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Title of article Uranium-series dating of fossil corals from marine sediments
of southeastern United States Atlantic Coastal Plain"

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TABLE 1. ANALYTICAL DATA AND $^{230}\text{Th}/^{234}\text{U}$ AGES OF FOSSIL CORALS FROM LATE PLEISTOCENE MARINE BEDS IN VIRGINIA AND NORTH CAROLINA

Locality	Material*	Lab. no.	Uranium (ppm)	Activity ratios			Age** ($\times 10^3$ yr)
				$\frac{^{234}\text{U}}{^{238}\text{U}}$	$\frac{^{230}\text{Th}}{^{232}\text{Th}}$	$\frac{^{230}\text{Th}}{^{230}\text{Th}}$	
Womack, VA†	ENC	C-1	2.53 ± 0.02	1.09 ± 0.02	15	0.436 ± 0.017	62 \pm 4
New Light VA†	ENC	C-2	2.64 ± 0.03	1.10 ± 0.02	25	0.500 ± 0.020	74 \pm 4
Gomez (Mears), VA†	ENC	C-18	2.44 ± 0.05	1.11 ± 0.02	24	0.524 ± 0.021	79 \pm 5
Gomez (Mears), VA†§	ENC	C-36A	2.73 ± 0.05	1.10 ± 0.02	31	0.475 ± 0.019	69 \pm 4
Gomez (Mears), VA†§	ENC	C-36B	2.78 ± 0.06	1.09 ± 0.02	20	0.463 ± 0.019	67 \pm 4
Moyock, NC†	ENC	C-15	2.98 ± 0.04	1.10 ± 0.02	39	0.487 ± 0.019	72 \pm 4
Moyock, NC†§	ENC	C-37	3.35 ± 0.07	1.03 ± 0.02	11	0.495 ± 0.020	74 \pm 4
City Line, NC§	ENC	C-35	3.19 ± 0.06	1.08 ± 0.02	18	0.495 ± 0.020	73 \pm 4
Stetson, NC§	ENC	C-34	2.82 ± 0.06	1.12 ± 0.02	40	0.489 ± 0.020	72 \pm 4

* ENC is encrusting form of Septastrea and/or Astrangia sp. coral.

† Localities described in Cronin and others (1981).

§ Specimens provided by T. M. Cronin and J. N. Rosholt.

** ^{230}Th age; calculated using half-lives of ^{230}Th and ^{234}U of 75,200 and 244,000 yrs, respectively.

TABLE 2. ANALYTICAL DATA AND $^{230}\text{Th}/^{234}\text{U}$ AGES OF FOSSIL CORALS FROM LATE PLEISTOCENE MARINE BEDS IN SOUTH CAROLINA

Locality	Material*	Lab. no.	Uranium (ppm)	Activity ratios			Age††† (x 10^3 yr)
				$\frac{^{234}\text{U}}{^{238}\text{U}}$	$\frac{^{230}\text{Th}}{^{232}\text{Th}}$	$\frac{^{230}\text{Th}}{^{230}\text{Th}}$	
<u>Late Wando Formation, Charleston, SC area</u>							
Scanawah Island, SC†§	ENC	C-9	2.79 ±0.04	1.09 ±0.02	1.95 ±0.05	0.581 ±0.023	93 ± 6§§§
Scanawah Island, SC†§**	ENC	C-44	2.52 ±0.04	1.08 ±0.02	8.7 ±0.3	0.551 ±0.022	86 ± 5§§§
Scanawah Island, SC†§††	ENC	C-45A	3.14 ±0.06	1.07 ±0.02	7.6 ±0.3	0.567 ±0.023	94 ± 6§§§
Scanawah Island, SC†§ §§	ENC	C-45B	2.61 ±0.05	1.10 ±0.02	2.03 ±0.05	0.595 ±0.024	83 ± 5§§§
Venning Pit, Mt. Pleasant, SC†§	ENC	C-10	2.66 ±0.04	1.07 ±0.02	7.1 ±0.2	0.586 ±0.023	94 ± 6
Is. Constr. Co., Pit, Mount Pleasant, SC†§	ENC	C-7	3.42 ±0.07	1.07 ±0.02	2.00 ±0.05	0.594 ±0.024	96 ± 6****
Is. Constr. Co., Pit, Mount Pleasant, SC†§	DET	C-7-DET	13.6 0.3	1.02 ±0.02	0.476 ±0.014	0.777 ±0.031	n.a. ****
Shadowmoss, SC§	ENC	C-11	4.87 ±0.07	1.08 ±0.02	50 ±2	0.541 ±0.022	>79††††
<u>Early Wando Formation, Charleston, SC area</u>							
Mark Clark SC†§	ENC	C-17	2.86 ±0.04	1.09 ±0.02	13.1 ± 0.5	0.677 ±0.020	120 ± 6
Detyens Shipyard, SC***	ENC	C-52	2.52 ±0.05	1.10 ±0.02	9.4 ±0.3	0.735 ±0.029	139 ± 10

