

LA JOLLA NATURAL RADIOCARBON MEASUREMENTS IX

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INTRODUCTION

The following date list covers samples dated by the La Jolla Radiocarbon Laboratory during calendar year 1978. All archaeological, all geologic, and some geochemical and botanical samples measured during that period are included here. Recent measurements of ^{14}C in tree rings and in annual coral rings will be published elsewhere. Plots and discussion of data for corals from Belize and Florida have been published already by Druffel (1980).

Sample preparation technique has remained the same as described by Linick (1977). Results reported here are based on 95% of NBS oxalic acid activity normalized to a $\delta^{13}\text{C}$ of -19% (PDB). All sample activities have been normalized to a $\delta^{13}\text{C}$ of -25% (PDB). Mass spectrometric $\delta^{13}\text{C}$ measurements were made on all samples and standards using, as previously, CO_2 prepared by recombusting an aliquot of the acetylene counting gas sample. Seven gas proportional counters described by Linick (1977; 1979) were used. Ages listed here are conventional radiocarbon ages BP based on the 5568-year Libby ^{14}C half-life. Uncertainties are given as one sigma statistical standard errors. Where applicable, dates corresponding to the probable true time of origin for terrestrial plant or animal material are given at the end of the sample descriptions. These dates, based on the La Jolla calibration table (Suess, 1979), are presented as possible centuries of growth, with the most probable centuries italicized. The conventional ages for shells and carbonate sediments must be considered to be "apparent ages" only (Linick, 1979).

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I. ARCHAEOLOGIC SAMPLES

A. North America

LJ-4218. Camus, Washington 2500 \pm 70

Charcoal from small limb of Oregon maple tree (*Acer macrophyllum*) from Site 45CL48, Lady I., Camus, Washington ($45^\circ 35' \text{ N}$, $122^\circ 25' \text{ W}$). Depth 76cm. Assoc with Prehistoric living floor containing nuts of *Quercus* in Unit S7E5. Sample measured to reconstruct paleoenvironment of Lady I. in Columbia R, and to determine rate of midden accumula-

tion at site. Coll June 1977 and subm by J A Woodward, Mt Hood Comm Coll, Gresham, Oregon 97030. Previous ^{14}C dates from site are from other levels: 2370 ± 60 , 2320 ± 60 , 2420 ± 50 (LJ-3296, -3395, -3398; R, 1977, v 19, p 34); 1970 ± 60 (LJ-3749; R, 1979, v 21). LJ calibration: 7th, 8th, 9th BC.

LJ-4254. San Joaquin Hills 230 \pm 70

Charcoal from hearth in open shell scatter site in San Joaquin Hills, 6.5km N of Pacific Ocean, 5km E of Upper Newport Bay, Orange Co, California ($33^{\circ} 37' 22''$ N, $117^{\circ} 49' 50''$ W). Alt 110m. Retrieved from loose, sandy loam from Unit 2, 10 to 20cm sub-surface. Dated to enhance knowledge of aboriginal exploitation/habitation of Upper Newport Bay region of Orange Co. Coll Oct 1977 and subm by William McCawley and John Murray, Archaeol Assoc, 1022-B Victoria St, Costa Mesa, California 92627.

LJ-4255. San Joaquin Hills 330 \pm 70

Charcoal from same site and unit as LJ-4254, above; 30 to 40cm subsurface.

Villa La Cumbre series

Three shell samples from Site SDM-W-147, Villa La Cumbre, N of Alga Rd, La Costa, San Diego Co, California ($33^{\circ} 06'$ N, $118^{\circ} 24'$ W). Coll June-July 1977 and subm by C S Bull and M J Hatley, Regional Environmental Consultants, 1094 Cudahy Place, Suite 204, San Diego, California 92110.

LJ-4133. Villa La Cumbre-A 7120 \pm 150

Shells (*Aquiptectin*) from Unit E360-N660, 30 to 40cm depth.

LJ-4134. Villa La Cumbre-A 7440 \pm 110

Shells (*Aquiptectin*) from Unit E340-N620, 30 to 40cm depth.

