

INGEIS RADIOCARBON LABORATORY DATES I*

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The Instituto de Geocronología Geología Isotópica (INGEIS) belongs to the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) of Argentina and is supported by another six government institutions. Its headquarters are located in the Facultad de Ciencias Exactas y Naturales of the Universidad de Buenos Aires.

The ^{14}C laboratory of the Institute was established in 1977 for research on coastal geology, hydrogeology, archaeology, anthropology, and contamination measurements. The method employed is liquid scintillation counting of synthesized benzene using the basic technique of Tamers (1975) and Noakes *et al* (1965). Samples are converted to CO_2 (carbonates by perchloric acid dissolution; organics by combustion in an oxygen stream in a combustion system) then to C_2H_2 and finally, using 160g of Perlkator Catalyst activated for 4 hours at 360°C , to high purity benzene (99.994%, checked by gas chromatography). The average yields are over 90%. The activity measurements are done in a Packard-Tricarb 3255 liquid scintillation spectrometer using glass vials (low potassium content) of ca 20ml with a mixture of 5ml of synthesized benzene and 1.25ml of scintillation cocktail (7g of PPO and 0.5g of Me_2POPOP in 1l of scintillation-grade toluene). The upper part of the vial is wrapped in aluminum foil to reduce cross-talk of the photomultipliers. The dates reported here are calculated with a ^{14}C half-life of 5568 years. The modern reference is taken as 0.95 of the activity of the NBS ^{14}C standard. The oxalic acid is converted to CO_2 by reaction with a solution of KMnO_4 in sulfuric acid. Errors are reported as one standard deviation which includes the combined uncertainty of the background, reference, and sample. All ages are corrected to correspond to a $\delta^{13}\text{C}(\text{PDB})$ value of -25‰ and the standard activity is normalized to $\delta^{13}\text{C} = -19\text{‰}$. The $\delta^{13}\text{C}$ measurements are performed in the Stable Isotopes Laboratory of the Institute which works with a double collector mass spectrometer Micromass 602-D. Errors in $\delta^{13}\text{C}$ measurements are $\pm 0.3\text{‰}$.

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I. GEOLOGIC SAMPLES

*Argentina***Pedro Luro series**

Surface shells coll to determine ancient shorelines from Pedro Luro site, Buenos Aires Prov. Coll and subm 1978 by N Weiler and J O Codignotto.

AC-0026. **2160 ± 110**
 $\delta^{13}C = 1.8\text{‰}$

(39° 39' 42" S, 62° 09' W) 2.5m asl; 3km from present shoreline.

AC-0027. **2590 ± 110**
 $\delta^{13}C = 1.1\text{‰}$

(39° 39' 10" S, 62° 07' 30" W) 2.5m asl; 1.25km from present shoreline.

AC-0028. **410 ± 100**
 $\delta^{13}C = 1.5\text{‰}$

(39° 38' S, 62° 08' W) 2.5m asl; 0.75km from present shoreline.

AC-0029. **6000 ± 150**
 $\delta^{13}C = 1.2\text{‰}$

(39° 39' 20" S, 62° 13' 28" W) 5m asl; 9.5km from present shoreline.

AC-0045. **5310 ± 120**
 $\delta^{13}C = 0.5\text{‰}$

(39° 37' 40" S, 62° 11' W) 5m asl; 6.5km from present shoreline.

AC-0046. **6930 ± 130**
 $\delta^{13}C = 1.1\text{‰}$

(39° 36' 24" S, 62° 14' W) 5m asl; 11.5km from present shoreline.

AC-0047. **3060 ± 120**
 $\delta^{13}C = 1.8\text{‰}$

(39° 37' S, 62° 08' W) 2.5m asl; 1.5km from present shoreline.

AC-0170. **3220 ± 100**
 $\delta^{13}C = 1.6\text{‰}$

(39° 40' S, 62° 07' W) 2.5m asl; 0.5km from present shoreline.

