670 ± 65

DIC-34. Doctor's site, No. 2-C **AD 1280**

Charcoal from stratum representing single cultural occupation of site No. 2-C (*cf* DIC-40, above). Coll by E J Prahl, subm by D M Stothers.

850 ± 65

DIC-39. Doctor's site, No. 3-C **AD 1100**

Charcoal from stratum representing single cultural deposit (*cf* DIC-40, above). Coll by E J Prahl; subm by D M Stothers.

Waterworks Burial Mound series

1120 ± 55

DIC-51. Waterworks Burial Mound, No. 1-A **AD 830**

Charcoal, burnt twigs, from hearth feature at base of burial mound, matrix of clayey silt. Feature H2/Sq 1, Lucas Co, Ohio, Reno Beach, USGS 7½′ quad (41° 41′ N, 83° 18′ W), representing Middle Woodland to Late Woodland transition. Coll and subm by D M Stothers.

1460 ± 55

DIC-36. Waterworks Burial Mound, No. 2-A **AD 490**

Charcoal in clayey silt from exploratory trench at base of burial mound, assoc with partially charred human skeleton. Feature Tr Du 1, (41° 41′ N, 83° 18′ W) (*cf* DIC-51, above). Coll by E J Prahl; subm by D M Stothers.

1460 ± 55

DIC-48. Waterworks Burial Mound, No. 3-A **AD 490**

Charcoal and clayey silt from fill encompassing a flexed burial at base of mound. Feature Sq 3/Bu 2 (41° 41′ N, 83° 18′ W) (*cf* DIC-51, above). Coll and subm by D M Stothers.

590 ± 75

DIC-37. Williams site, No. 1-D **AD 1360**

Charcoal from refuse pit, 15 to 30cm below subsoil in sandy silt on edge of Maumee R flood plain, S of Toledo (41° 31′ N, 83° 40′ W) Wood Co, Maumee, USGS 7½′ quad. Assoc artifactual sample considered representative of Upper Mississippian culture. Coll by E J Prahl; subm by D M Stothers.

1410 ± 65

DIC-60. North Bass Island **AD 540**

Charcoal, possibly cedar, clayey matrix in File C, 0.3 to 0.6m below surface, from crypt with assoc cremations, possibly typical of Western Basin Middle Woodland. Mound located on S central shore of North Bass I in W basin of Lake Erie (41° 42′ N, 82° 49′ W) Ottawa, Co, Put-in-Bay, USGS 7½′ quad. Coll by E J Prahl; subm by D M Stothers.

1690 ± 60

DIC-50. North Bass Island, No. 2-B **AD 260**

Burnt cedar logs from crematory crypt in clayey matrix 0.3 to 0.6m below surface of mound near center and base of mound. Sample from North Bass I burial mound (*cf* DIC-60, above). Coll by E J Prahl; subm by D M Stothers.

Patyi-Dowling Site series

480 ± 55

DIC-42. Patyi-Dowling site, No. 1-G **AD 1470**

Charcoal from burial in yellow sand subsoil overlying sandy humus from fill encompassing burial with grave pit below plow zone. Burial designated Feature 1, Pit Feature 2 (41° 37′ 19″ N, 83° 55′ 05″ W) Fulton Co, Ohio. Sample represents Springwells phase. Coll by R Cufr; subm by D M Stothers.

650 ± 50

DIC-55. Patyi-Dowling site, No. 2-G **AD 1300**

Charcoal from pit 3m from burial containing undefined variant of Macomb Linear ceramics (*cf* DIC-42, above). Coll by R Cufr; subm by D M Stothers.

2390 ± 100

DIC-53. Bone fragments **440 BC**

Human bone cremation fragments in sandy matrix representing red ocher Archaic cremation with assoc cremation items. Sample from burial pit below plough zone along flood plain of Maumee R 3.2km SW of Fort Meigs (32° 30′ N, 83° 40′ 15″ W), Wood Co. Coll by Toledo Area Aboriginal Research Club; subm by D M Stothers. *Comment*: date is slightly more recent than expected and a duplicate sample is being analyzed. Results will be listed later.

2. Tennessee

Site 40 series

1660 ± 80

DIC-28. Site 40 LD-45, No. 254 (F 18) **AD 290**

Finely divided charcoal in clayey matrix from Feature 18, shallow basin-shaped fire pit containing several burned quartzite cobbles. Points of origin 0.3m below present surface, base of Level II midden 35° 45′ 22″ N, 84° 22′ 15″ W), Loudon Co. Sample dates Early Woodland occupation of site and adjoining Early Woodland house of same horizon. Coll and subm by M C R McCollough, Anthropol Dept, Univ Tennessee, Knoxville.