LJ-4135. Villa La Cumbre-B 7060 \pm 110

Shells (*Chione* sp) from Unit E354-N327, 30 to 40cm depth.

LJ-4216. Indian Hill, 91 to 107cm 3810 \pm 70

Charcoal from Indian Hill Site 5, a rock shelter in Anza Borrego State Park, San Diego Co, California. Pit D-8, depth 91 to 107cm. Coll April 1961; subm by J L Bada, Scripps Inst Oceanog, La Jolla, California 92093. LJ calibration: 23rd, 24th, 25th BC.

LJ-4217. Indian Hill, 76 to 91cm <250

Charcoal from same site as LJ-4216, above. Pit D-8, depth 76 to 91cm. Coll April 1961; subm by J L Bada.

San Clemente Island series

Twelve samples from San Clemente I., a Southern California coastal island. Samples were measured to date human habitation on the island and to contribute to S coastal chronology. Series started in Linick (1979).

LJ-4130. SCLI/RC-6 8180 ± 110

Shells (2 wavy turban shell fragments, 8 abalone shell fragments, and 1 mussel shell fragment) from NE slope of Eel Point dune site SCLI-539 (32° 55' 07.086" N, 118° 32' 38.541" W). Sample taken from SW side of existing pit at depth of 51 to 66cm. Coll Sept 1977 and subm by L M Axford and R M Carlson, both of Mesa Coll, 7250 Mesa Coll Dr, San Diego, California.

LJ-4131. SCLI/RC-7(A) 5810 ± 90

Shells (1 wavy turban shell fragment, 7 mussel shell fragments, 1 limpet shell, 11 abalone shell fragments, and 3 sea snail shells) from same location as LJ-4130, above. Sample taken from SW side of existing pit at depth of 38 to 43cm. Coll Sept 1977 and subm by L M Axford and R M Carlson.

LJ-4132. SCLI/RC-7(B) 5650 ± 90

Single abalone shell from same provenience as LJ-4131, above. Coll Sept 1977 and subm by L M Axford and R M Carlson.

LJ-4170. SCLI/RC-8, charcoal 3110 ± 120

Charcoal from Site SCLI-1088 (33° 01' 30.80" N, 118° 34' 52.09" W). Sample taken 41cm below surface in E wall of ravine. Coll Oct 1977 and subm by L M Axford and R M Carlson. LJ calibration: 14th, 15th, 16th BC.

LJ-4173. SCLI/RC-8, shell 3300 ± 360

Shell from same provenience as LJ-4170, above. Coll Oct 1977 and subm by L M Axford and R M Carlson. *Comment:* agreement of LJ-4170 and LJ-4173 is very good.

LJ-4168. SCLI/RC-9 6300 ± 90

Shells from inside rockshelter, Site SCLI-1093 (33° 01' 59.80" N, 118° 35' 51.35" W). Taken from depth of 70cm from nominal floor, 140cm down from ceiling. Coll Oct 1977 and subm by L M Axford and R M Carlson.

LJ-4169. SCLI/RC-10 4950 ± 90

Shells from same site as LJ-4168, above. Taken at depth of 38 to 43cm from nominal floor, 116cm down from ceiling. Coll Oct 1977 and subm by L M Axford and R M Carlson. Charcoal sample (LJ-4172) from same provenience will be dated in future.

LJ-4219. SCLI/RC-11 430 ± 70

Charcoal from Site SCLI-1167, at S end of earth dam in valley NW of national forest on main island rd (32° 58' 01.453" N, 118° 32' 27.240" W). Taken at depth of 10 to 23cm. Coll Dec 1977 and subm by L M Axford and R M Carlson. Abalone shell sample (LJ-4220) from same provenience will be dated in future.

LJ-4224. SCLI/RC-12 350 ± 70

Charcoal from Site SCLI-379, area designation Red/Harding (32° 56' 09.61" N, 118° 32' 55.22" W). Coll May 1977 and subm by L M Axford. Probable late historic site.

