

MUSEO DE LA PLATA RADIOCARBON MEASUREMENTS I

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INTRODUCTION

The reinstallation, operation, and the ^{14}C measurements reported here were made since 1976 in the LATYR, the Radiocarbon Dating Laboratory of the Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata. Sample preparation is preceded by careful visual separation and hand removal of gross impurities. This is followed in all cases (charcoal, wood) with successive washings of the sample with boiling 2% HCl and 1% NaOH solution for removal of carbonates and humic acids. Thereafter, it is washed with distilled water and acidified to $\text{pH} = 3$. Individual variations in the pretreatment are not described in the date list, but they are usually reported directly to the collector together with the data obtained.

Shell is dissolved in two fractions by HCl. The outer part of the shell (20% in weight) is discarded to reduce possible surface contamination. The inner part (20 to 100% in weight) is used for dating. In some cases these two fractions are dated separately. Bone is pretreated by solution of collagen in acid hot water, according to Longin (1970; 1971) with slight modifications. The chemical procedure for the groundwater samples preparation is to precipitate the carbon already in the field as barium carbonate. Atmospheric samples are collected by weekly static absorption in sodium hydroxide solution. In the lab, the solutions are converted to carbon dioxide by acid hydrolysis.

For organic materials the CO_2 is produced in a tube combustion unit with an oxygen stream, with initial purification by CuO (600°C), acid potassium permanganate, and precipitation in sodium hydroxide solution in the form of barium carbonate. The solution is acid hydrolyzed in vacuo using phosphoric acid.

CO_2 is evolved from carbonate samples by means of acid hydrolysis. We obtain the purest gases by final purification through a vacuum line with a water vapor trap (-80°C), Cu furnace (450°C), water vapor trap, and liquid air trap for CO_2 . Then, it is stored for three weeks for complete decay of radon.

Radioactivity is measured with a gas proportional counter, using carbon dioxide at 820mm Hg as filling gas, at room temperature (20°C). The dating system has a 381ml copper-walled proportional counter, surrounded by 3cm of selected lead, which is encircled by a ring of 14 cosmic-ray Geiger counters. Working voltage is 5200v with a plateau length of 300v and a plateau slope of ca 1% per 100v (for mesons).

Influence of cosmic and local environmental radiation on the counters is reduced with a composite shield consisting of layers of iron (10cm),

paraffin (15cm), and iron (30cm), at the top. All samples are counted at least twice for periods of not less than 2000 minutes each.

Age calculations are based on a contemporary value equal to 0.950 the specific activity of NBS oxalic acid standard and on the conventional Libby half-life for ^{14}C of 5570 ± 30 years. Results are reported in years before 1950 (years BP). Errors quoted (1σ) include standard deviations of count rates for the unknown sample, contemporary standard, and background. Background CO_2 is obtained from the acidification of marble and combustion of petroleum coke. The modern standard is prepared from NBS oxalic acid (SRM 4990 B) by wet oxidation with great care to achieve complete reaction (Valastro, Land, & Varela, 1977; 1979). No corrections were made for isotopic fractionation and/or reservoir effect.

The description of each sample is based on information provided by the submitter.

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INTER-LABORATORY CHECK SAMPLES

Lab no.	LP date	Other lab no.	Other date	Refs
LP-71	9910 ± 240	T-2917	9580 ± 150	Pers commun
LP-72	9280 ± 250	T-2919	9480 ± 140	Pers commun
LP-73	7460 ± 210	R-9048*	7670 ± 70	Pers commun

* Internal no.-New Zealand lab

General Comment: apparent differences are considered statistically insignificant (Ward & Wilson, 1978) and LP dates are in statistical concordance with those provided by other labs.

SAMPLE DESCRIPTIONS

GEOLOGIC SAMPLES

Argentina

Las Escobas I series

Marine coastal deposits corresponding to Las Escobas Fm, Prov Buenos Aires. Coll and subm by F Fidalgo, Fac Sci Nat Mus (FCNyM), Univ Nac La Plata (UNLP).

LP-7. Rincón Grande

5630 ± 200

Pelecypod shells from Rincón Grande ($35^\circ 49' 28''$ S, $57^\circ 29' 20''$ W), Partido de Castelli, depth 0.9m.

LP-8. Rincón de López, Sample 1 **3050 ± 160**

Pelecypod shells from Rincón de López (35° 47' 08" S, 57° 24' 20" W), Partido de Castelli, depth 1.2m.

LP-9. Canal 18 **5770 ± 170**

Pelecypod shells from exposed profile near Estancia San Horacio (35° 42' 51" S, 57° 35' 30" W), partido de Chascomús, depth 0.7m.

