

**INSTITUTO VENEZOLANO DE INVESTIGACIONES CIENTIFICAS
NATURAL RADIOCARBON MEASUREMENTS VI**

M. A. TAMERS

Instituto Venezolano de Investigaciones Cientificas,
Department of Chemistry, Caracas, Venezuela

The I.V.I.C. laboratory continues operation using liquid scintillation spectrometry with synthesized benzene. A plastic-glass counting vessel contains 3 ml benzene, 1 ml commercial toluene, and concentrations of 0.4% PPO and 0.01% POPOP as scintillators. Background is 6.9 cpm and activity of the modern standard, 95% of the activity of the NBS oxalic acid, is 21.4 cpm. In the age calculations, 5568 years is taken for the half-life of C^{14} and quoted errors are one standard deviation arising from the random nature of the radioactive disintegration process. Uncertainties in the half-life are not included nor are variations in the deposition rate of stratospheric radiocarbon and dilution by industrial use of fossil fuels. A.D. 1950 is employed as the reference year in the B.P. (before present) notation of ages.

ACKNOWLEDGMENTS

Close collaboration is maintained with the I.V.I.C. Dept. of Anthropol., J. M. Cruxent, head. V. García and F. Machado carry out the benzene syntheses and routine chemical analyses. A. Russo maintains the liquid scintillation counter.

SAMPLE DESCRIPTIONS

I. GROUND WATER SAMPLES

Considerable portions of Venezuela, including several of its principal cities, lie in semi-arid regions. Traditionally, fresh water in these areas has depended on subterranean aquifers. However, recent introduction of large bore deep wells and electric pumps, necessary for increasing living standards, developing industry, and irrigation, have resulted in lowering ground water levels. A study of the recharge characteristics of the water tables is a *sine qua non* for future planning in these areas.

The principal ground water aquifers of Venezuela have been investigated by radiocarbon dating of dissolved carbonate species. The results have been presented in previous date lists. Two aquifers are sampled annually in a program to observe changes caused by contamination of the atmosphere by nuclear weapons. The wells on the N and S sides of the Lake of Valencia and the Bosque Macuto municipal wells of Barquisimeto are producing modern water. The technique of sequential sampling, initiated in these cases in 1966, allows a fitting of the limestone-corrected radiocarbon dates with the fallout curve (Tamers and Scharpenseel, 1970). The method works well for Barquisimeto, but the Lake of Valencia modern waters are apparently being over-exploited and are no longer reaching the lake. This is accelerating the natural desiccation of the large continental body of water.

Wells of Valencia Lake Basin

	Collection (day/month/yr)	C ¹⁴ (% of modern)
IVIC-685. Mariara 1 (10° 15' N Lat, 67° 43' W Long)	14/1/70	88.8 ± 0.7
IVIC-686. Mariara 2 (10° 13' N Lat, 67° 43' W Long)	14/1/70	99.7 ± 0.8
IVIC-687. El Trompillo (10° 4' N Lat, 67° 48' W Long)	14/1/70	98.8 ± 0.8
IVIC-688. Güigüe 1 (10° 5' N Lat, 67° 47' W Long)	14/1/70	91.5 ± 1.0
IVIC-689. Güigüe 3 (10° 5' N Lat, 67° 47' W Long)	14/1/70	91.8 ± 0.8

Barquisimeto Wells

IVIC-768. Macuto 1 (10° 3' N Lat, 69° 19' W Long)	12/5/70	91.3 ± 0.8
IVIC-769. Macuto 2 (10° 3' N Lat, 69° 19' W Long)	12/5/70	92.8 ± 0.7
IVIC-770. Macuto 3 (10° 3' N Lat, 69° 19' W Long)	12/5/70	86.5 ± 0.7
IVIC-771. Macuto 5 (10° 3' N Lat, 69° 19' W Long)	12/5/70	87.1 ± 0.8
IVIC-772. Macuto 6 (10° 3' N Lat, 69° 19' W Long)	12/5/70	85.5 ± 0.7
IVIC-773. Macuto 7 (10° 3' N Lat, 69° 19' W Long)	12/5/70	91.4 ± 0.7
IVIC-774. Macuto 8 (10° 3' N Lat, 69° 19' W Long)	12/5/70	85.1 ± 0.7

II. ARCHAEOLOGIC SAMPLES

*A. Venezuela***IVIC-723. Misteque** **850 ± 60**
A.D. 1100

Charcoal obtained from mortar of piled stones, ca. 6 km SE Chachopo, state of Mérida, Venezuela (8° 56.0' N Lat, 70° 46.7' W Long). Assoc. with simple pottery, trade pottery, stones, manos, animal bones, ashes. This is 1st date for region of Chachopo. Other dates for Venezuelan Andes discussed previously (Wagner, 1967). Coll. 1970 and subm. by E. Wagner, I.V.I.C., who estimated age to be 500 to 1000 B.P. *Comment* (E.W.): date confirms age estimation from artifacts.