AC-0171. **1680 ± 90**
 $\delta^{13}C = 1.4\text{‰}$

(39° 38' 50" S, 62° 08' 30" W) 5m asl; 2.5km from present shoreline.

Mayor Buratovich series

Mollusk shells from Mayor Buratovich site, Buenos Aires Prov. Surface shells coll and subm 1978 by N Weiler and J O Codignotto.

AC-0044. **1600 ± 100**
 $\delta^{13}C = 1.0\text{‰}$

(39° 28' 22" S, 62° 03' 25" W) 2.5m asl; 1.25km from present shoreline.

AC-0048. 1650 ± 80
 $\delta^{13}C = 0.9\text{‰}$
 (39° 28' 25" S, 62° 04' W) 5m asl; 2km from present shoreline.

AC-0049. 3600 ± 90
 $\delta^{13}C = 0.6\text{‰}$
 (39° 28' S, 62° 09' W) 5m asl; 9.5km from present shoreline.

AC-0050. 2850 ± 80
 $\delta^{13}C = 1.2\text{‰}$
 (39° 25' S, 62° 08' 15" W) 3m asl; 5km from present shoreline.

AC-0051. 1240 ± 80
 $\delta^{13}C = 1.1\text{‰}$
 (39° 29' 46" S, 62° 05' 11" W) 5m asl; 2km from present shoreline.

Villalonga series

Mollusk shells from Villalonga site, Buenos Aires Prov. Surface shells coll and subm 1979 by N Weiler and J O Codignotto.

AC-0052. 3850 ± 90
 $\delta^{13}C = 1.0\text{‰}$
 (39° 57' S, 62° 20' W) 3m asl; 0.25km from present shoreline.

AC-0053. 9460 ± 120
 $\delta^{13}C = 1.5\text{‰}$
 (39° 57' 35" S, 62° 20' 30" W) 4m asl; 1km from present shoreline; 1.5m depth.

AC-0054. 5920 ± 100
 $\delta^{13}C = 1.7\text{‰}$
 (39° 56' 30" S, 62° 20' W) 7.5m asl; 2.2km from present shoreline.

Mar del Plata series

Marine shells from Mar del Plata site and surroundings, Buenos Aires Prov. Coll and subm 1980 by E J Schnack, Centro Geol Costas, Mar del Plata.

AC-0062. 2830 ± 80
 $\delta^{13}C = 0.7\text{‰}$
 Mar Chiquita (37° 37' 03" S, 57° 18' 50" W) 1.5m asl; 0.3 to 0.45m depth.

AC-0063. 2880 ± 80
 $\delta^{13}C = 1.8\text{‰}$
 Mar Chiquita (37° 37' 03" S, 57° 18' 50" W) 1.5m asl; 0.3 to 0.45m depth.

AC-0064. 3110 ± 80
 $\delta^{13}C = 0.7\text{‰}$
 Atlántida Medaland (37° 27' 53" S, 57° 13' 10" W) 2.3m asl; 0.5 to 0.6m depth.

AC-0065. 2920 ± 80
 $\delta^{13}C = 1.2\text{‰}$
 Vivoratá (37° 34' 05" S, 57° 26' 24" W) 1.2m asl; 0.8m depth.

AC-0066. 2700 ± 60
 $\delta^{13}C = 0.0\text{‰}$
 Vivoratá (37° 34' 05" S, 57° 26' 24" W) 1.2m asl; 0.8m depth.

AC-0100. 1340 ± 60
 $\delta^{13}C = -4.1\text{‰}$
 Mar del Plata (37° 47' 08" S, 57° 27' 20" W) 2.5m asl; surface sample.

AC-0101. 3840 ± 70
 $\delta^{13}C = 0.5\text{‰}$
 Mar del Plata (37° 27' 14" S, 57° 15' W) 2.4m asl; 0.2 to 0.5m depth.

AC-0102. 3620 ± 60
 $\delta^{13}C = -0.8\text{‰}$
 Mar del Plata (37° 27' 14" S, 57° 15' W) 2.4m asl; 0.2 to 0.5m depth.

