

## TEXAS A&M UNIVERSITY RADIOCARBON DATES II

T. D. MATHEWS, A. D. FREDERICKS, and W. M. SACKETT

Department of Oceanography, Texas A&M University  
College Station, Texas

The radiocarbon laboratory in the Oceanography Department at Texas A&M University was established primarily for the examination of seawater samples, although other types of samples have been run. Emphasis has been placed on seawater samples of the Gulf of Mexico and adjacent areas. Most of the samples examined have been inorganic carbon, but some organic-carbon samples are being run, mainly wood and charcoal whose ages have been determined previously. More samples of known age will be run as a further check on the reliability of experimental methods and procedures.

The procedure currently used is based on the benzene-liquid scintillation counting method (Noakes *et al.*, 1967). Samples are either acid-digested or combusted to produce CO<sub>2</sub>, depending on the type of material. The CO<sub>2</sub> is then reacted with molten lithium to form lithium carbide, which reacts in turn with distilled water to form acetylene. The acetylene is trimerized on a vanadium-alumina catalyst to form benzene. The counter used is a Beckman LS-100 liquid scintillation counter. All samples are treated by standard techniques (Kim *et al.*, 1969).

Ages are calculated using a half-life of 5570 years for C<sup>14</sup> with the reference standard being NBS oxalic acid. Seawater samples are reported as  $\Delta$  (Broecker and Olson, 1961).

The  $\delta C^{13}$  composition of the seawater samples was ca. +1‰ relative to PDB for surface samples and 0‰ for those of ca. 100 m or greater depth. All samples are reported to one standard deviation with respect to sample, standard, and background.

### ACKNOWLEDGMENTS

This work was supported by Office of Naval Research Contract NONR-2119 (04). We are also indebted to S. Valastro, Jr., University of Texas at Austin, for his technical assistance. In addition, this work is partial fulfillment of the requirements for the Ph.D. in oceanography at Texas A&M University.

### I. INTERLABORATORY CHECK SAMPLE

#### TAM-11. Little Valley, Utah

Wood from organic-rich calcareous clay on Promontory Point (41° 17' N Lat, 112° 28' W Long), dated and reported previously as W-876: 20,600 ± 500 (R., v. 2, p. 162); L-730: 20,800 ± 800 (D. L. Thurber, written commun.).

**20,065 ± 400**  
**18,115 B.C.**

## II. OCEAN WATER SAMPLES

Inorganic carbon samples coll. on various cruises aboard *R/V Alaminos* in the Gulf of Mexico and adjacent areas.

## A. Cruise 70-A-3 Feb. 4-March 4, 1970

Sample no.	Depth (m)	Co-ordinates		$\delta C^{14}$ ‰	$\delta C^{13}$ ‰	$\Delta$ ‰
		Lat.	Long.			
TAM-47	0	20°36'N, 72°33'W		283 ± 17	+1	216 ± 17
TAM-48	0	" "		257 ± 14	+1	192 ± 14
TAM-49	250	" "		143 ± 15	0	85 ± 15
TAM-50	250	" "		104 ± 14	0	50 ± 14
TAM-51	750	" "		- 9 ± 16	0	- 59 ± 16
TAM-54	750	" "		23 ± 15	0	- 28 ± 15
TAM-53	1800	" "		- 86 ± 24	0	-131 ± 24
TAM-55	1800	" "		- 10 ± 15	0	- 60 ± 15
TAM-63	0	25°48'N, 80°13'W		171 ± 19	(0)*	112 ± 19
TAM-60	0	23°56'N, 81°13'W		219 ± 18	+1	156 ± 18
TAM-61	600	" "		- 46 ± 17	0	- 94 ± 17
TAM-62	1000	" "		21 ± 16	0	- 30 ± 16
TAM-64	0	23°31'N, 88°37'W		192 ± 19	+1	130 ± 19
TAM-68	0	21°40'N, 85°55'W		297 ± 23	+1	230 ± 23
TAM-65	140	" "		143 ± 21	0	86 ± 21
TAM-66	0	19°38'N, 74°34'W		265 ± 18	(1)	199 ± 18
TAM-67	600	" "		75 ± 13	0	21 ± 13
TAM-69	1500	" "		31 ± 14	0	- 21 ± 14
TAM-70	2000	20°02'N, 84°56'W		- 33 ± 18	0	- 81 ± 18
TAM-72	2000	18°58'N, 80°34'W		- 14 ± 19	0	- 63 ± 19
TAM-75	2000	17°14'N, 76°31'W		- 34 ± 14	0	- 75 ± 14
TAM-79	2000	" "		- 43 ± 9	0	- 90 ± 9

*Comment:* relatively high  $\Delta$  values at depth seem to indicate penetration of bomb  $C^{14}$  below the thermocline.

\*  $\delta C^{13}$  values in parentheses are estimated.