IVIC-724. Ensilada de Mucuyupú **200 ± 60**
A.D. 1750

Small charcoal sample from cave NW of Timotes, on boundary between states of Mérida and Trujillo, Venezuela (9° 1.1' N Lat, 70° 44.9' W Long). Assoc. with simple pottery and pieces of shell necklace. Coll.

1970 and subm. by E. Wagner. This is 1st date from cave in elevated zone in Venezuelan Andes. Estimated age, 400 to 1000 B.P. *Comment* (E.W.): probably intrusive charcoal.

Taima-taima series

This paleo-indian kill site W of Vela de Coro, state of Falcón, Venezuela (11° 30' N Lat, 69° 30' W Long) has been under intensive investigation by the I.V.I.C. Anthropol. Dept. for past 10 yr (Cruxent, 1967). Pleistocene animal bones have been dated at $13,010 \pm 280$ and $14,440 \pm 435$ B.P. (IVIC-191-1 and IVIC-191-2, R., 1966, v. 8, p. 206) for non-carbonate fractions and 7590 ± 100 B.P. (IVIC-191-B, R., 1969, v. 11, p. 407) for carbonates. The fluorine content was 1.0% (Tamers, 1969b). A wood sample, presumably preserved by high sulfur content of soil, provided date of $11,860 \pm 130$ B.P. (IVIC-655, R., 1970, v. 12, p. 516). Evidence for man is based on numerous cutting scars on bones and stone points (Cruxent, pers. commun.).

	9650 ± 80
IVIC-657. Taima-taima A, 0.65 to 0.75 m	7700 B.C.
Black clay, Profile A, Sec. 38, NE corner. 1.5% non-rootlet, non-carbonate carbon content.	
	9650 ± 110
IVIC-658. Taima-taima A, 0.75 to 0.85 m	7700 B.C.
Black clay, Profile A, Sec. 38, NE corner. 2.9% non-rootlet, non-carbonate carbon content.	
	10,140 ± 90
IVIC-659. Taima-taima A, 0.85 to 0.95 m	8190 B.C.
Black clay, Profile A, Sec. 38, NE corner. 3.9% non-rootlet, non-carbonate carbon content.	
	12,660 ± 120
IVIC-660. Taima-taima A, 1.50 to 1.65 m	10,710 B.C.
Gray sand, Profile A, Sec. 38, NE corner. 0.25% non-rootlet, non-carbonate carbon content.	
	12,620 ± 120
IVIC-661. Taima-taima A, 1.65 to 1.80 m	10,670 B.C.
Gray sand, Profile A, Sec. 38, NE corner. 0.35% non-rootlet, non-carbonate carbon content.	
	13,390 ± 130
IVIC-662. Taima-taima A, 1.80 to 1.95 m	11,440 B.C.
Gray sand, Profile A, Sec. 38, NE corner. 0.54% non-rootlet, non-carbonate carbon content.	
	13,130 ± 130
IVIC-663. Taima-taima A, 1.95 to 2.10 m	11,180 B.C.
Gray sand, Profile A, Sec. 38, NE corner. 0.67% non-rootlet, non-carbonate carbon content.	