General Comment: results confirm Holocene age of Las Escobas Fm (Fidalgo, 1979).

Bahia San Antonio series

Marine shells coll from Baliza San Matías and San Antonio Fms (Angulo *et al*, 1978; Fidalgo *et al*, 1980), Bahía de San Antonio, Prov Río Negro. Both deposits record marine advances during Upper Pleistocene and Holocene times, respectively. Mollusk shells were taxonomically determined by Z Castellanos (FCNyM, UNLP). Coll and subm by F Fidalgo.

LP-33. Baliza San Matías **>27,000**

Shells (*Crepidula dilatata*) (40° 49' 22" S, 64° 45' 17" W), Baliza San Matías Fm. *Comment:* inner fraction (80%) was used.

LP-35. San Antonio, Sample 1 **>28,000**

Shells (*Amiantis purpurata*) (40° 42' 22" S, 64° 51' 40" W), San Antonio Fm. *Comment:* inner fraction (80%) was used.

LP-36. Ruta no. 3 **>40,000**

Shells (*Glycimeris longior*) (40° 44' 35" S, 65° 02' 30" W), San Antonio Fm. *Comment:* inner fraction (80%) was used.

LP-44. San Antonio, Sample 2 **>40,000**

Shells (*Clamys* sp) (40° 42' 22" S, 64° 51' 40" W), San Antonio Fm. *Comment:* inner fraction (80%) was used.

LP-45. Caleta Falsa **>40,000**

Shells (*Chionidae* sp) (40° 47' 56" S, 64° 50' 38" W), Baliza San Matías Fm. *Comment:* inner fraction (80%) was used.

General Comment: geologically, difference observed between ¹⁴C ages and relative age assigned to San Antonio Fm deposits would indicate that mollusk specimens might have been retransported from older units. Min ages obtained (3σ criterion) are related to pelecypod ages and not deposit age (Fidalgo *et al*, 1980).

Las Escobas II series

Samples were coll from Destacamento Río Salado and Las Escobas Fms, Prov Buenos Aires. First lithostratigraphic unit could have developed during last glaciation, and other unit during Holocene (Fidalgo, 1979). Samples coll by F Fidalgo. Mollusk shells were coll by LP lab (Fidalgo *et al*, 1981). Bone was taxonomically id. by E Tonni (FCNyM, UNLP). Mollusk shells were id. by Z Castellanos (FCNyM, UNLP). X-ray diffraction analyses were made by M Iñiguez Rodríguez (FCNyM, UNLP).

LP-46. Villa Catella 4730 ± 220

Collagen extracted from the mandibular branch fragment of *Eubalaena sp.*, Villa Catella (34° 53' 39" S, 57° 56' 47" W), Partido de Ensenada, from within sediments of ancient shoreline pertaining to Las Escobas Fm.

LP-47. Villa Catella 3470 ± 230

Bone apatite extracted following Haynes (1968) from same mandibular branch fragment of *Eubalaena sp.*; thus, same sample as LP-46.

LP-49. Rincón de López, Sample 2 7030 ± 320

Shells (*Macra isabelleana*) extracted from Rincón de López (35° 46' 07" S, 57° 24' 30" W), Partido de Castelli, from upper part of Destacamento Río Salado Fm. *Comment:* inner fraction (80%) was used.

LP-50. Canal Las Escobas, Sample 1 6150 ± 190

Shells (*Tagelus plebeius*) extracted from exposed profile in Las Escobas Channel (35° 58' 21" S, 57° 29' 16" W), Partido de Castelli, Las Escobas Fm, from depth 0.5m below surface. *Comment:* inner fraction (80%) was used.

LP-51. Ruta Provincial no. 11, Sample 1 7890 ± 340

Shell (*Adelomedon sp.*) extracted from profile above Ruta Provincial no. 11 (35° 37' 57" S, 57° 18' 19" W), Partido de Magdalena, Las Escobas Fm, from depth 0.4m under edaphic sediments. *Comment:* inner fraction (80%) was used.

LP-52. Rincón de López, Sample 3 4920 ± 220

Shell (*Adelomedon brasiliensis*) coming from Rincón de López (35° 46' 07" S, 57° 24' 30" W), Partido de Castelli, extracted from Las Escobas Fm. *Comment:* inner fraction (80%) was used.

LP-54. Manuel B Gonnet Modern

Evaporite sample from Calle 516 and Calle 7 (34° 52' 28" S, 58° 00' 11" W), Manuel B Gonnet, Partido de La Plata, extracted from Las Escobas Fm, by sounding from depth 0.5m from surface.

