

## INGEIS RADIOCARBON LABORATORY DATES II\*

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The following list consists of archaeological and geologic dates from Argentina processed in the  $^{14}\text{C}$  laboratory of INGEIS. The ages presented were obtained by liquid scintillation counting of benzene, using the techniques outlined in a previous paper (Albero & Angiolini, 1983). The results are expressed in  $^{14}\text{C}$  years relative to 1950, using the Libby half-life of 5570 yr.

Errors are reported as one standard deviation ( $1\sigma$ ), based on combined uncertainties of standard, sample, and background. The standards used are NBS oxalic acid (SRM-4990) and INGEIS C-14-1, secondary standard of barium carbonate (Albero & Angiolini, 1983).

Improvements in our method are: 1) specially designed low background Cu-PTFE vials (Kuc & Rózanski, 1979) used for small volume samples. Up to 2ml sample plus 0.5ml of scintillation cocktail (7g of PPO and 0.5g of  $\text{Me}_2\text{POPOP}$  in 1L of scintillation-grade toluene) were measured in a specially calibrated Packard Tri-Carb Liquid Scintillation Spectrometer, Model 3320. Background of  $1.90 \pm 0.04$  cpm and figure of merit ( $Q = S_0^2/B$ ) of  $131 \pm 2$  with maximally 70% efficiency were obtained; 2) a system of "wet combustion" was designed for samples with low carbon content, such as mud, paleosoils, argillaceous peats, etc. The sample is digested in a glass vessel with  $\text{H}_2\text{SO}_4 + \text{Na}_2\text{Cr}_2\text{O}_7$ . The evolved  $\text{CO}_2$  is purified through  $\text{AgNO}_3$  and  $\text{MnO}_2$  traps and then is converted to benzene. Up to 1kg of sample can be processed by this method.

The  $\delta^{13}\text{C}$  values are measured related to PDB and reported ages are corrected for isotopic fractionation by normalizing to  $-25\text{‰}$ . The  $\delta^{13}\text{C}$  measurements were performed in the Stable Isotope Laboratory of the Institute.

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### GEOLOGIC SAMPLES

#### AC-0326.

**$36,000 \pm 1800$**

$\delta^{13}\text{C} = 2.2\text{‰}$

Shell (*Chlamys* [*Zygochlamys*] *anderssoni* Henning) from Pecten Fm, Cockburn I. ( $64^\circ 12' 30''$  S,  $56^\circ 45' 20''$  W) Antarctica, 265m asl. Coll and subm 1980 by F Medina. *Comment* (FM): sample was dated to establish that

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Pecten Fm corresponds to Pleistocene interglacial age. This age agrees with those obtained by Speden (1962) and Turner (1967) for same sp in Scallop Hill Fm outcropping on Ross I. This date was also used by Malagnino *et al* (1983) to date drift of Vicecomodoro Marambio I., concluding that these glacial sediments are not older than 36,000 yr, based on apparent continuity between marine terraces of Cockburn and Vicecomodoro Marambio I.

### Bahía Blanca series

Shells from Bahía Blanca and surroundings, Buenos Aires prov. These samples were used to solve some strat Quaternary problems in particularly complicated area. Coll and subm 1980 by E Farinati.

**AC-0119.** **4470 ± 100**  
 $\delta^{13}C = 1.5\text{‰}$

Undetermined sp from beach ridge, Colonia Ferroviaria (72° 15' S, 38° 44' W) 4m asl, 0.6m depth.

**AC-0333.** **4820 ± 120**  
 $\delta^{13}C = 1.6\text{‰}$

Mixed sample (*Brachydontes rodriguezii*, *Tegula patagonica*, and *Buccinanops deformis*) from beach ridge, Villa Rosas (62° 15' S, 38° 46' W) 8m asl, 0.4m depth.

**AC-0334.** **4660 ± 100**  
 $\delta^{13}C = 1.3\text{‰}$

Mixed sample (*Brachydontes rodriguezii*, *Ostrea* sp, *Pitar rostrata*, and *Buccinanops deformis*) from beach ridge, Loma Paraguaya (62° 17' S, 38° 45' W) 8m asl, 0.1m depth.

**AC-0352.** **6490 ± 110**  
 $\delta^{13}C = 1.6\text{‰}$

Undetermined sp from beach ridge, Frigorífico Viñuelas (62° 07' S, 38° 48' W) 8m asl, 0.2m depth.

*General Comment* (EF): dates show that these Holocene deposits correspond to two different marine ingressions, one determined by AC-0119, -0333, and -0334; an older one by AC-0352.

### Puerto Madryn series

Calcareous paleosol (Typical Paleorthid, according to Soil Survey Staff, 1975) 8km W of Puerto Madryn, Chubut prov (42° 27' S, 65° 02' W), 90m asl. Coll and subm 1981 by M Rostagno.

**AC-0323.** **5440 ± 160**  
 $\delta^{13}C = -4.8\text{‰}$

Upper soil cap (0.4m thick) overlying deckenschotter (Plio-pleistocene) through lithologic discontinuity at 0.3m depth (A<sub>12</sub>-ca soil horizon).

**AC-0324.** **24,300 ± 600**  
 $\delta^{13}C = -8.7\text{‰}$

Calcareous crust of deckenschotter, 3m thick, overlying Miocene sediments (Puerto Madryn Fm, constituted by psamites and pelites at 0.4m depth (IIC1-cam soil horizon).

**AC-0325.** **36,500 ± 2500**  
 $\delta^{13}C = -3.7\text{‰}$

Sample below AC-0324, also in upper part of deckenschotter at 0.5m depth (IIC2-cam soil horizon).