- 12,730 ± 120**
- IVIC-664. Taima-taima A, 2.10 to 2.25 m** **10,780 B.C.**
 Gray sand, Profile A, Sec. 38, NE corner. 0.78% non-rootlet, non-carbonate carbon content. Soil samples coll. 1969 and subm. by J. M. Cruxent and M. A. Tamers. Black clay layer is overlain by ca. 65 cm impermeable yellow clay. From ca. 95 to 150 cm is another deposit of almost carbon-free clay. The kill site bones are located in the gray sand layer, which is in the phreatic zone. Surface vegetation is sparse and xerophytic. At ca. 225 cm begins rock strata of tertiary period. *Comment:* see General Comment after Taima-taima B series.
- 9860 ± 110**
- IVIC-665. Taima-taima B, 0.65 to 0.75 m** **7910 B.C.**
 Black clay, Profile B, Sec. 38, SE corner. 1.6% non-rootlet, non-carbonate carbon content.
- 10,030 ± 90**
- IVIC-666. Taima-taima B, 0.75 to 0.85 m** **8080 B.C.**
 Black clay, Profile B, Sec. 38, SE corner. 3.6% non-rootlet, non-carbonate carbon content.
- 10,290 ± 90**
- IVIC-667. Taima-taima B, 0.85 to 0.95 m** **8340 B.C.**
 Black clay, Profile B, Sec. 38, SE corner. 4.8% non-rootlet, non-carbonate carbon content.
- 13,390 ± 130**
- IVIC-668. Taima-taima B, 1.50 to 1.65 m** **11,440 B.C.**
 Gray sand, Profile B, Sec. 38, SE corner. 0.30% non-rootlet, non-carbonate carbon content.
- 12,770 ± 120**
- IVIC-669. Taima-taima B, 1.65 to 1.80 m** **10,820 B.C.**
 Gray sand, Profile B, Sec. 38, SE corner. 0.37% non-rootlet, non-carbonate carbon content.
- 12,990 ± 260**
- IVIC-670. Taima-taima B, 1.80 to 1.95 m** **11,040 B.C.**
 Gray sand, Profile B, Sec. 38, SE corner. 0.59% non-rootlet, non-carbonate carbon content.
- 13,180 ± 130**
- IVIC-671. Taima-taima B, 1.95 to 2.10 m** **11,230 B.C.**
 Gray sand, Profile B, Sec. 38, SE corner. 0.62% non-rootlet, non-carbonate carbon content.
- 14,010 ± 140**
- IVIC-672. Taima-taima B, 2.10 to 2.25 m** **12,060 B.C.**
 Gray sand, Profile B, Sec. 38, SE corner. 1.2% non-rootlet, non-carbonate carbon content. Soil samples coll. same time as those of Profile A and soil strata are similar. Previous soil sample date on Taima-taima gray sand was 12,580 ± 150 B.P. (IVIC-627, R., 1970, v. 12, p. 516), from an adjacent area of site; agrees with these dates.

General Comment (M.A.T.): black clay layer overlies and underlies impermeable strata and can be used to give minimum possible age of $10,290 \pm 90$ B.P. to artifacts located in gray sand. Radiocarbon dates in the gray sand are practically indistinguishable, except for IVIC-672, which is a little older. There is definite increase of carbon content with depth, contrary to other cases of soil profiles studied in Venezuela (see Sec. III). Possibly, carbon originates from a deposit at ca. 2.10 m depth and was partially transported upward by seasonal fluctuations of ground water level. Therefore, $14,010 \pm 140$ B.P. could be taken as oldest date for the bones. The impermeability of upper strata minimizes the possibility of a large amount of more recent carbon infiltration causing falsely young ages, as observed in work of Bonn lab. (Scharpenseel and Pietig, 1969). The age of Taima-taima kill site must lie between 11,000 and 15,000 B.P. This is oldest dated archaeological site in South America.

+2310
36,690
-1790
34,740 B.C.

IVIC-704. Taima-taima organic material

Carbonaceous material, probably lignite, from 2.00 m depth in part of Taima-taima site with few bones. Coll. 1970 and subm. by J. M. Cruxent. Material not typical of site nor of area and must have been introduced artificially from a considerable distance. Previous date on similar sample from Taima-taima was $>41,000$ B.P. (Y-1199, R., 1969, v. 11, p. 634), which is within 2σ of IVIC date. *Comment* (J.M.C.): material cannot be considered to date Taima-taima artifacts.

B. Chile

Caleta Abtao series

Samples of loco (*Concholepas concholepas*) shells from 3rd marine terrace mound on Mejillones Peninsula, prov. of Antofagasta, Chile ($23^{\circ} 20' S$ Lat, $70^{\circ} 31' W$ Long). Coll. 1969 and subm. by G. Boisset and A. Llagostera, Univ. del Norte, Antofagasta, Chile.

IVIC-679. Caleta Abtao 1

5030 \pm 70
3080 B.C.

From Site 2, Pit 2, 2.20 m below surface. First occupation level. Assoc. with shell fish hooks, bone and lithic instruments, plant origin cord, guano.

IVIC-680. Caleta Abtao 4

4820 \pm 70
2870 B.C.

From Site 2, Pit 1, 2.40 m below surface. First occupation level. Assoc. with 2 shell fish hooks and 1 cactus spine fish hook.