AC-0206. 3430 ± 90
 $\delta^{13}C = -0.1\text{‰}$
 Mar de Cobo (37° 46' 15" S, 57° 26' 40" W) 2m asl; surface sample.

Mar Chiquita series

Marine shells from Mar Chiquita site, Buenos Aires Prov (37° 44' S, 57° 26' 30" W). Coll and subm 1980 by C Gentili, Fac Ciencias Exactas y Naturales, Univ Buenos Aires.

AC-0106. 4880 ± 90
 $\delta^{13}C = -0.4\text{‰}$
 Depth: 1.6m.

AC-0107. 4810 ± 90
 $\delta^{13}C = 2.6\text{‰}$
 Depth: 0.85m.

AC-0108. 3830 ± 80
 $\delta^{13}C = 1.9\text{‰}$
 Depth: 0.4m.

Bahía Blanca series

Mollusk shells from Bahía Blanca site, Buenos Aires Prov and surroundings. Coll and subm 1980 by E Farinati, Univ Nacional del Sur.

AC-0118. 5980 ± 130
 $\delta^{13}C = 2.6\text{‰}$
 Punta Cigueñas (38° 55' S, 62° 03' W) 3m asl; 1m depth.

AC-0120. $14,250 \pm 180$
 $\delta^{13}C = 1.4\text{‰}$
 Estancia Los Blancos (38° 59' S, 62° 22' W) 10m asl; 2m depth.

- AC-0121.** **6650 ± 100**
 $\delta^{13}C = 0.9\text{‰}$
 Empalme Aguará (38° 43' S, 62° 20' W) 8m asl; 2m depth.
- AC-0169.** **19,140 ± 250**
 $\delta^{13}C = 1.4\text{‰}$
 Baterias (39° 24' S, 62° 07' W) 5m asl.
- AC-0178-I.** **35,500 ± 2100**
 $\delta^{13}C = -20.2\text{‰}$
- AC-0178-II.** **35,000 ± 2000**
 $\delta^{13}C = -20.2\text{‰}$
 Highly carbonized wood (*Austrocedrus chilensis?*) from 2m gravel bed, underlying 1.5m non-cemented gravel, W front of Sierra Catan-Lil, 10km from Rahue, Neuquén Prov (39° 22' S, 70° 56' W). Coll and subm 1980 by J Fernández, INGEIS. *Comment* (JF): Sierra Catan-Lil was probably forested and free of ice at that time, in probable coincidence with an interstadial.
- La Calera series**
 Shells (*Erodona mactroides*) from test pit in Estancia La Calera, Guleaguay Dept, Entre Ríos Prov (33° 25' S, 58° 35' W). Coll and subm 1980 by J Fernández.
- AC-0126.** **5410 ± 110**
 $\delta^{13}C = -2.3\text{‰}$
 0.3m below surface.
- AC-0127.** **5280 ± 100**
 $\delta^{13}C = -2.1\text{‰}$
 0.5m below surface.
- AC-0128.** **5490 ± 110**
 $\delta^{13}C = -1.4\text{‰}$
 0.8m below surface.
- AC-0129.** **5530 ± 110**
 $\delta^{13}C = -2.2\text{‰}$
 1.2m below surface.
- General Comment* (JF): dates show Holocene shoreline, 4 to 5m asl ("Que-randinense" ingression).
- Río Negro series**
 Marine shells from Río Negro site, coll and subm 1980 by J O Codignotto.
- AC-0137.** **3370 ± 80**
 $\delta^{13}C = 2.5\text{‰}$
 Sample from right shore of Río Negro (41° 00' 45" S, 62° 47' 08" W).
- AC-0138.** **1030 ± 80**
 $\delta^{13}C = 2.6\text{‰}$
 Sample from dune, 400m from present shoreline (41° 00' 00" S, 62° 39' 38" W).