*General Comment* (MR): age difference between AC-0323 and -0324 to -0325 indicates lithologic discontinuity in petrocalcic horizon because of change in environmental conditions.

### Villalonga series

Shells from Villalonga site and surroundings, Buenos Aires prov. Coll and subm 1981 by N Weiler. Samples dated to determine different Holocene shorelines in mouth and S of Río Colorado delta. These ancient shorelines were previously geomorphologically determined and are composed of sandy beach barriers, ancient pelithic tidal flats, tidal paleochannels, and river beds at mouth of delta; S of delta are beach barriers and spits of gravel and sands. Two Holocene max marine levels have been determined up to now. Other evidence is under study.

**AC-0055.** **6760 ± 100**  
 $\delta^{13}C = 0.6\text{‰}$

Surface sample (*Zidona* sp) extracted from gravel beach ridge (39° 56' 36" S, 62° 20' 39" W) 6m asl.

**AC-0250.** **4830 ± 110**  
 $\delta^{13}C = 1.4\text{‰}$

Surface sample, fragmented specimens (*Buccinanops* sp) from dune site, Estancia El Tigre (39° 48' 11" S, 62° 21' 30" W) 5m asl.

**AC-0251.** **5510 ± 110**  
 $\delta^{13}C = 1.5\text{‰}$

Samples from beach ridge of gravel and sand, different sp of *Buccinanops*, Estancia El Tigre (39° 48' 30" S, 62° 21' 10" W) 5m asl, 0.4m depth.

**AC-0239.** **5140 ± 110**  
 $\delta^{13}C = 1.1\text{‰}$

Surface sample (*Adelomelon* sp) from gravel beach ridge (39° 48' S, 62° 23' 32" W) 7.5m asl.

**AC-0240.** **5590 ± 110**  
 $\delta^{13}C = 1.1\text{‰}$

Undetermined sp from bank, 0.15m thick, assoc with gravel mixed with sand (39° 48' S, 62° 23' 32" W) 7.5m asl, 0.3m depth.

- AC-0241.** **3740 ± 90**  
 $\delta^{13}C = 1.4\text{‰}$   
Surface sample (*Pitaria* sp) from dune base, Estancia San Antonio Viejo (39° 46' 48" S, 62° 11' 55" W) 3m asl.
- AC-0242.** **2790 ± 90**  
 $\delta^{13}C = 0.9\text{‰}$   
Surface sample (*Zidona* sp) from dune, Estancia San Antonio Viejo (39° 46' 36" S, 62° 10' 30" W) 3m asl.
- AC-0243.** **2620 ± 90**  
 $\delta^{13}C = 2\text{‰}$   
Surface sample, undetermined sp, from dune, Estancia San Antonio Viejo (39° 46' 47" S, 62° 10' 30" W) 2.5m asl.
- AC-0252.** **9420 ± 150**  
 $\delta^{13}C = 1.4\text{‰}$   
Surface sample (*Pitaria rostrata*) from gravel beach ridge, Estancia El Tigre (39° 49' 51" S, 62° 19' W) 5m asl.
- AC-0244.** **8520 ± 140**  
 $\delta^{13}C = 1.9\text{‰}$   
Sample, undetermined sp, 1m depth, from left bank of old tributary of Río Colorado, Riacho Azul (39° 49' S, 62° 19' W) 5m asl, used, at present, as irrigation outlet channel and occasionally flooded by tides. *Comment* (NW): shells (*Tagelus gibbus*) were found assoc with this sample dated to  $810 \pm 80$  BP and  $\delta^{13}C = -2.7\text{‰}$  which indicates mixing with continental waters.
- AC-0253.** **7850 ± 130**  
 $\delta^{13}C = 1.3\text{‰}$   
Surface sample (*Glycimeris* sp) from gravel beach ridge (39° 49' 52" S, 62° 19' 40" W) 5m asl.
- AC-0245.** **8720 ± 140**  
 $\delta^{13}C = 1.1\text{‰}$   
Undetermined sp from gravel beach ridge, Estancia El Tigre (39° 49' 53" S, 62° 19' 06" W) 5m asl.
- AC-0246.** **5500 ± 100**  
 $\delta^{13}C = 1.2\text{‰}$   
*Pitaria rostrata*, assoc with gravel-sand spit, formed in outlet of paleo-channel where *Tagelus gibbus* with articulated valves was found (AC-0247) (39° 51' 40" S, 62° 22' W) 4m asl.
- AC-0362.** **4820 ± 100**  
 $\delta^{13}C = 1.1\text{‰}$   
*Zidona angulata*, 0.5m depth, from gravel beach ridges, which constitute cuspidal barrier (39° 51' 40" S, 62° 22' W) 4m asl.