IVIC-681. Caleta Abtao 7

5100 \pm 130
3150 B.C.

From Site 1, Sq. 01, 0.10 m below surface. Seventh (last) occupation level. Assoc. with stone points and fragments and tubular bone beads.

IVIC-682. Caleta Abtao 8**5090 ± 80****3140 B.C.**

From Site 1, Sq. 01, 0.90 m below surface. First occupation level. Assoc. with shell, bone, and cactus spine fish hooks; lithic, bone, and wood instruments; and cord.

IVIC-683. Caleta Abtao 11**4800 ± 70****2850 B.C.**

From Site 1, Sq. 01, 0.40 m below surface. Fifth occupation level. Assoc. with shell, bone, and cactus spine fish hooks; lithic, bone, and wood instruments; and cord. *Comment* (M.A.T.): the 5 dates are statistically indistinguishable.

General Comment (G.B.): dates agree perfectly with archaeological evidence. Previous date for shell fish hook culture of Quiani, Arica site was 6170 ± 220 B.P. (I-1348, R., 1969, v. 11, p. 102). Date for cactus spine fish hooks from same site was 5630 ± 145 B.P. (I-1349, R., 1969, v. 11, p. 102). In Caleta Abtao both cultures appear in all occupation levels. Since IVIC dates are close to but less than I-1349, we could say that immigrants from N came to Caleta Abtao at period of beginning of use of cactus spine fish hooks. Shell fish hook use persisted in Caleta Abtao longer than in N, e.g., in Quiani.

Alero Rocoso de San Pedro Viejo series

Charcoal samples from Hortado R. valley, N side, Ovalle Dept., Coquimbo prov., Chile ($30^{\circ} 23' S$ Lat, $70^{\circ} 53' W$ Long). Coll. 1968 and 1970 and subm. by G. Ampuero B. and M. A. Rivera, Univ. de Concepción, Concepción, Chile.

IVIC-727. Pichasca 1**7050 ± 80****5100 B.C.**

From Sq. D-2, Level II, 1 m below surface. Located in simple burial pocket without furnishings. Level occupied by hunters with knowledge of agriculture and possibly in contact with the El Molle ceramic culture. Sample date contact between Levels I and II.

IVIC-728. Pichasca 2**9890 ± 80****7940 B.C.**

From Sq. D-3, Level III. Assoc. with projectile points, bone and wood tools, and food debris. Existence of basketry. Level occupied by hunters with probable beginnings of agriculture, preceramic, and before El Molle culture. Sample dated twice on separate batches of charcoal with results: 9920 ± 110 and 9860 ± 110 B.P.

IVIC-729. Pichasca 3**4700 ± 80****2750 B.C.**

From NW wall Sq. A-1, base of Level II. Assoc. with projectile points, basketry, and objects of wood and bone. Sample corresponds to contact between Levels II and III. Occupation by hunters with probable beginnings of agriculture. Ceramics absent.

General Comment (M.A.R.): 1st impression is that dates agree with other evidence of the 2 excavations.

III. SOIL SAMPLES

Radiocarbon dating of soil associations in various regions of Venezuela is one major project of the lab. Pretreatment is similar to that developed in Bonn (Scharpenseel, Tamers, and Pietig, 1968). Sample first passed through gross screen to remove large roots and stones. A slurry is then produced with distilled water and a high torque stirrer. A fine screen removes small rootlets from this suspension. Hydrochloric acid is added to eliminate carbonates and slurries centrifuged to permit decantation of supernatant liquids. After drying at 110°C, soils are burned in usual combustion tubes and CO₂ collected in ammonia bubblers. Precipitation with strontium chloride permits gravimetric analysis of non-carbonate, non-rootlet carbon content and provides material for benzene synthesis.

Maracay series

Soil association on NE bank of Lake of Valencia, in orchard of Fac. de Agron., Univ. Central in Maracay, state of Aragua, Venezuela (10° 17' N Lat, 67° 36' W Long). Surface layer of alluvial loam ca. 60 cm separated by ca. 135 cm almost carbon-free sand from fossil horizon. Coll. 1970 and subm. by R. Herrera and M. A. Tamers.

IVIC-690. Maracay A-1 **123.4 ± 0.9 ‰ modern**

Gray-black clayey soil, 0 to 0.15 m below surface. 1.6% non-carbonate, non-rootlet carbon content.