LJ-4532. SCLI/RC-13 910 ± 50

Charcoal fragments from fire lens at China Point area site SCLI-1295 (32° 48' 14.8" N, 118° 25' 43" W). Taken from area 46cm below nominal surface of Unit B. Site is eroding into sea, accelerated by frequent high winds. Coll July 1978 and subm by L M Axford. LJ calibration: AD 12th, 11th, 10th.

LJ-4533. SCLI/RC-14 1400 ± 100

Charcoal fragments from fire lens at same site as LJ-4532, above. Taken 10cm from nominal surface of Unit C. Coll July 1978 and subm by L M Axford. LJ calibration: AD 7th, 6th, 5th.

LJ-4536. SCLI/RC-15 36,000 ± 4000

Abalone shell encrusted with lime deposit from site SCLI-1295, NW of China Point (32° 48' 14.8" N, 118° 25' 32" W). Other shells in area were also under caliche. Dated to add to SCLI chronology and to study time scale of deposition of caliche over shell.

LJ-4534. Bancroft Ranch, #1 410 ± 70

Charcoal from Bancroft Ranch, Site W-389 (32° 44' 44.15" N, 117° 00' 02.81" W). Unit N15/E160, 46 to 61cm depth. Measured to study chronology of a Kumeyaay Indian village site. Coll June 1975 and subm by L M Axford and D Barbolla.

LJ-4535. Bancroft Ranch, #2 230 ± 60

Charcoal from same site as LJ-4534, above. Unit CC-2, 71cm depth. Coll June 1975 and subm by L M Axford and D Barbolla.

*B. Europe***Szákmar series**

Grain and charcoal samples from Szákmar, a Neolithic Körös site in SE Hungary (46° N, 20° E). Excavated 1975-1976 by Makkay; subm by Marija Gimbutas, Inst Archaeol, Univ California, Los Angeles, California 90024.

LJ-4376. Szákmar, alpha 3260 ± 140

Caryopsis of cereal grain. Tr (Sj 15) II/neues foed. LJ calibration: 15th, 16th, 17th, 18th BC.

LJ-4377. Szákmar, beta 3040 ± 140

Caryopsis of cereal grain. Qr Qs (Sj 16) II/neues foed. LJ calibration: 12th, 13th, 14th, 15th, 16th BC.

General Comment: LJ-4376 and -4377 were combined for measurement in a larger detector. The measurement of the combined samples gave an

age of 3220 ± 100 , resulting in an average for the 3 measurements of 3180 ± 70 . LJ calibration for single measurement of combined sample: 15th, 16th, 17th BC. LJ calibration for average: 15th, 16th, 17th BC. *Comment* (MG): dates are not for a Neolithic settlement.

LJ-4378. Szákmar, gamma **1980 \pm 100**

Charcoal. Po Sb (Sj 23) VI/b fakén alsó. LJ calibration: AD 1st, 1st, 2nd, 3rd, 4th BC.

LJ-4379. Szákmar, delta **3030 \pm 110**

Charcoal. Qr Qs (Sj 25) VI/a, b gödör-83. LJ calibration: 12th, 13th, 14th, 15th, 16th BC.

LJ-4380. Szákmar, epsilon **840 \pm 130**

Charcoal. Sx (Sj 1) IX/c-gödör-85 vékony cackbar. LJ calibration: AD 13th, 12th, 11th, 10th.

LJ-4381. Szákmar, zeta **700 \pm 130**

Charcoal. Sr (Sj 1) IX/c-gödör-85 vékony cackbar. LJ calibration: AD 15th, 14th, 13th, 12th, 11th.

General Comment: LJ-4380 and -4381 were combined for measurement in a larger detector. The measurement of the combined samples gave an age of 640 ± 70 , resulting in an average for the three measurements of 690 ± 60 . LJ calibration for single measurement of combined sample: AD 15th, 14th, 13th. LJ calibration for average: AD 14th, 13th, 12th.

LJ-4382. Szákmar, eta **3030 \pm 110**

Charcoal. Qr (Sj 5) XIV/b. LJ calibration: 12th, 13th, 14th, 15th, 16th BC.