Note: n.a. = not applicable

* ENC is encrusting form of Septastrea and/or Astrangia sp. coral, and DET is acid-insoluble material found in coral that is separated and analyzed.

† Localities described in Cronin and others (1981).

§ Localities described in McCartan and others (1982).

** Single, well-preserved coral; specimen provided by J. F. Wehmiller.

†† Single, well-preserved coral fragment; specimen provided by R. E. Weems.

§§ Small fragments of coral combined to one sample; specimen provided by R. E. Weems.

*** Specimen provided by R. E. Weems.

††† ^{230}Th age; calculated using half-lives of ^{230}Th and ^{234}U of 75,200 and 244,000 yr, respectively.

§§§ ^{230}Th age, corrected for detrital ^{230}Th contamination from the $^{230}\text{Th}/^{234}\text{U}$ against $^{232}\text{Th}/^{234}\text{U}$ isochron plot, is 86,000 ± 6,000 yr.

**** The isochron-plot method of Szabo and Stern (1978) is used for correction of detrital ^{230}Th contamination; the corrected uranium-thorium date is 87,000 ± 6,000 yr.

†††† Cavities contained plant material; ^{230}Th age is considered a minimum age estimate.

TABLE 3. ANALYTICAL DATA AND $^{230}\text{Th}/^{234}\text{U}$ AGES OF FOSSIL CORALS FROM LATE MIDDLE PLEISTOCENE MARINE BEDS IN VIRGINIA, NORTH CAROLINA, AND SOUTH CAROLINA

Locality	Material*	Lab. no.	Uranium (ppm)	Activity ratios			Age†† ($\times 10^3$ yr)
				^{234}U ^{238}U	^{230}Th ^{232}Th	^{230}Th ^{230}Th	
<u>Rappahannock River beds</u>							
Norris Bridge, VA†§	ENC	C-3	2.27 ±0.04	1.06 ±0.02	10.7 ±0.4	0.832 ±0.033	187 ± 20 §§
Norris Bridge, VA†§	DET	C-3-DET	1.77 ±0.04	1.04 ±0.02	0.608 ±0.024	0.946 ±0.047	n.a. §§
<u>Accomack beds</u>							
Mathews' Field, VA†	BR	C-4A	2.13 ±0.04	1.05 ±0.02	8.49 ±0.02	1.13 ±0.04	***
Mathews' Field, VA†	BR	C-4B	2.02 ±0.04	1.06 ±0.02	21.2 ±1.3	0.975 ±0.039	†††
<u>Fossil-rich bed at Ponzer</u>							
Ponzer, NC§	ENC	C-16A	2.69 ±0.04	1.07 ±0.02	80 ±15	0.837 ±0.025	189 ± 15
Ponzer, NC§	ENC	C-16B	2.58 ±0.05	1.05 ±0.02	119 ±24	0.914 ±0.027	253 ± 30
<u>Ten Mile Hill beds, Charleston, SC</u>							
Johns Island RR ditch**	BR	C-24	2.37 ±0.04	1.07 ±0.02	109 ±22	0.858 ±0.025	202 ± 18
Johns Island RR ditch**	ENC	C-23	3.77 ±0.06	1.06 ±0.02	1.62 ±0.06	0.773 ±0.023	150 §§§
Ravenel drill hole**	ENC	C-19	2.57 ±0.05	1.07 ±0.02	2.80 ±0.11	0.923 ±0.037	230 +35**** -26