IVIC-691. Maracay A-2 **103.4 ± 0.8 ‰ modern**

Gray-black clayey soil, 0.15 to 0.30 m below surface. 1.2% non-carbonate, non-rootlet carbon content.

IVIC-692. Maracay A-3 **104.6 ± 0.8 ‰ modern**

Gray-black clayey soil, 0.30 to 0.45 m below surface. 0.52% non-carbonate, non-rootlet carbon content.

IVIC-693. Maracay A-4 **103.3 ± 0.9 ‰ modern**

Gray-black clayey soil, limit of this horizon, 0.45 to 0.60 m below surface. Mixed with yellow sand. 0.42% non-carbonate, non-rootlet carbon content.

IVIC-700. Maracay A-11 **1260 ± 70
A.D. 690**

Gray-black friable soil, beginning of fossil horizon. 0.50% non-carbonate, non-rootlet carbon content. 1.35 to 1.50 m below surface.

IVIC-701. Maracay A-12 **1650 ± 80
A.D. 300**

Gray-black soil, 1.50 to 1.65 m below surface. Second half of fossil horizon. 0.24% non-carbonate, non-rootlet carbon content.

General Comment: it was not expected that all upper horizon samples would be modern. Inorganic fertilizer was employed here and soil has not been recently ploughed, and certainly to no more than 30 cm. Modern dates of IVIC-692 and IVIC-693 must be due to infiltration of recent material from upper layers, a phenomenon described elsewhere (Benzler and Geyh, 1966; Scharpenseel and Pietig, 1969). Since sand separating these layers from fossil horizon is permeable, it must be concluded that IVIC-700 and IVIC-701 are also falsely young. Values indicate only minimum ages. It is not clear to us why surface carbon infiltration is so pronounced in this particular soil.

Tierra Pipe series

Clay soil samples, brown earth of A-C horizon type in Altos de Pipe, state of Miranda, Venezuela (10° 23' N Lat, 66° 58' W Long), on steep side of Pipe hill. Previous profile gave dates of 2230 ± 60, 4220 ± 90, and 5720 ± 80 B.P. for 15 cm fractions from 0.15 to 0.60 m (IVIC-652, IVIC-653, IVIC-654, R., 1970, v. 12, p. 524). Profiles reported here continue study, Pipe 3 being ca. 50 m below previous samples, Pipe 4 ca. 100 m below, Pipe 2 ca. 50 m above, and Pipe 5 on hill top, slightly on opposite side with gentle slope. Coll. 1970 and subm. by R. Herrera and M. A. Tamers.

	890 ± 60
IVIC-756. Pipe 5, 0.25 to 0.35 m	A.D. 1060
2.3% non-rootlet, non-carbonate carbon content.	
	1400 ± 70
IVIC-757. Pipe 5, 0.35 to 0.45 m	A.D. 550
2.1% non-rootlet, non-carbonate carbon content.	
	2150 ± 70
IVIC-758. Pipe 5, 0.45 to 0.55 m	200 B.C.
0.91% non-rootlet, non-carbonate carbon content.	
	2050 ± 70
IVIC-759. Pipe 5, 0.55 to 0.65 m	100 B.C.
0.56% non-rootlet, non-carbonate carbon content.	
	2460 ± 70
IVIC-760. Pipe 5, 0.65 to 0.75 m	510 B.C.
0.53% non-rootlet, non-carbonate carbon content.	
	2480 ± 80
IVIC-761. Pipe 5, 0.75 to 0.85 m	530 B.C.
0.26% non-rootlet, non-carbonate carbon content.	
	2830 ± 80
IVIC-730. Pipe 2, 0.15 to 0.30 m	880 B.C.
0.42% non-rootlet, non-carbonate carbon content.	
	5620 ± 100
IVIC-731. Pipe 2, 0.30 to 0.45 m	3670 B.C.
0.34% non-rootlet, non-carbonate carbon content.	

