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MIAMI NATURAL RADIOCARBON MEASUREMENTS III*

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INTRODUCTION

The list of dates grouped below is a continuation of work reported in our earlier lists. In one case (Core A 254-BR-C), an extensive sequence of dates is reported which, for completeness, includes some data presented in an earlier report (Miami II, 1963).

We continue to use a 1.0-L CO_2 proportional counter operating a 3 atm pressure (see Stockholm V for details). Except for the early incorporation of a counter for tritium analyses within our present shielding house and switching over to transistorized electronics, we do not anticipate changes in our set-up.

Wherever possible we have entered the δC^{13} corrected date as well as the δC^{13} value determined from that sample. An apparent 400-yr sea-surface carbonate age is subtracted from the calculated age of marine carbonate materials, but not for organic material (Miami I and Miami II).

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SAMPLE DESCRIPTIONS

I. GEOLOGIC SAMPLES FROM DEEP-SEA CORES

Tongue of the Ocean, Bahamas, B.W.I.

Core MG 62-17 series

Large diam (11.4 cm) piston core from E wall of the Cul de Sac (23° 31′ N Lat, 76° 35′ W Long, water depth 631 m). Collected for a study of slope accumulation and radium diffusion rates. A previous core from the vicinity of this basin slope had indicated a relatively high sediment accumulation rate (see Miami I, Core MG 61-1 series) and suggested the possibility of evaluating the uniformity of the local sedimentation mechanism and the radium diffusion rates in calcilutite. A large-diam (11.5 cm) piston corer was used so that close-spaced sections of the core could yield sufficient C for testing the uniformity of sedimentation conditions. Reliable carbonate radium-diffusion rates could be

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established only if it could be proved that the sediment accumulated uniformly with time and then only if the rates were so slow as to show significant differences in radium content above the lowest detection capabilities of radium analyses. One of us (G.A.R.) examined the core after its recovery by the Marine Lab. staff and judged the core to be undisturbed and suitable for this study; it exhibited no obvious lithologic variations and appeared to be homogeneous calcilutite.

ML-123. MG 62-17, 0-2 cm **<200**

Bulk $CaCO_3$; $\delta C^{13} = +0.74$, $\Delta = -82 \pm 6$.

ML-124. MG 62-17, 149-151 cm **465 ± 55**
A.D. 1485

Bulk $CaCO_3$; $\delta C^{13} = +2.21$.

ML-125. MG 62-17, 266-268 cm **540 ± 50**
A.D. 1410

Bulk $CaCO_3$; $\delta C^{13} = +1.55$.

General Comment (G.A.R.): this series demonstrates the difficulty of obtaining a core with a uniform deposition rate, for, although the lithology appears uniform, the assumption of uniformity cannot be made safely for this area even for short time intervals. The core's usefulness for radium diffusion studies must be rejected on the basis of non-uniform deposition, but even without that difficulty the core could not be used because the rate of accumulation is too high. According to B. Szabo (personal communication) the difference in radium content between top and bottom of the core is at the limit of detectable difference.

Caribbean Sea

The two Caribbean core series included here have undergone extensive O^{18}/O^{16} analyses from which detailed paleotemperature curves have been constructed. The Core A 254-BR-C series has had several sections dated previously by the Pa^{231}/Th^{230} method (Rosholt *et al.*, 1961, 1962) as well as by C^{14} (Miami II). The previous date list (Miami II) established the importance of C^{14} dating in (1) establishing verification and correspondence of the Pa^{231}/Th^{230} method, (2) providing closely-spaced series for dating rapid inflections of the paleotemperature curve, (3) giving sufficient detail in dating for discrimination among changing accumulation rates related to climatic events, and (4) demonstrating that the coarse ($>62\,\mu$) and fine ($<62\,\mu$) fractions of cores may have differing sedimentation histories. The model we have commonly assumed for pelagic deposits requires that pelagic Foraminifera often undergo co-deposition with older, bottom-transported fines. The following series shows that such a generalized model should be used with caution, as reversals probably caused by turbidity-current deposition or burrowing benthic fauna, may be common.

Core A 254-BR-C series

Piston core from Beata Ridge area, Caribbean Sea (15° 57′ N Lat, 72° 53.5′ W Long, depth 2968 m). *Globigerina*-ooze core exhibiting well-defined stratigraphy. Sections selected for dating were based on stratigraphy and nearness to core segments used for Pa^{231}/Th^{230} dating as a check of reliability of the method. Dates are arranged in order of increasing age. Unless otherwise stated, an average δC^{13} value of –1.21 has been used in making the fractionation correction. Coll. by J. Zeigler and W. Athearn; subm. by G. A. Rusnak.