- AC-0363.** **5050 ± 100**  
 $\delta^{13}C = 1.1\text{‰}$   
Surface sample (*Zidona angulata*) overlying AC-0362, with same geomorphol assoc (39° 51' 40" S, 62° 22' W) 4m asl.
- AC-0247.** **3860 ± 100**  
 $\delta^{13}C = 1.5\text{‰}$   
*Tagelus gibbus*, from sandy-silt sediments, at 1m depth in paleochannel related to cuspidal barrier where AC-0363, -0362, -0246 were found (39° 51' 40" S, 62° 22' W) 4m asl.
- AC-0464.** **4380 ± 80**  
 $\delta^{13}C = 1.6\text{‰}$   
Subsurface sample (*Tagelus gibbus*) (39° 48' S, 62° 30' W) 3m asl.
- AC-0248.** **4640 ± 100**  
 $\delta^{13}C = 1.5\text{‰}$   
Surface sample (*Zidona angulata*) from dune base, Península Verde (39° 21' 30" S, 62° 01' 06" W) 2.5m asl.
- AC-0249.** **2170 ± 90**  
 $\delta^{13}C = 1.0\text{‰}$   
Surface sample (*Adelomelon* sp) from dune base, Península Verde (39° 17' 21" S, 62° 05' 04" W) 2.5m asl.
- AC-0463.** **5820 ± 110**  
 $\delta^{13}C = 2.2\text{‰}$   
Surface sample (*Adelomelon* sp) found in mobile dune with archaeol remains, Mayor Buratovich, Estancia La Asunción (32° 12' 40" S, 62° 44' 15" W) 25m asl. *Comment* (NW): date does not agree with alt, probably transported by prehistoric man.
- AC-0067.** **3930 ± 70**  
 $\delta^{13}C = 1.0\text{‰}$   
Articulated shells (*Tagelus gibbus*) in argillaceous silt in tidal paleochannel, Pedro Luro, Estancia El Chara (39° 24' S, 62° 12' 50" W) 2m asl, 0.5m depth.
- AC-0068.** **5340 ± 70**  
 $\delta^{13}C = 1.1\text{‰}$   
Surface sample (*Zidona angulata*) from dune base, Pedro Luro (39° 29' 30" S, 62° 04' W) 3m asl.

### Entre Ríos Holocene series

Holocene marine ingression at Río de la Plata estuary, flooded S part of Entre Ríos prov from Paraná R in W and S to Uruguay R in E. Eurihaline mollusk shells (*Erodona mactroides*) were sampled from beach ridge that crosses cities of Victoria, Gualeguay, Médanos, and Gualeguaychú, to study

chronology of estuarine sediments related to Holocene transgression. Coll and subm 1982 by N Guida and M A González.

<b>AC-0415.</b>	<b>5960 ± 110</b> $\delta^{13}C = -2.9\text{‰}$
Sample from surface of Río Gualeguay bed (33° 09' S, 59° 17' W).	
<b>AC-0416.</b>	<b>5610 ± 110</b> $\delta^{13}C = -1.8\text{‰}$
(33° 15' S, 59° 30' W) 5m asl, 0.8m depth.	
<b>AC-0417.</b>	<b>5750 ± 110</b> $\delta^{13}C = -1.9\text{‰}$
(33° 15' S, 59° 30' W) 5m asl, 1.4m depth.	
<b>AC-0418.</b>	<b>6030 ± 140</b> $\delta^{13}C = -1.8\text{‰}$
(33° 13' S, 59° 31' W) 5m asl, 0.7m depth.	
<b>AC-0419.</b>	<b>5620 ± 110</b> $\delta^{13}C = -1.9\text{‰}$
(33° 13' S, 59° 31' W) 5m asl, 1m depth.	
<b>AC-0420.</b>	<b>5680 ± 110</b> $\delta^{13}C = -1.8\text{‰}$
(33° 12' S, 59° 32' W) 4m asl, 0.85m depth.	
<b>AC-0421.</b>	<b>5720 ± 110</b> $\delta^{13}C = -1.9\text{‰}$
Surface sample (33° 14' S, 59° 28' W) 4.5m asl.	
<b>AC-0422.</b>	<b>5680 ± 110</b> $\delta^{13}C = -1.7\text{‰}$
Surface sample (33° 16' S, 59° 27' W) 5m asl.	
<b>AC-0423.</b>	<b>6440 ± 110</b> $\delta^{13}C = -2.1\text{‰}$
Surface sample (33° 16' S, 59° 23' W) 5m asl.	
<b>AC-0424.</b>	<b>5820 ± 110</b> $\delta^{13}C = -2.5\text{‰}$
(32° 59' S, 58° 30' W) 2.5m asl, 2.3m depth.	

*General Comment* (MAG & NG): max level for this postglacial Holocene transgression has been dated to 5700 yr BP; these deposits are between 3 and 5m asl.

#### **Entre Ríos Pleistocene series**

Outcroppings of Pleistocene estuarine levels were found in pits in vicinity of some tributaries of Uruguay R. *Erodona mactroides*, *Tagelus gib-*

*bus*, and *Ostrea* sp shells were dated for Pleistocene max estuarine expansion. Related sediments are at 6m asl. Coll and subm 1982 by N Guida and M A González.

**AC-0425.** **30,800 ± 1700**  
 $\delta^{13}C = -2.5\text{‰}$   
*Erodona mactroides* (33° 05' S, 58° 30' W) 6m asl, 0.65m depth.

**AC-0608.** **35,400 ± 1800**  
 $\delta^{13}C = -4.6\text{‰}$   
*Tagelus gibbus* (33° 03' S, 58° 32' W) 7m asl, 5.5m depth.

**AC-0609.** **26,600 ± 720**  
 $\delta^{13}C = -3.3\text{‰}$   
*Erodona mactroides* (33° 38' S, 58° 32' W) 7m asl, 6m depth.

**AC-0610.** **32,700 ± 1300**  
 $\delta^{13}C = -3.8\text{‰}$   
*Erodona mactroides* (33° 38' S, 58° 31' W) 7m asl, 5.5m depth.

**AC-0612.** **32,700 ± 1800**  
 $\delta^{13}C = -0.6\text{‰}$   
*Ostrea* sp (33° 07' S, 58° 31' W) 7m asl, 5.5m depth.

**AC-0613.** **33,000 ± 1300**  
 $\delta^{13}C = 2.7\text{‰}$   
*Erodona mactroides* (33° 07' S, 58° 31' W) 7m asl, 5.5m depth. *General Comment* (MAG & NG): samples correspond to relatively high marine level related to Plum-Point interstadial. Evidence of this marine level was found along coast from 33° 10' S to 40° S.