Arene Candide series

Charcoal samples from middle to earliest Neolithic levels in cave of Arene Candide, Liguria, Italy (44° 30' N, 8° 30' E). Excavated Aug 1977 by Santo Tinè (Univ Genova, Italy); subm by Marija Gimbutas. All depths were measured relative to point 160cm down, and they are given as depth plus 160cm.

LJ-4136. Arene Candide #1 **5940 \pm 80**

Charcoal from mid-Neolithic Level 12, Sq R1, depth 176 to 200cm plus 160cm. LJ calibration: 48th, 49th, 50th, 51st, 52nd BC.

LJ-4137. Arene Candide #2 **5700 \pm 90**

Charcoal from mid-Neolithic Level 12, Sq Q1, depth 220 to 225cm plus 160cm. Purpose of dating was to confirm the chronology established by stratigraphy and ceramic typology. LJ calibration: 45th, 46th, 47th, 48th BC.

LJ-4138. Arene Candide #3 **5940 \pm 100**

Charcoal from early Neolithic (or transition between mid and early Neolithic) Level 13A; Sq N3, depth 221 to 228cm plus 160cm; Sq N2,

depth 187 to 198cm plus 160cm; and Sq 03, depth 239 to 246cm plus 160cm. Found underlying sherds of painted Rippoli pottery. The 3 squares were coll together as representative of a floor or contemporary horizon due to the find of 3 separate sherds of painted Rippoli fine ceramic (imported ware) in each square. LJ calibration: 48th, 49th, 50th, 51st, 52nd BC.

LJ-4139. Arene Candide #4 6230 ± 90

Charcoal from early Neolithic (or transition between mid and early Neolithic) Level 13B, Sqs M2 and N2, depth 198 to 199cm plus 160cm. Dated to confirm observed stratigraphy and ceramic typology. LJ calibration: *late to mid-6th millennium BC*.

LJ-4140. Arene Candide #5 6090 ± 90

Charcoal from early Neolithic Level 13B, Sq N2, depth ca 220cm plus 160cm. From concentration of charcoal found in the “*carbonaia*,” fire pit. LJ calibration: 50th, 51st, 52nd, 53rd, 54th BC.

LJ-4141. Arene Candide #6 6220 ± 100

Charcoal from early Neolithic Level 13C, Sqs M2 and N2, depth 198 to 209cm plus 160cm. LJ calibration: *late to mid-6th millennium BC*.

LJ-4142. Arene Candide #7 6070 ± 90

Charcoal from early Neolithic Level 13C, Sq P3, depth ca 268 to 276cm plus 160cm. From the floor around the collapsed domed oven, or “*forno*.” LJ calibration: 50th, 51st, 52nd, 53rd, 54th BC.

LJ-4143. Arene Candide #8 6870 ± 100

Charcoal from earliest Neolithic floor, immediately above Mesolithic Level 15; from Level 14, Sq N2, depth ca 262 to 273cm plus 160cm. Sample is important for dating the first occurrence of the Neolithic in N Italy. LJ calibration: *early 6th millennium to late 7th millennium BC*.

LJ-4144. Arene Candide #9 6490 ± 100

Charcoal from earliest Neolithic Level 14, Sq O3, depth ca 279 to 283cm plus 160cm. LJ calibration: *mid-6th millennium BC*.

Toppo Daguzzo series

Four charcoal samples from Toppo Daguzzo, a Bronze age site in Italy. Excavated 1978 by Mirella Cipolloni, Ist Paletnol, Univ Rome; subm by Marija Gimbutas.

LJ-4544. Toppo Daguzzo, 3a 4680 ± 60

Charcoal from Trench 12—ditch, Level 3-4. LJ calibration: 34th, 35th, 36th, 37th BC.

LJ-4545. Toppo Daguzzo, 3b 4710 ± 80

Charcoal from Trench 12—ditch, Level 3-4. LJ calibration: 34th, 35th, 36th, 37th BC.