Note: n.a. = not applicable

* ENC is encrusting form of Septastrea and/or Astrangia sp. coral, BR is branching form of Septastrea sp., and DET is acid insoluble material found in coral that is separated and analyzed.

† Localities described in Mixon and others (1982).

§ Localities described in Cronin and others (1981).

** Localities described in McCartan and others (1982).

†† ^{230}Th age; calculated using half-lives of ^{230}Th and ^{234}U of 75,200 and 244,000 yr, respectively.

§§ The isochron-plot method of Szabo and Stern (1978) is used for correction of detrital ^{230}Th contamination; the corrected uranium-thorium data is $184,000 \pm 20,000$ yr.

*** Excess ^{230}Th , no age can be calculated.

††† An aliquot of samples C-4 was scrubbed ultrasonically for ~ 80 min, resulting in partial removal of the excess ^{230}Th . The ^{230}Th age estimate is <275,000 yr. B.P.

§§§ Cavities contained plant material; ^{230}Th age is considered a minimum age estimate.

**** Corrected for unsupported ^{230}Th : $(^{230}\text{Th})_0 = 0.67 \cdot 10^6 \cdot 10^{-\lambda t} \cdot 10^{-\lambda t}$; uncorrected ^{230}Th age is $256,000 +48,000$ yr, $-34,000$ yr.

TABLE 4. ANALYTICAL DATA AND $^{230}\text{Th}/^{234}\text{U}$ AGES OF FOSSIL CORALS NEAR MYRTLE BEACH,
SOUTH CAROLINA

Locality*	Material†	Lab. no.	Uranium (ppm)	Activity ratios			Age§ ($\times 10^3$ yr)
				^{234}U ^{238}U	^{230}Th ^{232}Th	^{230}Th ^{230}Th	
Rt. 501 Bridge, SC**	ENC	C-20	5.10 ± 0.10	1.07 ± 0.02	7.5	0.503 ± 0.020	>70****
Rt. 501 Bridge, SC††	ENC	C-26B	3.02 ± 0.06	1.10 ± 0.02	7.4	0.888 ± 0.036	220 \pm 30
Rt. 501 Bridge, SC††	BR	C-26C	3.07 ± 0.06	1.07 ± 0.02	41	1.07 ± 0.04	++++
Rt. 501 Bridge, SC§§	ENC	C-46	3.00 $\pm .06$	1.07 ± 0.02	12	0.717 ± 0.029	134 \pm 10
Rt. 501 Bridge, SC§§	BR	C-47	2.62 ± 0.05	1.02 ± 0.02	29	1.04 ± 0.04	500§§§§
S. of Rt. 501 Bridge, SC***	ENC	C-50	4.25 ± 0.08	1.07 ± 0.02	27	0.565 ± 0.023	84****
S. of Rt. 501 Bridge, SC†††	BR	C-49	2.66 ± 0.05	1.07 ± 0.02	179	0.999 ± 0.040	>300
Windy Hill Airport, SC§§§	ENC	C-48	3.11 ± 0.06	1.07 ± 0.02	18	0.709 ± 0.028	131 \pm 10

* Localities described in McCartan and others (1982).

† ENC is encrusting form of Septastrea and/or Astrangia sp. coral, BR is branching form of Septastrea sp.