#### General Cerri marine Holocene series

Marine shells from Bahía Blanca inner estuary, Buenos Aires prov (38° 40' S, 62° 15' W). Samples from different clastic shell beach ridges of General Cerri spit, dated to establish chronology of relative oscillations of post-glacial Holocene transgression. Coll and subm 1981 by M A González, N Weiler, and N Guida.

*First beach ridge (landward), 11m asl*

**AC-0311.** **5990 ± 120**  
 $\delta^{13}C = 0.8\text{‰}$   
*Buccinanops* sp, 2m depth.

**AC-0312.** **6600 ± 120**  
 $\delta^{13}C = 1\text{‰}$   
*Buccinanops* sp, 1m depth.

**AC-0313.**

*Brachydontes rodriguezii*, 1m depth.

**6100 ± 120**  
 $\delta^{13}C = 2.6\text{‰}$

**AC-0314.**

*Pitar rostrata*, 0.2m depth.

**6350 ± 110**  
 $\delta^{13}C = 2.6\text{‰}$

*Third beach ridge, 9.5m asl*

**AC-0390.**

*Buccinanops* sp, 1m depth.

**6420 ± 140**  
 $\delta^{13}C = 1.5\text{‰}$

**AC-0391.**

*Brachydontes rodriguezii*, 1m depth.

**6000 ± 110**  
 $\delta^{13}C = 3.1\text{‰}$

*Fourth beach ridge, 9m asl*

**AC-0381.**

*Brachydontes rodriguezii*, 1.5m depth.

**5720 ± 100**  
 $\delta^{13}C = 3\text{‰}$

**AC-0382.**

*Buccinanops* sp, 1.5m depth.

**6000 ± 110**  
 $\delta^{13}C = 1.2\text{‰}$

**AC-0383.**

*Buccinanops* sp, 0.5m depth.

**6130 ± 110**  
 $\delta^{13}C = 1.3\text{‰}$

**AC-0384.**

*Brachydontes rodriguezii*, 0.5m depth.

**5470 ± 100**  
 $\delta^{13}C = 2.6\text{‰}$

*Fifth beach ridge, 8.5m asl*

**AC-0315.**

*Tagelus gibbus*, 1.5m depth.

**5280 ± 110**  
 $\delta^{13}C = 2.1\text{‰}$

**AC-0316-I.**

*Buccinanops* sp, 1.5m depth.

**5100 ± 100**  
 $\delta^{13}C = 1.4\text{‰}$

**AC-0316-II.**

*Brachydontes rodriguezii*, 1.5m depth.

**5400 ± 140**  
 $\delta^{13}C = 3.1\text{‰}$



**AC-0317.** **5460 ± 110**  
 $\delta^{13}\text{C} = 1.6\text{‰}$   
Undetermined sp, 0.5m depth.

**AC-0380.** **5420 ± 110**  
 $\delta^{13}\text{C} = 1.8\text{‰}$   
*Buccinanops* sp, 1m depth.

*General Comment* (MAG): high-energy waves ambience caused mixture of shells of different ages. Min  $^{14}\text{C}$  age in each ridge is accepted as closest date for ridge build-up.

### **Bahía Blanca marine and continental Holocene series**

Shells from Bahía Blanca and surroundings, Buenos Aires prov (38° 40' S, 62° 20' W). Coll and subm 1981 by M A González.

**AC-0386.** **3570 ± 100**  
 $\delta^{13}\text{C} = 1.1\text{‰}$   
*Brachydontes rodriguezii* from Jorge Moore St beach ridge, 7m asl, 0.5m depth.

**AC-0387.** **3950 ± 90**  
 $\delta^{13}\text{C} = 1.9\text{‰}$   
*Buccinanops* sp from Jorge Moore St beach ridge, 0.5m depth.

**AC-0388.** **4950 ± 100**  
 $\delta^{13}\text{C} = 2\text{‰}$   
*Buccinanops* sp from Villa Serra beach ridge, 7.5m asl, 0.5m depth.

**AC-0389.** **4460 ± 100**  
 $\delta^{13}\text{C} = 1.7\text{‰}$   
*Brachydontes rodriguezii* from Villa Serra beach ridge, 0.5m depth.

**AC-0349.** **4470 ± 90**  
 $\delta^{13}\text{C} = 1\text{‰}$   
*Buccinanops* sp from Litobril beach ridge, 7m asl, 0.5m depth.

**AC-0350.** **4520 ± 110**  
 $\delta^{13}\text{C} = 3\text{‰}$   
*Brachydontes rodriguezii* from Litobril beach ridge, 0.5m depth.

**AC-0337.** **4220 ± 100**  
 $\delta^{13}\text{C} = 3\text{‰}$   
*Tagelus gibbus* from Ing White tidal flats, 6m asl, 1m depth; bivalves *in situ* into pelithic sediments.

**AC-0338.** **5580 ± 130**  
 $\delta^{13}\text{C} = 1.9\text{‰}$   
*Pitar rostrata in situ* from Ing White tidal flats, 1.5m depth.

**AC-0348.** **3920 ± 90**  
 $\delta^{13}C = 1.7\text{‰}$   
*Buccinanops* sp from Ing White tidal flats, 1m depth.

**AC-0320.** **7240 ± 160**  
 $\delta^{13}C = -6.3\text{‰}$   
*Cyclodontina (Plagiodontes) patagonica* (pulmonate odontostomide) from alluvium of Parque de Mayo, 30m asl, 2.5m depth. *Comment* (MAG): soils of Hypsithermal were developed over these sediments.