- AC-0140.** **2930 ± 90**
 $\delta^{13}C = 2.1\text{‰}$
 Marine shells mixed with coarse sand, 500m from present shoreline
 (40° 58' 07" S, 62° 34' 38" W).
- AC-0141.** **13,400 ± 190**
 $\delta^{13}C = 1.5\text{‰}$
 Marine shells buried in coarse sand, 3000m from present shoreline
 (40° 55' 09" S, 62° 31' 47" W).
- San Blas series**
 Marine shells from San Blas site, Buenos Aires Prov. Coll and subm
 1980 by N Weiler and J O Codignotto.
- AC-0057.** **8920 ± 120**
 $\delta^{13}C = 2.1\text{‰}$
 Sample 6km SW of San Blas Town (40° 35' 00" S, 62° 16' 35" W).
 Marine shells from dune of partially cemented sand.
- AC-0058.** **17,000 ± 220**
 $\delta^{13}C = 1.4\text{‰}$
 Sample 2km N of Estancia La Serrana (40° 34' 36" S, 62° 18' 42" W).
- AC-0059.** **33,200 ± 1500**
 $\delta^{13}C = 0.9\text{‰}$
 Samples 2km N of Estancia La Serrana (40° 34' 36" S, 62° 18' 42" W).
Comment (JOC): even though AC-0058 and -0059 were coll in same place,
 age difference is attributed to different conservation of the two samples.
- Camarones series**
 Marine shells along shore between Camarones and Bahía Bustamante,
 coll and subm 1980 by J O Codignotto.
- AC-0165.** **32,900 ± 1300**
 $\delta^{13}C = 2.1\text{‰}$
 (44° 44' 51" S, 65° 41' 15" W) 200m from present shoreline.
- AC-0164.** **38,900 ± 2800**
 $\delta^{13}C = 1.8\text{‰}$
 (44° 45' 56" S, 65° 41' 15" W) 300m from present shoreline.
- AC-0163.** **4370 ± 100**
 $\delta^{13}C = 1.6\text{‰}$
 (44° 47' 34" S, 65° 41' 23" W) 100m from present shoreline.
- AC-0168.** **32,200 ± 1200**
 $\delta^{13}C = -1.1\text{‰}$
 Shells from gravel (44° 49' 11" S, 65° 43' 30" W) 800m from present
 shoreline.
- AC-0166.** **7520 ± 120**
 $\delta^{13}C = 1.5\text{‰}$
 (44° 42' 42" S, 65° 40' 30" W) 400m from present shoreline.

- AC-0167.** **3860 ± 100**
 $\delta^{13}C = 2.7\text{‰}$
Shells from gravel (44° 48' 06" S, 65° 42' 30" W) 100m from present shoreline.
- AC-0150.** **31,800 ± 1400**
 $\delta^{13}C = 1.6\text{‰}$
Shells from gravel and sands (45° 04' 08" S, 66° 30' 09" W) 1000m from present shoreline.
- AC-0151.** **30,900 ± 1100**
 $\delta^{13}C = 1.5\text{‰}$
Shells from gravel (45° 04' 01" S, 66° 28' 23" W) 1000m from present shoreline.
- AC-0152.** **2880 ± 90**
 $\delta^{13}C = 3.5\text{‰}$
Shells from gravel, 300m from present shoreline (45° 04' 08" S, 66° 28' 14" W).
- AC-0153.** **2030 ± 90**
 $\delta^{13}C = 1.4\text{‰}$
Shells from gravel, 50m from present shoreline (45° 04' 11" S, 66° 28' 09" W).
- AC-0154.** **36,000 ± 2000**
 $\delta^{13}C = 1.6\text{‰}$
Shells from sandy gravel, 3km from present shoreline (45° 02' 28" S, 66° 27' 08" W).
- AC-0155.** **37,300 ± 2400**
 $\delta^{13}C = 1.0\text{‰}$
Shells from muddy-gravel, 3km from present shoreline (45° 02' 08" S, 65° 25' 31" W).
- AC-0156.** **>43,000**
 $\delta^{13}C = 2.1\text{‰}$
Shells from muddy-sands (45° 01' 39" S, 66° 25' 00" W).