ML-94. A 254-BR-C, 0-4 cm — **8860 ± 130**; **6910 B.C.**

Bulk $CaCO_3$; $\delta C^{13} = -0.93$.

ML-137. A 254-BR-C, 7-13 cm — **7720 ± 115**; **5770 B.C.**

Bulk $CaCO_3$; $\delta C^{13} = -1.06$.

ML-72. A 254-BR-C, 20-28 cm — **12,480 ± 200**; **10,530 B.C.**

Coarse $CaCO_3$ fraction $>62\ \mu$.

ML-73. A 254-BR-C, 20-28 cm — **12,770 ± 150**; **10,820 B.C.**

Fine $CaCO_3$ fraction $<62\ \mu$.

ML-95. A 254-BR-C, 38-42 cm — **15,220 ± 220**; **13,270 B.C.**

Bulk $CaCO_3$; $\delta C^{13} = -1.55$.

ML-100. A 254-BR-C, 54-60 cm — **18,785 ± 510**; **16,835 B.C.**

Coarse $CaCO_3$ fraction $>62\ \mu$.

ML-101. A 254-BR-C, 54-60 cm — **19,100 ± 300**; **17,150 B.C.**

Fine $CaCO_3$ fraction $<62\ \mu$.

ML-96. A 254-BR-C, 68-72 cm — **21,910 ± 430**; **19,960 B.C.**

Bulk $CaCO_3$; $\delta C^{13} = -1.91$.

ML-102. A 254-BR-C, 74-80 cm — **24,350 ± 510**; **22,400 B.C.**

Coarse $CaCO_3$ fraction $>62\ \mu$.

ML-103. A 254-BR-C, 74-80 cm — **22,870 ± 350**; **20,920 B.C.**

Fine $CaCO_3$ fraction $<62\ \mu$.

ML-97. A 254-BR-C, 98-102 cm — **27,440 ± 950**; **25,490 B.C.**

Bulk $CaCO_3$; $\delta C^{13} = -3.00$.

ML-139. A 254-BR-C, 117-124.5 cm — **>32,000**

Coarse $CaCO_3$ fraction $>62\ \mu$; $\delta C^{13} = -0.79$.

ML-138. A 254-BR-C, 117-124.5 cm — **$30,200\ {}^{+1300}_{-1100}$**; **28,250 B.C.**

Fine $CaCO_3$ fraction $<62\ \mu$; $\delta C^{13} = -0.22$.

ML-141. A 254-BR-C, 147-153 cm — **>45,000**

Coarse $CaCO_3$ fraction $>62\ \mu$.

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ML-140. A 254-BR-C, 147-153 cm **30,720 +900 −770**
28,770 B.C.

Fine $CaCO_3$ fraction <62 μ; δC^{13} = −0.22. *Comment* (G.A.R.): this age considered invalid by stratigraphy.

Core CP-28 series

Piston core from Albatross Bank area SE of Jamaica (16° 47.7′ N Lat, 74° 26.4′ W Long, water depth 3036 m). Another *Globigerina*-ooze core showing well-defined stratigraphic sequence in upper 840 cm, but possible disturbances below in 840 to 1400 cm section. Core sections selected for dating on basis of temperature-curve and coarse-fraction-curve inflections. Dates arranged in order of increasing age to give possible ages of minor temperature maxima. Coll. by Marine Lab. staff; subm. by G. A. Rusnak. Unless otherwise stated, an average δC^{13} = + 0.40 (based on the three values reported for the CP-28 series) has been used for the fractionation correction.

ML-161. CP-28, 4.5-9.5 cm **4780 ± 80**
2830 B.C.

Coarse $CaCO_3$ fraction >62 μ.

ML-162. CP-28, 4.5-9.5 cm **4965 ± 150**
3015 B.C.

Fine $CaCO_3$ fraction <62 μ.

ML-163. CP-28, 45-50 cm **13,780 ± 305**
11,830 B.C.

Coarse $CaCO_3$ fraction >62 μ.

ML-164. CP-28, 45-50 cm **14,680 ± 270**
12,730 B.C.

Fine $CaCO_3$ fraction <62 μ; δC^{13} = + 0.09

ML-165. CP-28, 85-90 cm **21,850 ± 370**
19,900 B.C.

Coarse $CaCO_3$ fraction >62 μ; δC^{13} = − 0.56.