§ ^{230}Th age; calculated using half-lives of ^{230}Th and ^{234}U of 75,200 and 244,000 yr, respectively.

** Specimen supplied by R. E. Weems and E. M. Lemon, Jr.; collected at about midway of section.

†† Collected at bottom of section by T. M. Cronin.

§§ Specimens supplied by L. McCartan and J. P. Owens; collected at beach level.

*** About 1.2 km S. of Rt. 501 Bridge; collected by L. McCartan and J. P. Owens at about midway of section.

††† About 1.2 km S. of Rt. 501 Bridge; collected by L. McCartan and J. P. Owens at bottom of section.

§§§ Specimen supplied by L. McCartan and J. P. Owens.

**** Small, weathered fragments. The uranium concentration is too high; the ^{230}Th age is considered a minimum age estimate.

†††† Excess ^{230}Th ; no age can be calculated.

§§§§ The specimen is suspected to be reworked from the older Waccamaw Formation deposit.

TABLE 5. ANALYTICAL DATA OF FOSSIL CORALS FROM EARLY MIDDLE PLEISTOCENE MARINE UNIT OF THE CANEPATCH FORMATION IN SOUTH CAROLINA

Locality*	Material†	Lab. no.	Uranium (ppm)	Activity ratios		
				$^{234}\text{U}/^{238}\text{U}$	$^{230}\text{Th}/^{232}\text{Th}$	$^{230}\text{Th}/^{234}\text{U}$
<u>Canepatch Formation, Myrtle Beach, SC area</u>						
Near ICW-6§	BR	C-8	2.99 ±0.03	1.043 ±0.016	160	0.982 ±0.029
ICW-5§	BR	C-5	2.50 ±0.02	1.040 ±0.016	14	1.01 ±0.03
ICW-5, upper sections§	BR	C-30	2.26 ±0.05	1.042 ±0.016	39	0.975 ±0.039
ICW-5, lower sections§	BR	C-31	2.71 ±0.05	1.054 ±0.016	11	0.876 ±0.035
North of ICW-5	BR	C-29	3.27 ±0.07	1.027 ±0.015	26	0.784 ±0.031
South of ICW-5	BR	C-32A	2.22 ±0.04	1.034 ±0.016	18	1.01 ±0.04
South of ICW-5	BR	C-32B	2.32 ±0.05	1.029 ±0.015	19	0.957 ±0.038
Average:				1.038** ±0.009		

* Localities (ICW) are described in McCartan and others (1982).

† BR is branching form of Septastrea sp.

§ Localities described in Cronin and others (1981).

** ^{234}U age is calculated to be $460,000 \pm 100,000$ yr, assuming the initial $^{234}\text{U}/^{238}\text{U}$ activity ratio in corals to be near the Atlantic sea-water average of 1.14 ± 0.02 (Ku and others, 1977).

TABLE 6. ANALYTICAL DATA AND $^{230}\text{Th}/^{234}\text{U}$ AGES OF FOSSIL CORALS FROM EARLY PLEISTOCENE MARINE BEDS OF NORTH CAROLINA AND SOUTH CAROLINA