Península Valdés series

Marine shells along coast between Punta Norte and Punta Cantor sites, Chubut Prov. Coll and subm 1980 by J O Codignotto.

- AC-0157.** **4180 ± 100**
 $\delta^{13}C = 2.6\text{‰}$
Shells from gravel, 200m from present shoreline (42° 05' 24" S, 63° 45' 00" W).
- AC-0158.** **5100 ± 100**
 $\delta^{13}C = 1.7\text{‰}$
Shells from coarse gravel, 1000m from present shoreline (42° 07' 34" S, 63° 44' 00" W).
- AC-0159.** **1330 ± 80**
 $\delta^{13}C = 2.1\text{‰}$
Shells from middle gravel, 300m from present shoreline (42° 07' 34" S, 63° 44' 00" W).

- AC-0160.** **5730 ± 100**
 $\delta^{13}C = 2.1\text{‰}$
 Shells from middle gravel, 700m from present shoreline (42° 13' 30" S, 63° 37' 30" W).
- AC-0161.** **38,700 ± 2700**
 $\delta^{13}C = 0.2\text{‰}$
 Shells from muddy gravel, 400m from W coast of Caleta Valdés (42° 24' 00" S, 63° 36' 20" W).
- AC-0162.** **2160 ± 90**
 $\delta^{13}C = 2.5\text{‰}$
 Shells from gravel, 20m from W coast of Caleta Valdés (42° 24' 18" S, 63° 36' 20" W).
- Caleta Olivia series**
 Marine shells along coast between Punta Maqueda and Bahía Lán-gara, Santa Cruz Prov. Coll and subm 1978-1980 by J O Codignotto.
- AC-0040.** **2800 ± 70**
 $\delta^{13}C = 1.7\text{‰}$
 Shells from gravel, 150m from present shoreline (46° 23' 30" S, 67° 32' 37" W).
- AC-0041.** **39,000 ± 3600**
 $\delta^{13}C = 1.2\text{‰}$
 Shells from gravel, 150m from present shoreline (46° 20' 10" S, 67° 34' 30" W).
- AC-0042.** **2300 ± 120**
 $\delta^{13}C = 0.6\text{‰}$
 Shells from gravel, 100m from present shoreline (46° 20' 52" S, 67° 34' 10" W).
- AC-0130.** **5750 ± 120**
 $\delta^{13}C = 1.5\text{‰}$
 Shells from gravel, 200m from present shoreline (46° 03' 17" S, 67° 37' 30" W).
- AC-0131.** **4230 ± 100**
 $\delta^{13}C = 1.7\text{‰}$
 Shells from gravel, 300m from present shoreline (46° 06' 20" S, 67° 38' 06" W).
- AC-0132.** **1590 ± 70**
 $\delta^{13}C = 0.5\text{‰}$
 Shells from gravel, 350m from present shoreline (46° 15' 41" S, 67° 36' 00" W).
- AC-0133.** **25,800 ± 600**
 $\delta^{13}C = 1.7\text{‰}$
 Shells from muddy and sandy sediments, 200m from present shore-line (46° 19' 08" S, 67° 34' 37" W).