1700 ± 13

DIC-31. Site 40 LD-45, No. 255 (F 3) **AD 250**

Finely divided charcoal in loose dark brown sand, very friable, representing central core of fill of Feature 3, point of origin 0.2m below surface, top of Level II midden, plow zone (*cf* DIC-28, above). Coll and subm by M C R McCollough.

1310 ± 110

DIC-26. Site 40 LD-45, No. 256 (P H 9) **AD 640**

Finely divided charcoal with charred river cane and acorns occurring in S ½ of Postmold 9 with present surface base of Level II Midden. Occupation believed to be Early Woodland (*cf* DIC-28, above). *Comment*: ^{14}C age believed more recent than true age. Coll and subm by M C R McCollough.

DIC-27. Site 40 LD-45, No. 258 (F 12) **2730 ± 110 / 780 BC**

Finely divided charcoal in matrix of brown clay, burnt clay, and charcoal from edge of refuse pit (Feature 12) on compacted floor delimited by timber windbreak or shelter. Exact provenience is Feature 7, living floor intercalated between Levels III and IV 0.5m below present surface. Date assigned for Level III Midden, Late Archaic occupation and shelter (*cf* DIC-28, above). Coll and subm by M C R McCollough.

DIC-30. Site 40 LD-45, No. 259 (F 11) **2100 ± 85 / 150 BC**

Finely divided charcoal in matrix overlain by secondary fill of dark brown loam from bottom fill of cooking pit (Feature 11). Point of origin 0.5m below present surface (base of Level III) and excavated into yellow-brown clay of Level IV, 0.8m below present surface (*cf* DIC-28, above). Coll and subm by M C R McCollough.

DIC-29. Site 40 LD-45, No. 262 **1550 ± 95 / AD 400**

Finely divided charcoal in clayey matrix from deep Archaic living floor (Level V) comprising a thin lens (6cm) at horizon 1m below present surface. Sample intercalated between Level IV and Level VI, and represents earliest occupation of site. Occupation is probably as early as Middle Archaic with possible prehistoric flooding (*cf* DIC-28, above). Coll and subm by M C R McCollough. *Comment*: date is questionable and sample is being reprocessed. Results will be listed later.

3. Florida

DIC-44. Cayson West site, No. 1 **940 ± 145 / AD 1010**

Charcoal particles from clay wall, 690 E 490 (Feature 3) at 8CA 3 (30° 26′ N, 85° 01′ W) Blountstown, Florida. Coll by J Scarry; subm by D Brose.

DIC-45. Cayson West site, No. 2 **840 ± 65 / AD 1110**

Charcoal from burnt activity floor 2m below present surface of mound. At least 3 subsequent construction stages overlie this floor, and at least 4 such stages underlie it. Profile at edge of platform mound located at 8CA 3 (*cf* DIC-44). Coll by T Gray; subm by D Brose.

DIC-46. Cayson West site, No. 3 **770 ± 60 / AD 1180**

Charcoal from Level VIII at 495 E 775 in grayish silt 0.7 to 1.3m below surface. Sample represents refuse midden in basket loads, assoc with Wakulla Check-Stamp, Weeden Island Incised, Fort Walton Incised, and Lake Jackson Plain ceramics. Coll by P Essenpreis; subm by D Brose.

General Comment: DIC-44, -46 should represent a single early Fort Walton occupation.

B. Canada

1890 ± 60
DIC-56. East Sugar Island **AD 60**

Charcoal from prepared floor of burial mound in ash-clay till. Mound at S end of East Sugar I across channel from Serpent mounds (49° N, 79° 08′ W), Rice Lake, 31 D/1 E quad map Ontario, Canada. Sample represents Middle Woodland occupation. Coll and subm by D M Stothers.

II. GEOLOGIC SAMPLES

A. United States

+1300
32,420
−1960
DIC-52. Olen Pit **30,570 BC**

Branch from carbonaceous stratified sand in gravel pit terrace along Big Darby Creek at SE corner of Plain City quad map, Franklin Co, Brown Twp, Ohio, 7.5′ quad (40° 0′ 10″ N, 83° 15′ 15″ W). Sample overlain by 1.5m till, 10m outwash gravel, underlain by till. Coll by J Antrium; subm by D Fullerton, Ohio Geol Survey, Columbus, Ohio.