ML-166. CP-28, 85-90 cm **21,220 ± 350**
19,270 B.C.

Fine $CaCO_3$ fraction <62 μ; δC^{13} = + 1.77.

General Comment (G.A.R.): both piston cores exhibit age differences between their coarse and fine fractions within a sampled segment of the core. The data show no definite pattern of coarse fraction younger than fine fraction, or vice versa, within a single core. Thus one must consider composite models to explain the sedimentation data. Similarly, one cannot assume that the top of a core has approximate zero age for calculations of accumulation rates. Although dates from the tops of cores may sometimes be misleading (compare ML-94 with ML-137) because of possible mechanical disturbance in accumulation or coring, they provide additional control in evaluating sedimentary processes. Dating of separate size fractions provides not only insight into possible sedimentation mechanisms but also possible checks on the validity of a group of dates within a series. ML-140 and ML-141 are an example of widely divergent ages from a set of two size fractions. ML-140 has somehow become contaminated, and therefore indicates an erroneous age which cannot be accepted in view of the stratigraphy evident in the rest of the core. A Pa^{231}/Th^{230} age for this same core (A 254-BR-C), at a depth of 161-170 cm, is 60,000 ± 7000 yr B.P. and fits the C^{14} progression in stratigraphy (Rosholt *et al.*, 1962). Detailed discussion of rates of accumulation and models will appear elsewhere.

II. GEOLOGIC SAMPLES FROM NEARSHORE AND COASTAL DEPOSITS

A. Chesapeake Bay

ML-153. Sample BSC-A1 Chesapeake Bay Entrance **9900 ± 105**
7950 B.C.

Log fragment (designated BSC-A1) uncovered by Norfolk Dredging Co. from borrow pit (37° 04.2′ N Lat, 76° 03.2′ W Long) at Baltimore Ship Channel near Chesapeake Bay Entrance, from depth of 85 ft below MLW, 40 ft below bay bottom, in Recent sediments overlying tertiary contact. May date submergence during eustatic rise of sealevel. Coll. 1962 and subm. by B. W. Nelson, Univ. of South Carolina, Columbia. *Comment* (G.A.R.): sample was treated and dated twice as two separate fragments of the same log. The first fragment, treated only *once* for removal of carbonates and humic acids (Olson and Broecker, 1958), gave 9700 ± 105 yr B.P. with a measured δC^{13} value of –24.69. The second fragment, processed *twice* yielded the date recorded for ML-153 with a δC^{13} value of –24.05. The older age is considered more reliable because more "young" humic acid was removed. The difference in ages is not great but might be significant. Age agrees with dates previously obtained from the same area and the same apparent stratigraphic horizon (see ML-91 in Miami II). The significance of this date and others from this area is discussed by Harrison *et al.* (in press).

B. Georgia

ML-157. Cabretta Island, Georgia, sample 10-26 **42,200 $^{+4400}_{-2800}$**
40,250 B.C.

Shell material from sediment core taken with Sewell Portable corer near center of Cabretta Island (31° 25′ 57″ N Lat, 81° 14′ 27″ W Long) in low dunes. Hole cored and drilled to depth 47 ft. Shell material, from 16 ft below MLW, may help date sediments of Silver Bluff age. Coll. and subm. by J. H. Hoyt, Univ. of Georgia Marine Inst., Sapelo Island. Sample consists mainly of *Mulinia* sp.; id. by R. Work, Univ. of Miami. *Comment*: although ca. 30% of the material was digested with acid leaching, contamination by younger C is possible. Composite assortment of shells and shell fragments are especially vulnerable. The final date reported above preferably should be considered as a minimum age of a sample which is certainly >40,000 yr B.P. δC^{13} = + 4.46.

ML-158. Wilmington Island, Georgia, sample Wil-1 **42,700 $^{+5100}_{-3100}$**
40,750 B.C.

Shell material from borrow pit S of Canal St., Wilmington Island, Georgia (32° 01′ 58″ N Lat, 80° 58′ 20″ W Long), consisting of *Mulinia lateralis*, *Tagelus* sp., *Anadera* sp., *Donax* sp., *Pholas* sp., *Dosina* sp., *Nassarius* sp.,

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Busycon sp., *Terebra* sp., and *Mellita* sp. (id. by R. Work) from fine sand and mud, approx. at mean sealevel, in association with Silver Bluff shoreline on Wilmington Island. Coll. and subm. by J. H. Hoyt, Sapelo Island, Georgia, on possibility that it may date Silver Bluff sediments. *Comment*: although a finite date has been reported for this sample, as for the previous one ML-157, the age should be considered minimum for a sample which is certainly >40,000 yr B.P. $\delta C^{13} = +0.40$.