LJ-4546. Toppo Daguzzo, 4 **4580 ± 80**

Charcoal from Trench 12—ditch, Level L. LJ calibration: *34th, 35th, 36th BC.*

LJ-4547. Toppo Daguzzo, 4 **4440 ± 70**

Charcoal from Trench 12—ditch, Level L. LJ calibration: *31st, 32nd, 33rd, 34th BC.*

Rendina series

Four charcoal samples from Rendina, a Neolithic site in S Italy (41° N, 16° E). Excavated 1975 by Mirella Cipolloni; subm by Marija Gimbutas.

LJ-4548. Rendina, 1a **7110 ± 140**

Charcoal from C-shaped Ditch No. 4. LJ calibration: *late 7th millennium BC.*

LJ-4549. Rendina, 1b + 1c **6780 ± 100**

Charcoal from C-shaped Ditch No. 4. LJ calibration: *early 6th millennium BC.*

LJ-4550. Rendina, 2a **6530 ± 150**

Charcoal from last level of ditch, No. 14. LJ calibration: *mid-6th millennium BC.*

LJ-4551. Rendina, 2b **6900 ± 150**

Charcoal from last level of ditch, No. 14. LJ calibration: *early 6th to late 7th millennium BC.*

LJ-4449. Achilleion **7490 ± 150**

Charcoal from Achilleion, on edge of Karditsa Plain, near Farsala, Thessaly, Greece (ca 39.3° N, 22.4° E). Settlement is stratified Neolithic site of the Sesklo culture. Includes four periods starting with earliest ceramic period, partially contemporaneous with Anza site in Central Macedonia, Yugoslavia. This sample from Sq A, Quad 1, Level 32; from one of earliest levels at site. Coll and subm by Marija Gimbutas. Many other samples from site previously measured; see Linick (1977). For detailed discussion of archaeology in area, see Gimbutas (1974) and Ferguson *et al* (1976). LJ calibration: *7th millennium BC.*

II. GEOLOGIC SAMPLES

A. Terrestrial

Baja California series

The following wood and charcoal samples were measured to study geologic fault activity in Baja California in the vicinity of 30° 39' N, 115° 09' W. All samples from terraces were ironwood (*Olneya tesota*) and were expected to give oldest date for each terrace. Expectations given are those of submitter. Coll and subm by L G Brown, Dept Geol, San Diego State Univ, San Diego, California.

LJ-4365. PSC-1 360 ± 50

Wood from Loc 12 (30° 38' 50" N, 115° 09' 15" W). Coll Nov 1977 to establish upper limit for date of fault's motion. Sample could be older than fault scarp.

LJ-4366. PSC-2 3530 ± 80

Charcoal from Excavation 2 (30° 38' 00" N, 115° 08' 36" W). Coll April 1978 to establish lower limit for date of fault's age. LJ calibration: 18th, 19th, 20th, 21st bc.

LJ-4383. IA 700 ± 50

Ironwood from Terrace I (30° 38' 45" N, 115° 09' 10" W). Coll May 1978. LJ calibration: AD 14th, 13th, 12th.

LJ-4384. IB 410 ± 70

Ironwood from Terrace I, Site 14 (30° 38' 45" N, 115° 09' 10" W).

LJ-4385. IIA 560 ± 50

Ironwood from Terrace II (30° 38' 45" N, 115° 09' 10" W). Terrace II expected to be younger than Terrace I. Coll May 1978.

LJ-4386. IIB 330 ± 60

Ironwood from Terrace II (30° 38' 45" N, 115° 09' 10" W). Coll May 1978.

LJ-4387. IIIA 340 ± 60

Ironwood from Terrace III (30° 38' 45" N, 115° 09' 10" W). Terrace III expected to be younger than Terrace II. Coll May 1978.

LJ-4388. IIIB 670 ± 70

Ironwood from Terrace III (30° 38' 45" N, 115° 09' 10" W). Coll May 1978.

LJ-4389. IVA 240 ± 60

Ironwood from Terrace IV (30° 38' 45" N, 115° 09' 10" W). Terrace IV expected to be younger than Terrace III. Coll May 1978.