**AC-0322.** **5320 ± 100**  
 $\delta^{13}C = -6\text{‰}$   
*Cyclodontina (Plagiodontes) patagonica* and *Austroborus lutescens* from eolian dunes in Parque Independencia, 35m asl, 1m depth. *Comment* (MAG): soils of Hypsithermal were buried by these dunes.

**AC-0346.** **5350 ± 130**  
 $\delta^{13}C = -5.1\text{‰}$   
*Cyclodontina (Plagiodontes) patagonica* and *Austroborus lutescens* buried into post-Hypsithermal eolian dunes from Est Grünbein, 15m asl, 0.5m depth.

**AC-0351.** **3810 ± 120**  
 $\delta^{13}C = -6.7\text{‰}$   
*Cyclodontina (Plagiodontes) patagonica* and *Austroborus lutescens* buried into post-Hypsithermal eolian dunes from Est Grünbein, 18m asl, 0.5m depth.

*General Comment* (MAG): max postglacial Holocene transgression in this loc was established in ca 6000 yr BP. High temperature and humidity episode related to Holocene climatic optimum (Hypsithermal) was developed between 6000 and 5200 yr BP. Dune sands buried Hypsithermal soils ca 5200 yr BP. Clastic beach ridges that indicate max sea levels show periodicity of ca 500 yr that should correspond to extraordinary tidal episodes.

#### **Martín García series**

Marine and estuarine shells from Martín García I. (34° 11' S, 58° 15' W). Coll and subm 1981 by M A González.

**AC-0431.** **5740 ± 130**  
 $\delta^{13}C = 0.2\text{‰}$   
*Erodona mactroides* and *Macra isabelleana* from fine sand level, 4.5m asl, 0.8m depth. *Comment* (MAG): sample dates max postglacial Holocene transgression in Río de la Plata.

**AC-0433-I.** **18,500 ± 500**  
 $\delta^{13}C = -2.2\text{‰}$   
Mixture of estuarine mollusk shells (*Erodona mactroides* and *Macra isabelleana*) from fine gravel level. Sampled sediments show epigenetic carbon-

ate deposits. *Comment* (MAG): because of strat evidence, date is not acceptable (corresponds min global glacio-eustatic sea level). Sample was probably contaminated and inadequately pretreated.

**AC-0433-II.** **38,500 ± 3000**

*Erodona mactroides* from same loc as AC-0433-I, carefully pretreated to eliminate epigenetic carbonates.

**AC-0484.** **32,200 ± 1400**  
 $\delta^{13}C = 0.9\text{‰}$

*Thais haemastoma* from same loc as AC-0433-I. *Comment* (MAG): this Pleistocene relative high sea level is related to Plum Point interstadial.

#### ARCHAEOLOGIC SAMPLES

#### Cave 4 La Martita series

Charcoal from Cave 4 La Martita, Gobernador Gregores, Santa Cruz prov (48° 34' S, 69° 15' W), 350m asl. Coll and subm 1982 by A Aguerre.

**AC-0603.** **1620 ± 90**  
 $\delta^{13}C = -21.4\text{‰}$

Charcoal from 3rd layer, 0.68m depth, Sq I VIc, assoc with stemmed projectile point, indicating presence of Patagoniense industry, guanaco hunters present in Patagonia up to historic times. Date agrees with those from neighboring area, Río Pinturas.

**AC-0604.** **2190 ± 120**  
 $\delta^{13}C = -22.9\text{‰}$

Charcoal from 4th layer, 0.94m depth, Sq I VIIc. Sample dates occupation of cave by human groups with stone technol (small blades, scrapers, without projectile points) followers of Casapedrense technol, present at site since 4500 BP. This group was defined as Transitional industries for Río Pinturas area, where it appears earlier with same technol features.

#### Alero Cárdenas series

Vegetal charcoal from site with rupestrian art, Alero Cárdenas (Gradín, 1977) at Estancia La Lita, Río Pinturas area, NW of Santa Cruz prov. Coll and subm 1980–81 by C Gradín.

**AC-0497.** **7750 ± 130**  
 $\delta^{13}C = -21.1\text{‰}$

Lower part of Level 7; sample corresponds to beginning of human occupation of site, assoc with artifacts related to Río Pinturas I cultural level. Ages previously obtained for this cultural level at Cueva de las Manos range from ca 9300 – 7280 ± 60 BP.

**AC-0499.** **7300 ± 200**  
 $\delta^{13}C = -20.9\text{‰}$

Sample, 10cm above and 1m away from AC-0497, in upper part of level 7, *post quem* data for level with triangular points, 1 lanceolate point,

and 1 point with incipient stem and barbs, underlying AC-0499, morphologically related with Magallanes III cultural level.

**AC-0498.** **3450 ± 110**  
 $\delta^{13}C = -21.3\text{‰}$

Sample from lower part of Level 5, 0.67m depth; triangular stemless point was found at same depth. Sample dates presence of this type of artifacts (Toldense tradition). Contemporaneity with Patagoniense stem points has been checked in other sq and levels. This age represents *post quem* date for Patagoniense industry.

**AC-0500.** **1180 ± 90**  
 $\delta^{13}C = -20.6\text{‰}$

This sample is related to ceramic phase of Patagoniense and indicates early presence of this feature (AD 770) with geometric decoration at site. Date confirms previous date for similar site in SW of Chubut prov (Gradín, Aschero, & Aguerre, 1979).

#### Lechiguanas series

Shells from Isla Lechiguanas, Entre Ríos prov (33° 44' S, 59° 13' W), dated from third level of dense shell midden, 0.16 to 0.55m thick. Edaphic horizon containing fragments of pottery of Entrerriean cultures (Lechiguanas phase) overlies midden. Behind it, aceramic paleosoil, 0.08 to 0.3m thick, with bone harpoon was id. Coll and subm 1980 by R Raffino and A Caggiano.