- AC-0134.** **27,600 ± 700**
 $\delta^{13}C = 0.9\text{‰}$
 Shells from muddy sands, cemented with carbonates (46° 20' 51" S, 67° 34' 22" W).
- AC-0135.** **28,700 ± 850**
 $\delta^{13}C = 0.5\text{‰}$
 Shells from sandy gravels (46° 34' 36" S, 67° 24' 45" W).
- AC-0136.** **31,000 ± 1100**
 $\delta^{13}C = 2.7\text{‰}$
 Shells from muddy sands (46° 24' 03" S, 67° 32' 20" W).
- AC-0207.** **28,400 ± 800**
 $\delta^{13}C = 1.2\text{‰}$
 Shells from sandy gravel (46° 32' 59" S, 67° 26' 17" W).
- AC-0208.** **27,500 ± 700**
 $\delta^{13}C = 1.5\text{‰}$
 Shells from sandy gravel (46° 32' 59" S, 67° 26' 17" W).
- AC-0209.** **29,600 ± 1100**
 $\delta^{13}C = 0.6\text{‰}$
 Shells from sandy muddy gravels (46° 08' 06" S, 67° 37' 30" W).
- AC-0210.** **5750 ± 110**
 $\delta^{13}C = 1.1\text{‰}$
 Shells from gravels (46° 04' 00" S, 67° 37' 30" W).
- AC-0211.** **1550 ± 90**
 $\delta^{13}C = 1.3\text{‰}$
 Shells from gravels (46° 01' 21" S, 67° 35' 15" W).

Puerto Lobos series

Marine shells from terraces and beach ridges in Chubut Prov, near sea and border with Río Negro Prov. Coll and subm 1980 by J O Codignotto.

- AC-0144.** **20,300 ± 350**
 $\delta^{13}C = 1.5\text{‰}$
 Shells buried in coarse sand and gravel (42° 00' S, 65° 04' W).
- AC-0145.** **30,400 ± 1120**
 $\delta^{13}C = 1.9\text{‰}$
 Shells buried in coarse gravel (42° 00' S, 65° 05' W).
- AC-0146.** **32,100 ± 1400**
 $\delta^{13}C = 1.7\text{‰}$
 Shells buried in fine and middle gravel with coarse sand (42° 00' S, 65° 06' W).

- AC-0147.** **40,800 ± 4000**
 $\delta^{13}C = -0.2\text{‰}$
Shells mixed with gravel (42° 00' S, 65° 08' W).
- AC-0142.** **750 ± 80**
 $\delta^{13}C = 2.5\text{‰}$
Shells mixed with coarse and middle sand (42° 00' S, 65° 03' W).
- AC-0143.** **3310 ± 90**
 $\delta^{13}C = 2.3\text{‰}$
Shells buried in very coarse sand with gravel (42° 00' S, 65° 03' W).

II. ARCHAEOLOGIC SAMPLES

Picunches series

Fragments of ostrich eggshell (*Rhea americana*) from sand-dunes site with archaeological evidences in NW Patagonia, assoc with bones (mammals, birds, and fishes), fluvial shells, stone artifacts, and pottery. Coll and subm 1980 by J L Balbuena.

- AC-0205.** **1700 ± 90**
 $\delta^{13}C = -8.6\text{‰}$
Médano Estancia La Porteña (38° 35' S, 70° 20' W). Sample assoc with early Neolithic pottery and microlithic arrowheads (weight, 332 to 1016mg) mainly of obsidian. *Comment* (JLB): first date for microlithic techniques in NW Patagonia.

- AC-0197.** **980 ± 80**
 $\delta^{13}C = -7.9\text{‰}$
Médano Arroyo Cohunco (38° 34' S, 70° 35' W). *Comment* (JLB): date corresponds with Neolithic occupation in Patagonia; arrowheads of obsidian assoc with ceramics with high relief decoration.

Codihue series

Charcoal from arroyo Codihue cave, Neuquén (38° 28' S, 70° 35' W) assoc with stone artifacts, eggshell, and animal bones. Coll and subm 1980 by J L Balbuena.

- AC-0199.** **270 ± 80**
 $\delta^{13}C = -21.6\text{‰}$
Sample from entrance of cave, Level 1, 0.0 to 0.15m.
- AC-0200.** **1380 ± 90**
 $\delta^{13}C = -21.5\text{‰}$
Sample from inside cave, Level 1.
- AC-0201.** **1280 ± 90**
 $\delta^{13}C = -20.2\text{‰}$
Sample from inside cave, Level 1. *Comment* (JLB): these data correspond to first level of cave. Deeper layers are under study.