IVIC-732. Pipe 2, 0.45 to 0.60 m	6000 ± 100
0.36% non-rootlet, non-carbonate carbon content.	4050 B.C.
IVIC-733. Pipe 2, 0.60 to 0.75 m	6820 ± 90
0.34% non-rootlet, non-carbonate carbon content.	4870 B.C.
IVIC-734. Pipe 2, 0.75 to 0.90 m	6840 ± 100
0.27% non-rootlet, non-carbonate carbon content.	4890 B.C.
IVIC-735. Pipe 3, 0.15 to 0.30 m	390 ± 60
2.9% non-rootlet, non-carbonate carbon content.	A.D. 1560
IVIC-736. Pipe 3, 0.30 to 0.45 m	1030 ± 60
2.0% non-rootlet, non-carbonate carbon content.	A.D. 920
IVIC-737. Pipe 3, 0.45 to 0.60 m	1670 ± 70
1.4% non-rootlet, non-carbonate carbon content.	A.D. 280
IVIC-738. Pipe 3, 0.60 to 0.75 m	2330 ± 70
1.1% non-rootlet, non-carbonate carbon content.	420 B.C.
IVIC-739. Pipe 3, 0.75 to 0.90 m	2610 ± 80
0.98% non-rootlet, non-carbonate carbon content.	660 B.C.
IVIC-740. Pipe 4, 0.15 to 0.30 m	570 ± 60
1.7% non-rootlet, non-carbonate carbon content.	A.D. 980
IVIC-741. Pipe 4, 0.30 to 0.45 m	1050 ± 60
1.8% non-rootlet, non-carbonate carbon content.	A.D. 900
IVIC-742. Pipe 4, 0.45 to 0.60 m	1250 ± 70
1.4% non-rootlet, non-carbonate carbon content.	A.D. 700
IVIC-743. Pipe 4, 0.60 to 0.75 m	1710 ± 70
0.96% non-rootlet, non-carbonate carbon content.	A.D. 240
IVIC-744. Pipe 4, 0.75 to 0.90 m	2180 ± 70
0.47% non-rootlet, non-carbonate carbon content.	230 B.C.
IVIC-745. Pipe 4, 0.90 to 1.05 m	2220 ± 70
0.31% non-rootlet, non-carbonate carbon content.	270 B.C.

General Comment: samples all show correct date sequences with respect to stratigraphy. Ages and carbon contents increase with distance down

slope. Previous profile dates in agreement with these tendencies. This study is being continued with more samples and various chemical analyses on the soils.

Club de Campo series

Soil samples on opposite side of Pipe Hill, in direction of settlement Club de Campo (10° 23' N Lat, 66° 58' W Long). Pipe 5 dates could be given with this series. Club de Campo 1 is ca. 50 m from hill top and Club de Campo 2 is ca. 100 m down hill. Coll. 1970 and subm. by R. Herrera and M. A. Tamers.

IVIC-748. Club de Campo 1, 100.4 ± 0.8 % modern
0.15 to 0.30 m

1.3% non-rootlet, non-carbonate carbon content.

340 ± 60

IVIC-749. Club de Campo 1, 0.30 to 0.45 m A.D. 1610

0.82% non-rootlet, non-carbonate carbon content.

490 ± 60

IVIC-750. Club de Campo 1, 0.45 to 0.60 m A.D. 1460

0.17% non-rootlet, non-carbonate carbon content.

1330 ± 70

IVIC-752. Club de Campo 2, 0.25 to 0.35 m A.D. 620

1.1% non-rootlet, non-carbonate carbon content.

1790 ± 70

IVIC-753. Club de Campo 2, 0.35 to 0.45 m A.D. 160

0.65% non-rootlet, non-carbonate carbon content.

1650 ± 70

IVIC-754. Club de Campo 2, 0.45 to 0.55 m A.D. 300

0.37% non-rootlet, non-carbonate carbon content.

General Comment: dates increase and carbon contents decrease regularly with depth. Relatively recent dates were unexpected. Rather, we expected that this small slope would produce older soils than other side of hill, with its steep gradient. Club de Campo investigations are continuing.

Boconó series

Sandy alluvial soil profile, in pasture 2 km from M.O.P. (Ministerio de Obras Publicas) sta., 100 m from Boconó (Boconoito)—Puerto Nutrias rd., state of Barinas, Venezuela (8° 42' N Lat, 69° 52' W Long), W Llanos Altos region. Sediments formed from overflowing of Boconó R., which has since changed course. It was thought that this soil might date previous to those of next 2 series. Coll. 1970 by R. Herrera and J. García and subm. by R. Herrera and M. A. Tamers.

IVIC-706. Boconó, 0 to 0.10 m 104.8 ± 0.8 % modern

From A horizon, 2.1% non-rootlet non-carbonate carbon content.

30 ± 70

IVIC-707. Boconó, 0.10 to 0.25 m **A.D. 1920**
 From A horizon, 1.3% non-rootlet, non-carbonate carbon content.

1160 ± 70

IVIC-708. Boconó, 0.25 to 0.50 m **A.D. 790**
 From C horizon, 0.14% non-rootlet, non-carbonate carbon content.