**AC-0122.** **2740 ± 80**  
 $\delta^{13}C = -6.2\text{‰}$   
*Ampullaria insularum* and other pulmonate mollusks, 0.5m depth.

**AC-0124.** **2550 ± 90**  
 $\delta^{13}C = -6.1\text{‰}$   
*Ampullaria insularum* and other pulmonate mollusks, 0.37m depth.

*General Comment (RR):* samples date aceramic industry of bone harpoons older than 800 BC, for Paraná delta.

#### Paranacito series

Shells from surroundings of Paranacito R, Entre Ríos prov. Samples dated to establish beginning of Las Mulás cultural phase of Ribereños Plásticos culture. Coll and subm 1980 by A Caggiano.

**AC-0183.** **1300 ± 80**  
 $\delta^{13}C = -6.1\text{‰}$

Mollusk shells from Don Santiago site (33° 43' S, 58° 55' W), Level 1, 0.85m depth.

**AC-0186.** **1090 ± 80**  
 $\delta^{13}C = -6.3\text{‰}$

Mollusk shells from Don Santiago site, Level 1, 0.35m depth.

**AC-0187.** **1420 ± 80**  
 $\delta^{13}C = -6.5\text{‰}$

Mollusk shells from Rodeo Viejo de la Nena site (33° 37' S, 58° 45' W), Level 1, 0.47m depth.

**AC-0188.** **1420 ± 80**  
 $\delta^{13}C = -7.4\text{‰}$

Mollusk shells, from Rodeo Viejo de la Nena site, Level 1, 0.65m depth.

*General Comment (RR):* series dates beginning of Ribereños Plásticos culture in Paraná R.

**AC-0450.** **870 ± 90**  
 $\delta^{13}C = -23.5\text{‰}$

Charcoal from Molinos site, Molinos dept, Salta prov, 5km W of confluence of Molinos and Calchaquí Rivers, 1800m asl. Coll and subm 1982 by R Raffino and L Baldini. *Comment (RR):* charcoal came from first layer of midden between rooms, where several lentils of charcoal and ash were found. Pottery fragments assoc with charcoal correspond to early type similar to San José-Hualfin group, estimated to ca AD 1000.

### **Puerta La Paya series**

Samples of charcoal and burned maize grains assoc with archaeol remains from Puerta de La Paya site, on right bank of La Paya gulch, at confluence with right bank of Calchaquí R, Cachi dept, Salta prov (25° 12' S, 66° 11' W), 220m asl. Samples were taken from pit holes in two middens, 30m apart. Coll and subm 1981 by R Raffino and L Baldini.

#### *Stratigraphy 2*

**AC-272.** **990 ± 80**  
 $\delta^{13}C = -8.9\text{‰}$

Mixture of vegetal charcoal and charred maize grains from 2nd layer, 0.1 to 0.2m depth.

**AC-0273.** **830 ± 100**  
 $\delta^{13}C = -8.9\text{‰}$

Charred maize grains from 15th layer, 1.4 to 1.5m depth. *Comment (RR):* sample consisted of several types of maize, as rosita colorado, capia, chullpi, pisingallo, and morocho.

*General Comment (MCA & FEA):* despite submitter's description of sample,  $\delta^{13}C$  for AC-0272, different from vegetal charcoal, suggests sample consisted mostly of charred maize grains.

#### *Stratigraphy 3*

**AC-0271.** **780 ± 90**  
 $\delta^{13}C = -23\text{‰}$

Vegetal charcoal from 4th layer, 0.3 to 0.4m depth.

**AC-0270.** **620 ± 100**  
 $\delta^{13}C = -22.3\text{‰}$

Vegetal charcoal from 11th layer, 1 to 1.1m depth.

*General Comment (RR)*: ages are, in general, earlier than expected for settlement which corresponds to Inca occupation of area. Evident incongruence between depth and age was attributed to mechanical mixing and alteration of deposits after abandonment of site, especially in upper layers (AC-0272 and -0271). Date of AC-0272 is not acceptable for this settlement where contemporary pottery types are absent. Age of AC-0271 is acceptable but older than AC-0270 which lay in deeper level. Ceramic typology suggests that Stratigraphy 2 is older than Stratigraphy 3, but absence of Inca remains reveals that these middens are earlier than AD 1470.

**AC-0364.** **760 ± 90**  
 $\delta^{13}C = -18.5\text{‰}$

Vegetal charcoal from large fire pit, 3m diam, in room assoc with potsherds from Cerro Colorado, E bank of Río Hualfin-Belén in front of Ischanga R mouth, near La Ciénaga, Belén dept, Catamarca prov (27° 30' S, 66° 55' W). Coll and subm 1981 by R Raffino and C Sempé. *Comment (RR)*: assoc pottery with zoomorphous figures corresponds to Belén culture, Phase II. Site is fortified occupation over hill. Date is somewhat earlier than suggested by A González for these phases of Belén culture. New evidence supported by recent studies in area confirms earlier settlement of these fortified sites.

#### **Palo Blanco series**

Vegetal charcoal assoc with archaeol remains from Palo Blanco site, NW from Abaucán valley, Tinogasta dept, Catamarca prov, over S bank of Río de los Ranchillos, tributary of Abaucán R (27° 20' S, 67° 50' W). Coll and subm 1981 by R Raffino and C Sempé.

**AC-0366.** **1640 ± 100**  
 $\delta^{13}C = -21.6\text{‰}$

Group 1, 0.25 to 0.5m depth. Charcoal from fire pit in room. *Comment (RR)*: date corresponds to Phase II of Saujil culture; large pottery with striations assoc with this sample.