## B. Cruise 70-A-14 Oct. 21-Nov. 3, 1970

Sample no.	Depth (m)	Co-ordinates		$\delta C^{14}$ ‰	$\delta C^{13}$ ‰	$\Delta$ ‰
		Lat.	Long.			
TAM-56	0	22°21'N, 86°48'W		71 ± 19	+1	15 ± 19
TAM-57	0	23°08'N, 85°10'W		161 ± 21	+1	101 ± 21
TAM-88	600	" "		3 ± 16	0	- 47 ± 16
TAM-58	0	22°56'N, 87°07'W		104 ± 20	+1	47 ± 20
TAM-59	0	23°43'N, 88°50'W		198 ± 26	+1	136 ± 26
TAM-86	0	22°59'N, 90°00'W		268 ± 13	+1	202 ± 13
TAM-90	0	24°27'N, 85°47'W		252 ± 18	+1	187 ± 18
TAM-87	600	" "		68 ± 15	0	15 ± 15

Sample no.	Depth (m)	Co-ordinates		$\delta C^{14}$ ‰	$\delta C^{13}$ ‰	$\Delta$ ‰
		Lat.	Long.			
TAM-91	1500	"	"	40 ± 12	0	- 12 ± 12
TAM-94	0	26°05'N, 92°48'W		293 ± 17	+1	226 ± 17
TAM-95	0	24°22'N, 91°30'W		280 ± 17	+1	213 ± 17
TAM-96	0	27°47'N, 93°48'W		306 ± 17	+1	238 ± 17
TAM-97	0	25°40'N, 87°14'W		279 ± 18	+1	212 ± 18
TAM-98	600	"	"	39 ± 16	0	- 13 ± 16
TAM-99	1500	"	"	32 ± 13	0	- 20 ± 13
TAM-100	0	27°27'N, 90°32'W		295 ± 20	+1	228 ± 20

*Comment:* again high  $\Delta$  values at depth indicate penetration of bomb  $C^{14}$ . Also low surface values are a sign of upwelling along the coast of Yucatan.

*C. Cruise 71-A-3 Feb. 4-Feb. 9, 1971*

Sample no.	Depth (m)	Co-ordinates		$\delta C^{14}$ ‰	$\delta C^{13}$ ‰	$\Delta$ ‰
		Lat.	Long.			
TAM-78	0	29°15'N, 95°00'W		280 ± 15	(0)*	216 ± 15
TAM-80	0	29°10'N, 89°16'W		192 ± 23	(0)	131 ± 23
TAM-81	0	"	"	213 ± 13	(0)	152 ± 13
TAM-82	0	28°59'N, 89°22'W		206 ± 25	(0)	146 ± 25
TAM-85	0	28°55'N, 89°32'W		260 ± 12	(0)	194 ± 12
TAM-101	150	28°22'N, 89°38'W		151 ± 9	(0)	93 ± 9

\*  $\delta C^{13}$  values in parentheses are estimated.

III. ATMOSPHERIC SAMPLES

Sample no.	Date coll.	Location	$\delta C^{14}$ ‰	$\delta C^{13}$ ‰	$\Delta$ ‰
TAM-73	Oct. 1970— Jan. 1971	College Station, Texas	422 ± 27	-21.3	411 ± 27
TAM-74	Oct. 1970— Jan. 1971	College Station, Texas	382 ± 31	-21.3	372 ± 31

REFERENCES

- Arnold, J. R. and Anderson, E. C., 1957, The distribution of carbon-14 in nature: *Tellus*, v. 1, p. 28-32.
- Broecker, W. S., Gerard, R., Ewing, M., and Heezen, B. C., 1960, Natural radiocarbon in the Atlantic Ocean: *Jour. Geophys. Research*, v. 65, p. 2903-2931.
- Broecker, W. S. and Olson, E. A., 1960, Radiocarbon from nuclear tests, II: *Science*, v. 132, p. 712-721.

- Broecker, W. S. and Olson, E. A., 1961, Lamont natural radiocarbon measurements VII: Radiocarbon, v. 3, p. 176-204.
- Craig, Harmon, 1957, The natural distribution of radiocarbon and the exchange time of carbon dioxide between atmosphere and sea: Tellus, v. 9, p. 1-17.
- Fairhall, A. W. and Young, J. A., 1970, Radiocarbon in the environment: Adv. Chem. Ser., no. 93, p. 401-418.
- Kim, S. M., Ruch, R. R., and Kempton, J. P., 1969, Radiocarbon dating at the Illinois Geological Survey: Illinois State Geol. Survey Environmental Geol. Note 28, p. 1-19.
- Noakes, J. E., Kim, S. M., and Akers, L. K., 1967, Recent improvements in benzene chemistry for radiocarbon dating: Geochem. et Cosmochim. Acta, v. 31, p. 1094-1096.
- Rubin, Meyer and Alexander, Corrinne, 1960, U.S. Geological Survey radiocarbon dates V: Am. Jour. Sci. R. Supp., v. 2, p. 129-185.