LJ-4390. VA 110 ± 30

Ironwood from Terrace V (30° 38' 45" N, 115° 09' 10" W). Terrace V expected to be younger than Terrace IV. Coll May 1978.

LJ-4391. VB 850 ± 90

Ironwood from Terrace V (30° 38' 45" N, 115° 09' 10" W). Coll May 1978. LJ calibration: AD 13th, 12th, 11th, 10th.

LJ-4392. VIA 390 ± 60

Ironwood from Terrace VI (30° 38' 54" N, 115° 09' 18" W). Was expected to be possibly older than Terrace I, but may be correlative with younger fault movements. Coll May 1978.

B. Marine

LJ-4175. Pacific sediment 14,000 ± 1000

Coarse fraction of sediment, ca 70% forams, from piston core (32° 09.1' N, 118° W). M-4-70, 6P, 190 to 210cm depth in core. Sediment had been ultrasonically cleaned to remove fines and then sieved, resulting in fraction >62 μ . Ca 10,000 yr BP is date of deglacial meltwater spike. Coll March 1970 and subm by R B Dunbar, Scripps Inst Oceanog.

Indopac-15 sediment series

Organic fraction of deep-sea sediment samples coll on Indopac-15 Expedition of Scripps Inst Oceanog. Box Core 638, coll June 1977 (28° 34.4' N, 155° 30.3' W), water depth 5780m. Area is extensive abyssal plain located below low-productivity surface waters. Subm by P M Williams, Scripps Inst Oceanog. Results given in order of increasing depth in core. For interpretation of data, see Williams *et al* (1978).

LJ-4223. 0 to 3cm 10,700 ± 600

Box Core 2, Sample B, 0 to 3cm depth in core. *Comment:* LJ-4055, previously pub in Linick (1979), from Box Core 2, Sample B, 5 to 7cm depth in core, gave age of 16,000 ± 900.

LJ-4221. 7 to 9cm 18,500 ± 1900

Box Core 2, Sample A, 7 to 9cm depth in core.

LJ-4222. 11 to 13cm 20,300 ± 2200

Box Core 2, Sample A, 11 to 13cm depth in core.

LJ-4301. 13 to 15cm >23,700

Box Core 2, 13 to 15cm depth in core. *Comment:* LJ-4054, previously pub in Linick (1979), from Box Core 2, Sample B, 19 to 21cm depth in core, gave age of >22,000; date revised to >24,300 in Williams *et al* (1978).

Pleiades sediment series

Four sediment samples from the deep Pacific Ocean (1° 08' N, 109° 15' 06" W), sub-core from box core coll on Pleiades-72 Expedition of Scripps Inst Oceanog. Water depth 3626m. Coll May to Sept 1976 for W H Berger; subm by R C Finkel, both of Scripps Inst Oceanog.

LJ-4518. 0 to 3cm 3980 ± 70

Sediment from 0 to 3cm depth in core; inorganic fraction.

LJ-4519. 3 to 5cm 4200 ± 100

Sediment from 3 to 5cm depth in core; inorganic fraction.

LJ-4520. 18 to 20cm 6810 ± 70

Sediment from 18 to 20cm depth in core; inorganic fraction.

LJ-4521. 35 to 36cm 12,600 ± 180

Sediment from 34 to 36cm depth in core; inorganic fraction.

III. GEOCHEMICAL SAMPLES

A. Marine organisms

Marine organism series

Three specimens of rat-tail fish (*Coryphaenoides armatus*) caught in gill nets in the deep central Pacific Ocean. Measurements made on muscle sampled from frozen specimens. Coll Dec 1977 on the BMET Cruise. Obtained from K Smith; subm by P M Williams.

LJ-4737. BMET-1-PW $\Delta = +45 \pm 12\%$
 $\delta^{13}C = -18.4\%$

Fish from Sta C-48 (32° 33.6' N, 120° 26.3' W). Caught 400m above bottom; bottom depth ca 3800m. Dry weight 3.8g.

LJ-4338. BMET-2-PW $\Delta = +27 \pm 7\%$
 $\delta^{13}C = -18.3\%$

Fish from Sta C-48 (32° 33.6' N, 120° 26.3' W). Caught 300m above bottom; bottom depth ca 3800m. Dry weight 4.2g.

