

# APPENDIX III. RADIOCARBON DATING OF SEDIMENTS FROM THE CARIACO TRENCH, DEEP SEA DRILLING PROJECT SITE 147<sup>1,2</sup>

Elliott C. Spiker, U.S. Geological Survey, Reston, Virginia  
and

Bernd R. T. Simoneit, Institute of Geophysics and Planetary Physics,  
University of California at Los Angeles, Los Angeles, California

## ABSTRACT

Samples from Holes 147, 147A, and 147B have been dated by the radiocarbon method; ages ranged to 27,000 years ago at about 20 meters sub-bottom. The sedimentation rates were approximately 50 cm/10<sup>3</sup> y. for the last 5000 years and 10 to 75 cm/10<sup>3</sup> y. prior to that.

## INTRODUCTION

The Cariaco Basin, or Trench, is a fault depression in the Venezuelan continental shelf which has anaerobic water below 360 meters. Four holes were drilled on the saddle separating the eastern and western deeps (147: 10°42.48'N, 65°10.48'W; 147A, 147B, and 147C: 10°42.68'N, 65°10.45'W, water depth 892 m; Edgar et al., 1973). Most of the material recovered from Holes 147A, 147B, and 147C was frozen for organic geochemical studies. Since there were only two known radiocarbon dates for a piston core taken in the Trench (Heezen et al., 1958), it was of interest to determine further dates for the cores at Site 147 in order to provide a time frame for the recent sedimentation history.

## METHODS

Short sections of core material were sampled from the frozen organic geochemistry collection (Holes 147A and 147B); four samples, for carbonate dating only, were obtained from the working half of cores from Hole 147.

Radiocarbon measurements were performed on the carbonate fraction and/or the organic carbon fraction, depending on sample size and carbon content. The carbonate was extracted by acid leaching with dilute HCl in a vacuum system. The residual sample material was filtered, washed, and dried. The organic carbon was next extracted by combustion in a vacuum system. The <sup>14</sup>C activity was analyzed by the acetylene gas counting method (modified after Suess, 1954) at the U.S. Geological Survey, Reston, Virginia. Sample activities have not been corrected for isotope fractionation with a <sup>13</sup>C measurement. Assuming a δ<sup>13</sup>C value of zero and -21 per mil for the carbonate and organic fractions, respectively, this correction would add approximately 412 years to each carbonate date and 65 years to each organic date. The true age, however, may be as much as 1000 years younger than this corrected value, owing to the possible incorporation of reworked material as well as the marine reservoir effect (the radiocarbon deficiency of ocean waters) (Broecker et al., 1960). The dates were calculated relative to the National Bureau of Standards oxalic acid standard activity (Stuiver and Polach, 1977).

## RESULTS

The radiocarbon data for the organic and the carbonate carbon fractions of the samples are given in Table 1

Table 1. Results of radiocarbon analyses of samples from the Cariaco Trench, DSDP Site 147, and estimated ages.

Sample (interval in cm)	Sub-bottom Depth (m) <sup>a</sup>	<sup>14</sup> C Age (organic C) (years ago ± 1σ)	<sup>14</sup> C Age (carbonate) (years ago ± 1σ)	Estimated Age Assuming 50 cm/10 <sup>3</sup> y.
147-2-2, 43-50	6.0-9.5	—	4600 ± 90 <sup>b</sup>	15,500
147-2-2, 60-65	6.1-9.4	— <sup>c</sup>	5150 ± 200	15,500
147-2-4, 112-116	9.6-13.3	—	17,920 ± 300	22,900
147-3-1, 123-130	15.3-19.3	—	31,800 ± 700 <sup>b</sup>	34,600
147A-1-1, 46-50	0.5	1560 ± 200	—	1000
147A-1-1, 120-140	1.3	3070 ± 95	3270 ± 85	2600
147A-2-1, 130-142	2.9-9.4	10,790 ± 250	10,970 ± 250	13,300
147A-2-2, 0-15	3.1-9.6	11,230 ± 250	11,380 ± 250	14,400
147A-2-3, 113-130	4.2-12.2	—	25,490 ± 360	16,400
147A-2-3, 120-135	4.3-12.3	—	26,300 ± 470	16,600
147B-1-2, 65-75	4.2-5.2	—	5080 ± 80	9700
147B-1-2, 70-75	4.2-5.2	6200 ± 1000	—	9700
147B-2-2, 38-52	14.9-15.5	—	2030 ± 60	30,400
147B-2-3, 1-7	16.0-16.5	2620 ± 700	—	32,500
147B-2-3, 20-35	16.3-16.8	2120 ± 95	2020 ± 75	33,100
147B-2-5, 125-138	20.3-20.8	—	26,830 ± 370	41,100
V12-99 (Heezen et al., 1959)	3.0	8000	—	6000
V12-99 (Heezen et al., 1959)	4.6	11,200	—	9200

<sup>a</sup> Two values indicate the range of depth assignment, using the DSDP convention of measuring from the top of the core down or from the core catcher up.

<sup>b</sup> The total carbon (organic + carbonate fractions) was dated.