Túnel series

Charcoal from Túnel site, assoc with oldest known archaeological evidence of maritime adaptation in Beagle Channel region (54° 49' 15" S, 68° 09'

44" W). Sea canoe nomads with economy based on sea lion (*Arctophalus australis*) hunting, complemented with guanaco (*Lama guanicoe*), birds, fishes, cetaceous, and mollusk consumption. In addition to generalized lithic technology, bone industry is specialized (detachable harpoon heads for sea lions, barbed fixed harpoon heads for fishes, bird bone awls for basketry, chisels, and cross-base wedges for woodworking, etc). Cultural expression shows discontinued occupation of site for ca 200 yr. Bed dated by INGEIS was also dated by Rocasolano (CSIC-310: 6070 ± 70 and Beta Analytic (β-3270: 6200 ± 100). Upper levels of same cultural manifestation were also dated by Rocasolano (CSIC-309: 5960 ± 70; CSIC-308: 5850 ± 70; CSIC-305: 5920 ± 90) and by Beta (β-2819: 6140 ± 130).

First human occupation known, yielded by lower bed, was also dated (β-2517: 6980 ± 110 and shows very short occupation by small group of pedestrian hunters adapted to hinterland resources. Coll and subm 1978 by L Orquera and E L Piana.

AC-0236. **5700 ± 170**
δ¹³C = -21.5‰
"E" layer, Sq III.

AC-0237. **5020 ± 100**
δ¹³C = -23.5‰
"E" layer, Sq III. *Comment* (ELP): coll for testing sampling technique; probably contaminated.

AC-0238. **5690 ± 180**
δ¹³C = -23.0‰
"E" layer, Sq II.

Haichol cave series

Charcoal from Haichol cave (38° 35' S, 70° 40' W), E front of Cordillera de los Andes, 1000m asl, near Las Lajas city, Neuquén. Coll and subm 1979 by J Fernández.

AC-0069. **7020 ± 120**
δ¹³C = -22.5‰
Charcoal, Unit 16A2-17A2; 1.55 to 1.65m depth.

AC-0231. **5050 ± 100**
δ¹³C = -21.3‰
Charcoal, Unit 16B4-17B4; 1.9 to 2m depth.

AC-0232. **5530 ± 110**
δ¹³C = -21.7‰
Charcoal, Unit 16B4-17B4; 2 to 2.1m depth.

General Comment (JF): inhabitants of cave were hunters of guanacos (*Lama guanicoe*), edentates, minor rodents, etc, and gatherers of seeds (*Araucaria araucana*). Lithic industry is characterized by mill stones, stemless projectile points, end scrapers, and naturally worn edges of obsidian flakes. Data correspond to aceramic levels.

Truquico salt mine series

Shells and wood from Indian underground salt mine at Truquico, near Chos Malal, Neuquén (37° 27' S, 70° 17' W). Coll and subm 1976 by J Fernández.

AC-0002.	350 ± 70 $\delta^{13}C = -5.9\text{‰}$
Shells (<i>Diplodon</i> sp).	
AC-0004.	630 ± 80 $\delta^{13}C = -21.6\text{‰}$
Wood from axe handle.	
AC-0005.	590 ± 80 $\delta^{13}C = -23.4\text{‰}$
Wood from axe handle.	

General Comment (JF): samples measured to determine when mining began. Data show that it started prior to Hispanic and Araucanian domination and Huayna Capac conquest of Chile (15th century). Axes are xylo-lithic tools used in mining and were preserved buried in salt.

REFERENCES

- Noakes, J E, Kim, S M, and Stipp, J J, 1965, Chemical and counting advances in liquid scintillation age dating, in Chatters, R M and Olson, E A, eds, Internatl conf on radiocarbon and tritium dating, 6th, Pullman, Washington, Proc: Clearinghouse for fed sci and tech inf, Natl Bur Standards, Washington, DC.
- Tamers, M, 1975, Chemical yield optimization of the benzene synthesis for radiocarbon dating: Internatl Jour Appl Radiation and Isotopes, v 26, p 676-682.