LP-66A. Canal Las Escobas, Sample 2 6490 ± 230**LP-66B. 6760 ± 190**

Shells (*Tagelus plebeius*) extracted from exposed profile in Las Escobas Channel (35° 58' 21" S, 57° 29' 16" W), Partido de Castelli, Las Escobas Fm from depth 0.5m below surface. *Comment:* for LP-66A, outer fraction (20%) was used; for LP-66B, inner fraction (80%) was used.

LP-67A. Rincón de López, Sample 4 6060 ± 200**LP-67B. 5930 ± 220**

Shell (*Adelomedon brasiliensis*) from Rincón de López (35° 46' 07" S, 57° 24' 30" W), Partido de Castelli, extracted from Las Escobas Fm. *Comment:* for LP-67A, outer fraction (20%) was used; for LP-67B, columella was used.

LP-68A. Ruta Provincial no. 11, Sample 2 **3760 ± 240**

LP-68B. **4070 ± 220**

Shells (*Macra isabelleana*) extracted from exposed profile at Ruta Prov no. 11 (35° 37' 57" S, 57° 18' 19" W), Partido de Magdalena, Las Escobas Fm, from depth 0.4m below edaphic sediments. *Comment:* for LP-68A, outer fraction (20%) was used; for LP-68B, inner fraction was used.

General Comment: (Fidalgo *et al*, 1981): results from mollusk shells in life position — tanatocenosis — especially LP-50 and -66, yielded ages greater than those determined by other authors for these deposits (Cigliano, 1966; Cortelezzi, 1977). Obtained results from Destacamento Río Salado Fm (LP-49), older than most data from Las Escobas Fm, is consistent with geol relationships between both units: Las Escobas Fm overlies uncomformable Destacamento Río Salado Fm. Evaporite sample (LP-54), with 111% modern, would indicate contamination by infiltrated meteoric and phreatic waters very close to surface. This result shows age younger than first thermonuclear explosions. X-ray diffraction analyses of samples LP-66B, -67B, and -68B show no evidence of contamination by mineralogic conversion, since these samples are composed of aragonite.

Salina del Bebedero series

Gastropod shells from ancient shorelines in Salina del Bebedero (33° 20' S, 66° 45' W), Prov San Luis (González *et al*, 1981). Most samples were taken from different outcroppings, except for LP-57 and -58, which come from same profile, at depth of 2m and 5.5m below surface, respectively. Samples were coll by M A González and taxonomically determined by A Pérez, Univ Nac del Sur (UNS), Bahía Blanca, and D Fernández (FCNyM, UNLP); subm by R Pascual (FCNyM, UNLP). These dates were measured as part of palaeogeog and palaeoclimatic regional study, particularly related to Cordilleran ice ablation from last glaciation to Holocene.

LP-57A. Acceso a Dos Anclas, Sample 1 **15,500 ± 550**

LP-57B. **17,090 ± 790**

Shells (*Chilina parchapei*). *Comment:* for LP-57A, inner fraction (80%) was used; for LP-57B, outer fraction (20%) was used.

LP-58. Acceso a Dos Anclas, Sample 2 **18,630 ± 860**

Shells (*Chilina parchapei*). *Comment:* inner fraction (80%) was used.

LP-59. Puente Arroyo Bebedero **16,160 ± 710**

Shells (*Chilina parchapei*). *Comment:* inner fraction (80%) was used.

LP-60. Sector SO **13,910 ± 530**

Shells (*Chilina parchapei*). *Comment:* inner fraction (80%) was used.

LP-61. Camino Dos Anclas-El Lechuzo **17,060 ± 660**

Shells (*Chilina parchapei*). *Comment:* inner fraction (80%) was used.

LP-63. Camino Dos Anclas-Ruta **15,280 ± 770**
San Luis/BeazleyShells (*Chilina parchapei*). *Comment*: inner fraction (80%) was used.**LP-64. Hostería Dos Anclas** **16,950 ± 870**Shells (*Chilina parchapei*). *Comment*: inner fraction (80%) was used.
General Comment: antiquity of these deposits represents initial ablation of Andean Cordillera ice pertaining to last glaciation (González *et al.*, 1981).