<sup>c</sup> Insufficient sample or not determined.

and the results plotted in Figure 1. The data for Hole 147A show a change in the sedimentation rate from approximately 50 cm/10<sup>3</sup> y. to 10 cm/10<sup>3</sup> y. about 10,000 years ago. The data for Hole 147B show an anomaly: Samples 147B-2-2, 38-52 cm, 147B-2-3, 1-7 cm, and 147B-2-3, 20-35 cm cluster at about 2000-2600 years ago, completely outside the other data (Fig. 1). The sedimentological features of the Holocene section in Hole 147 do not include slump features or other evidence of redeposition. Anomalous major ion concentrations of pore fluids in Sample 147B-2-2 were observed (Broecker, 1973), however. Broecker determined the <sup>230</sup>Th/<sup>234</sup>U age of the solid fraction of this sample to be less than 3000 years old and interpreted it to be "fall in" material.

Contamination during coring could adequately explain the anomalous radiocarbon results. Alternatively, it is possible that these sections were simply mislabeled on shipboard. Sections 147B-2-1 and 147B-2-4 were not dated and may also be anomalous. If we assume that the <sup>14</sup>C age of Sample 147B-2-5, 125-138 cm is correct,

<sup>1</sup> Initial Reports of the Deep Sea Drilling Project, Volume 66.

<sup>2</sup> This appendix has been placed into Volume 66 for convenience. It presents data supplementary to DSDP Leg 15, Site 147, Cariaco Trench.

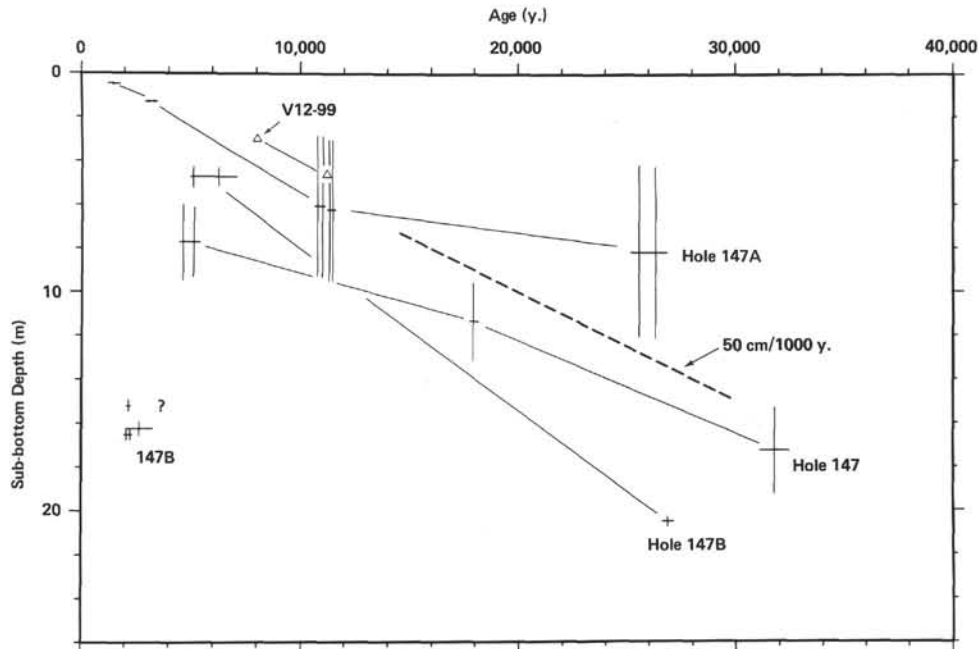


Figure 1. Radiocarbon ages of sediments from the Cariaco Trench, DSDP Site 147 and *Vema* piston core V12-99.

then the sedimentation rate extrapolates to a reasonable value: about  $75 \text{ cm}/10^3 \text{ y.}$  for Hole 147B.

In order to corroborate further the anomaly of Core 147B-2, four samples from the working half of core from Hole 147 were analyzed. These data indicate a sedimentation rate of about  $20 \text{ cm}/10^3 \text{ y.}$  Hole 147 is located approximately 370 meters south of Holes 147A and 147B. Also shown in Figure 1 and Table 1 are two dates reported from a piston core (V12-99) taken by the R/V *Vema* about 4 km southwest of Hole 147 in the middle of the ridge (Heezen et al., 1958, 1959). The sedimentation rate for V12-99 is approximately  $50 \text{ cm}/10^3 \text{ y.}$ , and this value has been used to estimate the sedimentation rates for the Hole 147 cores (cf. Table 1, Edgar et al., 1973). Based on data from this work, the sedimentation rate to about 10,000 years ago is approximately  $50 \text{ cm}/10^3 \text{ y.}$  (an average), whereas prior to that the rates vary from 10 to  $75 \text{ cm}/10^3 \text{ y.}$

### CONCLUSION

Samples from Holes 147, 147A, and 147B have been dated by the radiocarbon method to 27,000 years ago at a sub-bottom depth of about 20 meters. The sedimentation rates are variable and average about  $50 \text{ cm}/10^3 \text{ y.}$  to about 10,000 years ago and are 10 to  $75 \text{ cm}/10^3 \text{ y.}$  prior

to that. Sections 147B-2-2 and 147B-2-3 appear to be contaminated or mislabeled.

### ACKNOWLEDGMENTS

We thank J. Gieskes, M. Rubin, and E. T. Sundquist for helpful discussions and criticism and M. L. Kelley for analytical assistance. This chapter is Contribution No. 2030 from the Institute of Geophysics and Planetary Physics, University of California at Los Angeles.

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