+375
26,220
−410
DIC-57. Jackson Chapel, RC-2 **23,270 BC**

Wood in silt, weakly calcareous till from S bank of tributary to Scioto R, .09m SSE of Jackson Chapel Crossroads, Franklin Co, Twp, Commercial Point, 7.5′ quad (39° 52′ N, 83° 01′ 30″ W). Sample overlain by till of similar appearance and composition, and 2 younger sandy tills. Coll and subm by D Fullerton.

22,210 ± 120
DIC-32. Garfield Hts, RC-3, Schloss No. 1 **20,260 BC**

Unidentified twigs and wood fragments from laminated sand and gravel at W face of inactive gravel pit, 90 to 270m S W of Penn Central crossing on McCracken Blvd, Garfield Hts, Ohio, Cuyahoga Co, Shaker Hts, 7.5′ quad (41° 21′ N, 81° 35′ W). Varved sequence overlain by 3 till units and underlain by silt and Illinoian outwash gravel. Coll and subm by D Fullerton and G Groenwald, Ohio Geol Survey, Columbus, Ohio.

+580
23,560
−675
DIC-35. Garfield Hts series, RC-4 **21,160 BC**

Twigs and wood fragments from lower 8cm of laminated silt and clay (*cf* DIC-32, above) (41° 25′ N, 81° 35′ W). Overlain by 2 till units

and underlain by gastropod-rich silt, greatly decomposed till, and still older Illinoian outwash gravel. Debris deposited in preglacial lake formed in the Millcreek valley during initial ice advance that deposited till overlying lake sediment. Coll and subm by D Fullerton and G Groenwold.

24,520 +665 −800

DIC-38. Garfield Hts series, RC-5 **22,570 BC**

Unidentified log from W wall of gravel pit 35m NW of Penn-Central crossing (41° 25′ N, 81° 35′ W). Sample enclosed entirely by lake sediment with base resting on upper contact of loess (*cf* DIC-32). Varves directly overly upper loess and are overlain by silt and Hiram till. Coll and subm by D Fullerton and G Groenwald.

22,230 +400 −450

DIC-41. Eaton Cut, RC-6 **20,280 BC**

Wood fragments from W Bank of Seven Mile Creek, SE of Frederick Dr, Eaton, Ohio, NW ¼, SE ¼ W, 3 T.7N, R 2E (39° 44′ N, 84° 38′ W). Sample from 0.5m above base of Fayette till (Thomas, 1970), 6.6m thick, overlain by lacustrine-fluvial sediments and complex of younger till units. Coll and subm by R A Struble, Ohio Geol Survey.

24,440 +535 −615

DIC-47. Talawanda Creek, RC-7 **22,490 BC**

Wood, portion of unidentified log from E bank of Talawanda or Fourmile Creek, 4.8km N of Oxford, NE ¼, NW ¼, Sec 11, Oxford Twp, Butler Co (39° 33″ N, 84° 44′ W), Ohio. Sample from bedded calcareous sand from U 44 (Durrell, 1961). Coll and subm by R A Struble.

DIC-43. Camden Section, RC-8 **≥42,000**

Wood fragments from log in Camden S, 3.2km N Camden, Ohio, Camden morain, Sec 33, Somers Twp, S Eaton quad (39° 40′ N, 84° 39′ W). Sample from tentatively identified Whitewater till, overlain by at least 2 younger tills. Coll by T Agne and M De Wine; subm by R A Struble.

3. South Pacific

1380 ± 85

DIC-17. **AD 570**

Benthonic Foraminifera (diatom-nannoplankton ooze) in carbonate core, 0 to 6cm fraction from top, (54° 44.2′ S, 120° 00′ W) South Pacific Ocean, at depth 1500 fathoms. Coll by A V Eltanin; subm by R Douglas, F Stehli, and S Savin, Geol Dept, Case Western Reserve Univ.

2530 ± 85
DIC-12. **AD 580**

Benthonic Foraminifera (*cf* DIC-17), from 3 to 8cm depth in core.

10,710 ± 165
DIC-15. **876 BC**

Benthonic Foraminifera (*cf* DIC-17), below top of core.

13,650 ± 140
DIC-11. **11,700 BC**

Benthonic Foraminifera (*cf* DIC-17), from 24 to 28cm depth in core.

15,680 ± 550
DIC-54. **13,730 BC**

Benthonic Foraminifera (*cf* DIC-17), from 72 to 78cm depth in core. *Comment*: sample CO_2 mixed with "dead' material to increase O_6H_6 yield.

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