ARCHAEOLOGIC SAMPLES

*Argentina***LP-53. Arroyo Seco** **8390 ± 240**Collagen extracted from femur fragment of *Megatherium americanum*, from Arroyo Seco, Partido de Tres Arroyos (38° 21' 38" S, 60° 14' 39" W), Prov Buenos Aires. Sample from eolian sediments over carbonate level, from depth 0.6m below surface. Coll and subm by G Politis (FCNyM, UNLP), and L Meo Guzmán (Mus Mun Tres Arroyos). Taxonomic determination by E Tonni (FCNyM, UNLP). *Comment*: first determination in Prov Buenos Aires of extinct megamammalian remains in stratigraphic assoc with unifacial lithic material, with marginal retouch, without projectile points.**LP-62. Cuyín Manzano** **9280 ± 310**Charcoal fragments of Cueva Trafal I (40° 43' S, 71° 07' W), Prov Neuquén, from hearth in Bed 10d, at depth 1.5m below surface. Coll by D Curzio and E Crivelli; subm by M Silveira (all of Fac Filosofía y Letras, Univ Buenos Aires). *Comment*: absolute age of cultural remains belonging to guanaco hunters with triangular apedunculated projectile points.

GEOCHEMICAL SAMPLES

*Hydrogeologic samples*Measurements of environmental isotope content (³H, ²H, ¹⁸O, and ¹⁴C) were made on meteoric, surface, and underground waters in vicinity of Mar del Plata (38° 08' S, 57° 35' W) and surroundings, Prov Buenos Aires (table 1). This study was requested by Cátedra Hidrogeol (FCNyM, UNLP), as part of geohydrol investigation, required by Empresa Obras Sanitarias de la Nación (OSN), Argentina. Aim of study was to formulate series of preliminary hypotheses, related to temporal and spacial origin of groundwaters, and to explain aquifer salinization processes within mentioned area. ¹⁴C samples were extracted April 1978 from groundwater at different depths and may belong, in most cases, to more than one productive bed. Results of these measurements are given as percent of modern (% mod):

$$\% \text{ mod} = \frac{A \text{ sample} - A \text{ std}}{A \text{ std}} \times 100 \quad A \text{ is net cpm}$$

TABLE 1
Mar del Plata — ^{14}C measurements in groundwater

Sample no.	Well no. (OSN)	% modern
LP-20	105	71 ± 1
-21	130	79 ± 1
-22	27	72 ± 2
-23	53	83 ± 1
-24	49	85 ± 1
-25	314	94 ± 1
-26	165	75 ± 1
-27	186	60 ± 1
-28	16	88 ± 1
-29	34	70 ± 1
-30	330	112 ± 1
-31	128	91 ± 1
-39	32	102 ± 3
-40	56	88 ± 2
-41	78	79 ± 2
-42	29	70 ± 2
-43	58	73 ± 1
-48	94	63 ± 1

General Comment: two groundwater samples (near surface) from “rural” area (LP-25 and -30) show high concentration of ^{14}C . This is evidence of atmospheric contamination which started in 1954 and indicates active recharge by meteoric waters in recent years. Other samples, from “urban” area (average depth 90m), were assembled in geog secs:

- 1) “harbor” (LP-23, -28, -31, -40): measured activity shows recharge by relatively recent rain.
- 2) “downtown” (LP-22, -29, -41, -42, -43): groundwater of this sec has relatively major residence period and corrected ages should lie between 590 to 1560 ^{14}C yr.
- 3) “northern” (LP-20, -21, -26, -27, -48), divided in two sub-secs: S sub-sec shows water mixture of relatively “old” with relatively “young” waters, and N-most sub-sec, with relatively “old” waters, 1000 to 2800 ^{14}C yr (Figini *et al*, 1981).

TABLE 2
 ^{14}C measurements on atmospheric samples

Sample no.	Exposure period	% modern
LP- 3	14 Oct. - 20 Oct 1976	127 ± 1.0
- 4	09 Nov - 15 Nov 1976	135 ± 1.0
- 5	23 Dec - 29 Dec 1976	133 ± 2.0
- 6	18 Feb - 24 Feb 1977	136 ± 1.0
-10	25 Mar - 31 Mar 1977	131 ± 2.0
-12	22 Apr - 27 Apr 1977	135 ± 1.0
-11	27 May - 02 June 1977	132 ± 2.0
-13	11 July - 18 July 1977	132 ± 1.5
-14	26 Aug - 01 Sept 1977	136 ± 1.2
-15	29 Sept - 06 Oct 1977	133 ± 1.5
-16	01 Nov - 07 Nov 1977	131 ± 1.5
-17	30 Nov - 05 Dec 1977	130 ± 1.0

Atmospheric samples

Determinations were made with samples which cover period, Oct 1976 to Dec 1977, from sampling sta at FCNyM, UNLP (34° 54' 36" S, 57° 56' 03" W), Prov Buenos Aires (table 2).

General Comment: aim of this series was to determine ¹⁴C level in atmosphere and influence of nuclear explosions in these latitudes. ¹⁴C excess data obtained correspond to theoretical and experimental models of diminution in atmospheric ¹⁴C level (Figini *et al*, 1978).

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