2670 ± 70

IVIC-709. Boconó, 0.50 to 0.75 m **720 B.C.**
 From C horizon, 0.09% non-rootlet, non-carbonate carbon content.

General Comment: ages increase and carbon contents decrease regularly with depth. This series was from bank of previous position of Boconó R. Soil is very permeable and recent carbon infiltration into deeper levels should be at maximum here. Nevertheless, deepest sample, IVIC-709, is still quite old.

Fanfurria series

Sandy loam, alluvial, soil samples from M.O.P. sta. on Boconó (Boconoito)—Puerto Nutrias rd., state of Barinas, Venezuela (8° 42' N Lat, 69° 56' W Long). Deposits from overflowing of Boconó R., while in earlier position. Intermediate between Boconó series and Méndez series. Coll. 1970 by R. Herrera and J. García and subm. by R. Herrera and M. A. Tamers.

IVIC-710. Fanfurria, 0 to 0.15 m **106.9 ± 0.8 % modern**
 1.4% non-rootlet, non-carbonate carbon content.

IVIC-711. Fanfurria, 0.15 to 0.30 m **106.6 ± 0.8 % modern**
 0.70% non-rootlet, non-carbonate carbon content.

1190 ± 70

IVIC-712. Fanfurria, 0.30 to 0.45 m **A.D. 760**
 0.58% non-rootlet- non-carbonate carbon content.

1610 ± 70

IVIC-713. Fanfurria, 0.45 to 0.60 m **A.D. 340**
 0.52% non-rootlet, non-carbonate carbon content.

General Comment: ages and carbon contents tendencies are the same as in the Boconó series.

Méndez series

Clayey alluvial soil from M.O.P. sta. on Boconó (Boconoito)—Puerto Nutrias rd., state of Barinas, Venezuela (8° 41' N Lat, 69° 56' W Long). Deposits in furthest position from bed of previous Boconó R. Downhill from Boconó and Fanfurria series. Coll. 1970 by R. Herrera and J. García and subm. by R. Herrera and M. A. Tamers.

IVIC-714. Méndez, 0 to 0.12 m **109.8 ± 0.8 % modern**
 2.0% non-rootlet, non-carbonate carbon content.

IVIC-715. Méndez, 0.12 to 0.25 m	460 ± 70 A.D. 1490
0.73% non-rootlet, non-carbonate carbon content.	
IVIC-716. Méndez, 0.25 to 0.40 m	940 ± 60 A.D. 1010
0.53% non-rootlet, non-carbonate carbon content.	
IVIC-717. Méndez, 0.40 to 0.55 m	1690 ± 60 A.D. 260
0.35% non-rootlet, non-carbonate carbon content.	
IVIC-718. Méndez, 0.55 to 0.70 m	2540 ± 80 590 B.C.
0.21% non-rootlet, non-carbonate carbon content.	
IVIC-719. Méndez, 0.70 to 0.85 m	2530 ± 80 580 B.C.
0.16% non-rootlet, non-carbonate carbon content.	

General Comment: ages increasing and carbon contents decreasing regularly with depth. At equivalent levels, dates for these three series are similar, suggesting simultaneous formation. Distribution of particle sizes is due to smaller particles, *i.e.*, clay, being transported more easily and thus further by the flooding of previous Boconó river. Assumption that Boconó series would be oldest is rejected.

IV. GEOLOGIC SAMPLE

IVIC-722. Morrena Victoria	5470 ± 80 3520 B.C.
-----------------------------------	--------------------------------------

Soil sample (CS-24) from fluvial terrace, 1 m below surface, ca. 2.7 m E Alto de Santo Domingo (Macubají), state of Mérida, Venezuela (8° 48.7' N Lat, 70° 48.3' W Long). Ca. 1 km S Laguna Victoria. Assoc. with gravel and sand of glacial origin (Schubert and Sifontes, 1970). Coll. 1970 and subm. by C. Schubert, I.V.I.C. First date related to last glaciation in Venezuelan Andes. Soil contained 2.9% non-carbonate, non-rootlet carbon, which was used for radiocarbon determination. *Comment* (C.S.): date very reasonable.