C. Gulf of Mexico

Campeche Bank series, Gulf of Mexico

Samples in this group were coll. by Dept. of Meteorology and Oceanography, Texas Agricultural and Mechanical College, and subm. by Dr. E. Rona, Oak Ridge Inst. of Nuclear Studies, to test various dating techniques.

ML-135. Core sample C-1 (56), 20-30 cm **210 ± 215**
A.D. 1740

Bulk calcilutite; $\delta C^{13} = +0.11$. Depth 550 m (21° 06′ N Lat, 92° 48′ W Long). *Comment* (E.R.): sediment in core appears to have been reworked by burrowing organisms.

ML-136. Core sample C-27 (53), 20-30 cm **2760 ± 300**
810 B.C.

Bulk calcilutite; $\delta C^{13} = -0.38$. Depth 550 m (20° 37′ N Lat, 92° 48′ W Long). *Comment* (E.R.): sediment in core appears to have been reworked by burrowing organisms.

ML-185. Surface Grab sample 72 **10,580 ± 125**
8630 B.C.

Calcarenite; $\delta C^{13} = +0.75$. Depth of 37 m (22° 00′ N Lat, 89° 30′ W Long). *Comment* (E.R.): sand sample was treated with 30% H_2O_2 to remove organic C and then lightly leached with 5% HCl as pretreatment.

D. Chuckchi Sea, Alaska

Core 268-98 series

Piston core from Chuckchi Sea (67° 30′ N Lat, 165° 52′ W Long) water depth 40 m; length 744 cm; dark gray marine or brackish-water sediment throughout. Sample from core base dated 14,200 ± 600 yr B.P. (12,250 B.C.) by Isotopes, Inc. (I-843, unpub.). Only organic material of core suitable for dating. Pretreatment consisted of HCl digest of carbonates present. Coll. and subm. by J. Creager, Dept. of Oceanography, Univ. of Washington, Seattle.

ML-160. Core 268-98, 19-38 cm **3960 ± 110**
2010 B.P.

Organic fraction; $\delta C^{13} = -20.95$.

ML-159. Core 268-98, 344-359 cm **13,700 ± 150**
11,750 B.C.

Organic fraction; $\delta C^{13} = -24.24$.

General Comment (G.A.R.): this series permits estimate of rate of sediment accumulation in this remarkable area of near-estuarine to estuarine conditions. If derived ages can be considered valid, then data show a remarkable decrease of sediment accumulation during past 10,000-12,000 yr.

E. Bahama Bank, B.W.I.

ML-168. Grab Sample MG 63-34B **915 ± 60**
1035 B.C.

Partially indurated oölitic sand capping loose sand (23° 23.2′ N Lat, 76° 30′ W Long), from 20 ft water depth. Coll. and subm. by G. A. Rusnak. $\delta C^{13} = +7.77$.

General Comment (G.A.R.): although it had been suspected that partially indurated cap over on the oölite dunes might be old, date indicates that cap is relatively recent. Cementation of the dune surface must be accomplished either by direct precipitation of carbonate out of the overlying water mass or by cementing activities of organisms, such as the algae, or a combination of both.

ML-167. Grab Sample MG 63-34A **<200**

Strombus gigas shell, thickly encrusted with cemented oölites and algae, from hard encrusted surface of submerged oölite dunes (23° 23.2′ N Lat, 76° 30′ W Long), at 20 ft depth. Coll. and subm. by G. A. Rusnak. *Comment*: date is good evidence that active cementation of bank surface is occurring in this area. $\delta C^{13} = +6.40$. $\Delta = -67 \pm 5$.

ML-132. Grab Sample MG 62-37 **<200**

Fragment of *Strombus gigas* from wave-cut nip in reef-rock "pocket" on shoreline at S end of N Bimini (25° 43′ 15″ N Lat, 79° 18′ 30″ W Long), completely surrounded by reef growth, but free-moving within the hole. Coll. by R. F. Johnson; subm. by G. A. Rusnak. *Comment*: sample carefully cleaned to remove contamination, as shell gave promise of defining sealevel rise. After outer shell layers were sawed away, interior was subjected to HCl leach and X-ray diffraction analysis, which indicated only aragonite; hence sample was judged uncontaminated. Its surprisingly late date contrasts with its discolored appearance and position within the reef "pocket." $\delta C^{13} = +6.92$. $\Delta = -139 \pm 4$.

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