Locality*	Material†	Lab. no.	Uranium (ppm)	Activity ratios		
				$^{234}\text{U}/^{238}\text{U}$	$^{230}\text{Th}/^{232}\text{Th}$	$^{230}\text{Th}/^{234}\text{U}$
<u>James City Formation, Neuse River, NC</u>						
Flanner Beach, NC §	BR	C-12	2.70 ±0.04	1.02 ±0.02	55	1.04 ±0.04
Flanner Beach, NC **	BR	C-40	2.53 ±0.05	1.01 ±0.02	67	0.941 ±0.038
Flanner Beach, NC **	BR	C-41	2.57 ±0.05	0.996 ±0.015	80	0.941 ±0.038
James City, NC **††	BR	C-42	2.29 ±0.05	1.00 ±0.02	164	1.04 ±0.04
<u>Waccamaw Formation, Myrtle Beach, SC</u>						
Calabash, SC **	BR	C-38	2.36 ±0.05	1.02 ±0.02	186	0.970 ±0.039
Near ICW-9 §§	BR	C-27	2.22 ±0.04	1.02 ±0.02	28	0.950 ±0.038
Near ICW-9 ***	BR	C-28	2.42 ±0.05	1.02 ±0.02	8.0	1.12 ±0.04
ICW-5	ENC	C-43	3.21 ±0.06	1.01 ±0.02	19	0.996 ±0.030
Near ICW-5	BR	C-6	2.62 ±0.03	1.02 ±0.01	500	1.02 ±0.03
About 1.6 km N of ICW-5	BR	C-33	2.22 ±0.04	1.00 ±0.01	15	0.950 ±0.038
<u>Penholoway bed, Charleston, SC</u>						
Stallsville, SC **	BR	C.-21	2.76 ±0.06	1.02 ±0.02	23	0.850 ±0.034
ST-24, Charleston, SC †††	BR	C-22	2.79 ±0.06	0.994 ±0.015	17	0.999 ±0.040

* Localities described in McCartan and others (1982).

† BR is branching form of Septrastrea sp.; and ENC is encrusting form of

Astrangia sp.

§ Analytical data reported in Cronin and others (1981); coral is believed to be reworked from underlying James City Formation.

** Specimens supplied by L. McCartan and J. P. Owens.

†† From type section of James City Formation.

§§ At the bottom of section, below peat layer.

*** About 30 cm below sample C-27.

††† Specimen supplied by R. E. Weems; ST-24 is in the NE 1/4 Stallsville, SC quadrangle, near Charleston, SC.

TABLE 7. ^{231}Pa AGES OF CORALS FROM PLEISTOCENE UNITS
IN VIRGINIA AND NORTH CAROLINA

Locality	Lab. no.	$^{231}\text{Pa}/^{235}\text{U}$ (activity ratio)	^{231}Pa age ($\times 10^3$ yr)
Mears, VA	C-18	0.79 ± 0.05	73 ± 13
Moyock, NC	C-15	0.79 ± 0.05	73 ± 13
Stetson, NC	C-34	0.77 ± 0.05	69 ± 11
Ponzer, NC	C-16	0.98 ± 0.06	183 ± 65

TABLE 8. AVERAGE URANIUM CONCENTRATIONS AND $^{234}\text{U}/^{238}\text{U}$ ACTIVITY RATIOS OF CORAL SAMPLES IN EQUAL AGE GROUPS ALONG THE SOUTHEASTERN UNITED STATES ATLANTIC COASTLINE

Age group ($\times 10^3$ yr)	No. of samples in group	Average uranium (ppm)	Average $^{234}\text{U}/^{238}\text{U}$	$(^{234}\text{U}/^{238}\text{U})_{t=0}^*$
100	17	2.82 ± 0.30	1.091 ± 0.014	1.12 ± 0.02
212	6	2.44 ± 0.21	1.061 ± 0.015	1.11 ± 0.03
Socastee Formation deposits in dispute†	5	2.97 ± 0.18	1.075 ± 0.011	1.14§ ± 0.02
460	7	2.61 ± 0.40	1.039 ± 0.009	1.14 ± 0.03
1,200	12	2.56 ± 0.29	1.011 ± 0.010	- -

* Calculated initial value of uranium activity ratio of corals at the time coral built its skeleton; because uranium is taken up during the life cycles of the animal, the initial $^{234}\text{U}/^{238}\text{U}$ ratio is expected to be near the sea water average of 1.14 ± 0.02 (Ku and others, 1977).

† Marine deposits at localities ICW-1 (Rt. 501 Bridge), and ICW-9 (Windy Hill Airport); both near Myrtle Beach, S.C. (McCartan and others, 1982).

§ Calculated on the basis of the presumed age of 212,000 yr.