**AC-0365.** **1760 ± 100**  
 $\delta^{13}C = -19.1\text{‰}$

Group 1, 0.75 to 0.8m depth. Charcoal from fire pit in room. *Comment (RR)*: date corresponds to Phase I of Saujil culture; black-over-gray polished-surface pottery assoc with this sample.

*General Comment (RR)*: dates are acceptable for cultural relationship of these levels, and agree with previous dates from different sites of Abaucán valley of this culture.

#### **Salto Grande series**

Freshwater shells and charcoal from surroundings of Salto Grande site, Federación dept, Entre Ríos prov. Coll and subm 1980–1981 by R

Raffino and J Rodríguez. Samples dated to establish lithic and ceramic chronologies of different sites.

- AC-0109.** **1650 ± 70**  
 $\delta^{13}C = -3.4\text{‰}$   
Los Sauces II site, 15m asl. Shells (*Felipponea iheringy*) 0.3m depth, 3rd level.
- AC-0110.** **1340 ± 70**  
 $\delta^{13}C = -3.4\text{‰}$   
Los Sauces II site, 15m asl. Shells (*Felipponea iheringy*) 0.5m depth, 5th level. *Comment* (RR & JR): this sample and AC-0109 belong to same profile. No conclusions can be made because of inverted chronology.
- AC-0111.** **720 ± 70**  
 $\delta^{13}C = -3.7\text{‰}$   
Rancho Colorado site, 15m asl. Shells (*Felipponea iheringy*, *Asolene megastoma*) 0.3m depth, 3rd level.
- AC-0112.** **790 ± 70**  
 $\delta^{13}C = -3\text{‰}$   
Rancho Colorado site, 15m asl. Shells (*Felipponea iheringy*, *Asolene megastoma*) 0.4m depth, 4th level.
- AC-0172.** **1430 ± 80**  
 $\delta^{13}C = -2.3\text{‰}$   
Rancho Miño site, 25m asl. Shells (*Asolene megastoma*) 0.3m depth, Level III.
- AC-0173.** **1440 ± 80**  
 $\delta^{13}C = -3\text{‰}$   
Arroyo Yará Chico site, 15m asl. Shells (*Felipponea iheringy*, *Asolene megastoma*) 0.55m depth, Level 6B.
- AC-0269.** **1150 ± 100**  
 $\delta^{13}C = -24.7\text{‰}$   
Arroyo Yará Chico site, 15m asl. Vegetal charcoal, 0.45m depth, Level 5B.  
*General Comment* (RR & JR): dates establish preliminary chronology of some ceramic units. Some belong to Salto Grande cultural type, present between 400 BC and AD 1200 according to these and previous dates. Other units belong to Cerro Chico cultural type, developed between 300 BC and AD 1150.
- AC-0327.** **990 ± 80**  
 $\delta^{13}C = -22.5\text{‰}$   
Charcoal from ceramic site in Agrelo, 25km S of Mendoza (33° 07' S, 68° 53' W), 800m asl; assoc with gray pottery. Coll 1950 by J Semper and

subm 1981 by J Schobinger. *Comment* (JS): first  $^{14}\text{C}$  date for Agrelo's culture (Canals Frau, 1956). Date confirms assumption that this culture developed between AD 400 and 1200.

### High-altitude ceremonial places series

#### AC-0329.

**570 ± 80**

$\delta^{13}\text{C} = -20.4\text{‰}$

Wood from ritual site at summit of Cerro Negro Overo, Famatina Highlands, La Rioja prov (28° 56' S, 67° 51' W), 6050m asl. Coll 1963 and subm 1981 by J Schobinger. Partially burned wood (*Prosopis* sp) was assoc with antlers of Andean cervine (*Hippocamelus* sp) inside rectangular corral, "pirca". *Comment* (JS): floor of site was stony with no evidence of archaeol remains under it. Site shows late prehispanic features, probably Inca, even when some typical elements of this culture are not present. Site was found by H Harrington in 1941 and rediscovered by E Groch in 1960. Lower limit of  $1\sigma$  confidence interval is coincident with oldest arrival of Inca outpost, attributed to beginning of Tupac Inca Yupanki (1471–1493) reign. Other high alt sites must be identified and dated to establish whether this type of sanctuary precedes Inca expansion.

#### AC-0330.

**390 ± 80**

Wood from branch coll at 6000m asl on way to top of Cerro Mercedario (6770m high), Cordillera de los Andes, Calingasta dept, San Juan prov (31° 59' S, 70° 07' W). Coll 1968 and subm 1981 by J Schobinger.

#### AC-0331.

**350 ± 80**

$\delta^{13}\text{C} = -24.6\text{‰}$

Partially burned wood from 6-rm sta, "Pircas Indias", used for prehispanic expeditions to top of Cerro Mercedario, 5300m asl, at nearly same geog coordinates as AC-0330. Wood fragment was found partially buried in one of rooms, assoc with potsherds attributed to Inca period. Coll 1968 and subm 1981 by J Schobinger. *Comment* (JS): construction and potsherds from Cerro Mercedario suggest relation with Inca culture. Thus,  $^{14}\text{C}$  dates disagree with archaeol evidence, but are congruent with expected age when calibrated through dendrochronol curves (Ralph, Michael, & Han, 1973).

### Chocón Chico series

Sample from archaeol test pits near coast of Río Limay, Confluencia dept, Neuquén prov (39° 10' S, 68° 40' W) 300m asl. Coll and subm 1981 by J Fernández.