LJ-4339. BMET-3-PW $\Delta = +37 \pm 8\%$
 $\delta^{13}C = -19.7\%$

Fish from Sta C-69 (32° 34.3' N, 120° 28.9' W). Caught 50m above bottom; bottom depth ca 3800m. *Comment:* ^{14}C was previously measured in rat-tail fish coll June 1977 at 28° 30' N, 155° 30' W; coll 800m above bottom; bottom depth 5800m. $\Delta = +37 \pm 10\%$, $\delta^{13}C = -18.7\%$ (LJ-4057; Linick, 1979).

B. Seawater sample

LJ-4256. Ross Ice Shelf Project $\Delta = -73 \pm 7\%$
 $\delta^{13}C = -2.4\%$

Dissolved inorganic carbon from 20m below bottom of ice; coll at hole J-9 drilled in Ross Ice Shelf, Antarctica, on 29 Dec 1977 by S Jacobs for author's use. Site is 400km S of edge of Ross Ice Shelf (82° 22.5' S, 168° 37.5' W). For interpretation of ^{14}C and tritium data for samples coll at site, see Michel *et al* (1979).

IV. BOTANICAL SAMPLES

Palm tree series

Samples from a palm tree (*Cocos nucifera*) grown near Aracaju, Sergipe state, NE Brazil (ca 11° 00' S, 37° 01' W); alt near sea level. Tree had grown for ca 110 to 120 yr. Slices were taken at 1m intervals up the tree. Highest samples, from 17.4m above bottom, were taken just below oldest leaves. At each level, one sample was obtained from the outside of the cross-section (ca 0.5 through 2cm from the bark), and one was obtained from the inside of the cross-section (0 through 3 to 4cm from the center). Palm trees do not form annual rings, but rather grow in a more cylindrical, vertical manner than ring-forming trees. Samples were measured to study growth pattern, using bomb-produced carbon-14 as a tracer. Wood was pretreated with acetone, alkali, and acid; cellulose was not extracted for use in this project. Because annual rings are not

formed and the wood analyzed is not of a known age, no decay correction could be made in the Δ values given below. Subm by LHG Wiesberg, Chemistry Dept, Pontificia Univ Católica Rio de Janeiro, Brazil. *Comment* (LHGW): palm trees, which are monocotyledons, grow primarily cylindrically and vertically with no significant thickening of diam with age, unlike non-monocotyledenous trees. There is a question of whether palms thicken slightly with age, a phenomenon that may be designated "diffuse secondary growth." Vascular bundles are dispersed throughout the stem with widely scattered bundles in the center and more densely concentrated bundles on the outside. A single vascular bundle enters the tree stem at a leaf base and rapidly crosses the cortex to the center of the stem; however, as a tree grows, the bundle will travel gradually toward the periphery.

The high ^{14}C value of the inside sample at 9.4m may indicate that the sample contained an active vascular bundle, allowing late growth to give the stem added strength. At the 16.4m level, the higher bomb ^{14}C level of the inside sample compared to that of the outside sample indicates that cells in the center remain active longer than those near the cortex.

LJ no.	Height above bottom (m)	Inside/outside (I)/(O)	Δ (%)
-4305	17.4	O	+416 \pm 10
-4308	17.4	I	+409 \pm 10
-4306	16.4	O	+184 \pm 7
-4307	16.4	I	+240 \pm 7
-4100	15.4	O	+16 \pm 8
-4099	15.4	I	+30 \pm 8
-4450	12.4	O	-20 \pm 8
-4451	12.4	I	-4 \pm 8
-4303	9.4	O	-17 \pm 6
-4304	9.4	I	+87 \pm 8
-4452	8.4	O	-3 \pm 8
-4453	8.4	I	+8 \pm 8
-4454	5.4	O	-1 \pm 6
-4455	5.4	I	-12 \pm 7
-4102	2.4	O	-9 \pm 8
-4101	2.4	I	-7 \pm 7

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