V. EXTRATERRESTRIAL SAMPLE

IVIC-702. Caserio Ueera Meteorite	34.4 ± 2.2 dpm/kg
--	--------------------------

Thoroughly metamorphosed chondrite, Type H-6, fell 7:00 p.m., 16 Jan. 1970 near Caserio Ueera, state of Falcón, Venezuela (11° 2' N Lat, 69° 48' W Long). Stony meteorite weighed 4.95 kg, had thoroughly rounded edges and typical chemical composition for chondrites (Vaz, 1970). Fall heard by village inhabitants, who coll. meteorite while still warm. Obtained by E. Vaz, I.V.I.C., a few days later. Sample for radiocarbon analysis was taken from surface and heated at ca. 1000°C for 48 hr in oxygen stream. Polyethylene plastic used as carrier. *Comment* (M.A.T.): radiocarbon content is ca. 1/2 that of other "fall" stone meteorites we have measured, average value: 85 dpm/kg. It is also low in

comparison with accelerator measured cross section data for $O^{16}(p,3p)C^{14}$ (Tamers, 1963). There was no indication that Caserio Ucera had recently been transferred from a larger body, which would have meant that it had been irradiated only on one side. Other stone meteorite "Falls" showed average radiocarbon contents of 65 dpm/kg (Goel and Kohman, 1962) and 48 dpm/kg (Suess and Wänke, 1962). Caserio Ucera has lowest value so far observed.

REFERENCES

- Benzler, J. H. and Geyh, M. A., 1966, Versuch einer zeitlichen Gliederung von Dwog-Horizonten mit Hinweisen auf die Problematik der ^{14}C -Datierung von Bodenproben: *Deutsch geol. Gesell. Zeitschr.*, v. 118, p. 361-367.
- Buckley, J. D. and Willis, E. H., 1969, Isotopes' radiocarbon measurements VII: *Radiocarbon*, v. 11, p. 53-105.
- Cruxent, José M., 1967, El paleo-indio en Taima-taima, estado Falcón, Venezuela: *Acta Cient. Venezolana Supp.* 3, p. 3-17.
- Goel, P. S. and Kohman, T. P., 1962, Cosmogenic carbon-14 in meteorites and terrestrial ages of "finds" and craters: *Science*, v. 136, p. 875-876.
- Scharpenseel, H. W. and Pietig, F., 1969, Altersbestimmung von Böden durch die Radiokohlenstoffdatierungsmethode III. Böden mit B_t -Horizont und fossile Schwarzerden: *Pflanzenernährung Bodenkunde Zeitschr.*, v. 122, p. 145-152.
- Scharpenseel, H. W., Tamers, M. A., and Pietig, F., 1968, Altersbestimmung von Böden durch die Radiokohlenstoffdatierungsmethode. I. Methode und vorhandene ^{14}C -Daten: *Pflanzenernährung Bodenkunde Zeitschr.*, v. 119, p. 34-44.
- Schubert, Carlos and Sifontes, R. S., 1970, Bocono Fault, Venezuelan Andes: Evidence of Postglacial movement: *Science*, v. 170, p. 66-69.
- Stuiver, Minze, 1969, Yale natural radiocarbon measurements IX: *Radiocarbon*, v. 11, p. 545-658.
- Suess, H. E. and Wänke, H., 1962, Radiocarbon content and terrestrial age of twelve stony meteorites and one iron meteorite: *Geochim. et Cosmochim. Acta*, v. 26, 475-480.
- Tamers, M. A., 1963, Détermination des sections efficaces de quelques réactions nucléaires intervenant dans les effets du rayonnement cosmique: *C.E.A. Rap.*, v. 2298, p. 1-61.
- 1966, Instituto Venezolano de Investigaciones Científicas natural radiocarbon measurements II: *Radiocarbon*, v. 8, p. 204-212.
- 1969a, Instituto Venezolano de Investigaciones Científicas natural radiocarbon measurements IV: *Radiocarbon*, v. 11, p. 396-422.
- 1969b, Datage non destructif des os fossiles: *Acad. sci. [Paris] Comptes rendus*, v. 268D, p. 489-492.
- 1970, Instituto Venezolano de Investigaciones Científicas natural radiocarbon measurements V: *Radiocarbon*, v. 12, p. 509-525.
- Tamers, M. A. and Scharpenseel, H. W., 1970, Sequential sampling of radiocarbon in ground water, *in*: Use of isotopes in hydrology, I.A.E.A., Vienna, in press.
- Vaz, J. E., 1970, Mineralogía y composición química del meteorito "Caserio Ucera": *Acta Cient. Venezolana*, in press.
- Wagner, Erika, 1967, The prehistory and ethnohistory of the Carache area in western Venezuela: *Yale Univ. pub. in Anthropol.*, no. 71.