#### AC-0307.

**810 ± 80**

$\delta^{13}\text{C} = -6.4\text{‰}$

Shells (*Diplodon* sp) 0.0 to 0.2m depth.

#### AC-0308.

**1380 ± 90**

$\delta^{13}\text{C} = -7.5\text{‰}$

Shells (*Diplodon* sp) 0.2 to 0.45m depth.



**AC-0309.** **2490 ± 90**  
 $\delta^{13}C = -11.4\text{‰}$

Charcoal, 0.65 to 0.8m depth.

*General Comment* (JF): dates are correlated with Haichol series to compare Cordilleran site with others in Patagonian steppe. Lithic artifacts, triangular, stemless projectile points and scrapers, are same in both sites. Riverine shells (*Diplodon*) gathered by the prehistoric people for eating, can be error source in dates.

### Caballo Muerto series

This series includes samples from two exposures made by small erosion gully streams near Potrereros, W slope of sierra Alta, Tumbaya and Humahuaca depts, Jujuy prov (23° 30' S, 65° 37' W), 3820m asl. Profiles are of archaeol and paleoenvironmental interest and show sequence of sand, peat, silt, and diatomite layers where archaeol material is present. Coll and subm 1981 by J Fernández.

#### *Caballo Muerto A-B profile*

**AC-0290-I.** **2770 ± 100**  
 $\delta^{13}C = -26.1\text{‰}$

Humic acids extracted from upper layer of peat, exposed by erosion.

**AC-0290-II.** **2500 ± 100**  
 $\delta^{13}C = -26.6\text{‰}$

Oxygen-stream combustion of residue of AC-0290-I (after humic acid extraction).

**AC-0290-III.** **2570 ± 100**  
 $\delta^{13}C = -25.4\text{‰}$

Wet combustion (acid digestion with sodium dicromate + sulphuric acid) of residue of AC-0290-I (after humic acid extraction).

*General Comment* (MCA & FEA): sample was used to compare ages obtained on different fractions with different techniques of CO<sub>2</sub> production. There is no significant difference between wet and oxygen-stream combustions. Age of the humic acid extract (AC-0290-I) is slightly older than AC-0290-II, which shows that those humic acids do not come from later or upper vegetal activity, because, in this case, age would be younger.

**AC-0291.** **2520 ± 100**  
 $\delta^{13}C = -24.9\text{‰}$

Peat from first layer, 0.29 to 0.34m depth.

**AC-0293.** **3590 ± 90**  
 $\delta^{13}C = -23.9\text{‰}$

Peat from second layer under diatomite, 0.65 to 0.73m depth. *Comment* (JF): sample was also dated Wisconsin Lab, Wis-1384: 3410 ± 70 (V Markgraff, pers commun).

**AC-0292. 2320 ± 90**

Vegetal remains buried in sand layer, 1m depth. *Comment* (JF): histologic analysis of this material showed they were exclusively intrusive roots. This would explain younger age than AC-0293, despite its depth. Eolian erosion of this sandy stratum revealed large prehistoric workshop from which >1000 foliaceous, pseudofoliaceous, bifacial (Ayampitin type) and unifacial (Saladillo type), stemmed (Aguas Calientes type) lithic projectile points were recovered. Typology defined and illustrated by Menghin (1953–1954, Pl 11), González (1952, Pl 13), and Fernández (1967, figs 23, 32; 1971, Pls 22, 38). These data only postdate archaeol materials interbedded in sandy stratum bearing old roots. Basal organic strata that antedate prehistoric settlement can be sampled in adjacent exposure.

*Caballo Muerto C-D profile***AC-0299. 7550 ± 160**  
 $\delta^{13}C = -22.7\text{‰}$ 

Peat layer, 2.4 to 2.45m depth, 1.6m under level with archaeol evidence.

**AC-0294. 8670 ± 150**  
 $\delta^{13}C = -22.7\text{‰}$ 

Peat layer, 3.25m depth, 2.4m under archaeol level.

**AC-0295. 8600 ± 150**  
 $\delta^{13}C = -23\text{‰}$ 

Peat layer, 3.5m depth, 2.6m under archaeol level.

*General Comment* (JF): prehistoric settlement dates between 7550 ± 160 and 3590 ± 90 BP. Coleman (1973) and Fernández (1974) attributed age of site to 5500 BP, based on other evidence. Strat and chronol sequence show two climatic changes which are now being analyzed.

**AC-0003. 730 ± 100**  
 $\delta^{13}C = 2.5\text{‰}$ 

Marine shells (*Mytilus* sp) from Valle de las Fuentes, Cabo Vírgenes, E mouth of Magellan straits, Guer Aike dept, Santa Cruz prov (52° 20' S, 68° 23' W), 10m asl. Coll and subm 1979 by J Fernández. Sample is probably food remains from Spanish settlement, Ciudad del Nombre de Jesús, established in 1584 by Capt Pedro Sarmiento de Gamboa (Fernández, 1983a). Assoc with vitrified potsherds of European manufacture and metal pieces.

*General Comment* (MCA & FEA): difference between  $^{14}C$  and historic age, ca 360 yr, is probably due to reservoir effect of marine shells.

**Mata Molle series**

Stratified peat, peaty sediments, and sapropel from banks of Mata Molle Creek, Collon Cura dept, Neuquén prov (40° 10' S, 70° 45' W), 700m asl. Coll and subm 1981–1982 by J Fernández. Data are correlated with

“Mata Molle fossil man” problem (Groeber, 1947; Vignati, 1957–1959) whose min age was estimated at 6000 yr.

**AC-0276.** **2430 ± 130**

Peat, Mata Molle Profile 1, 2.25 to 2.35m depth, from close to skeletal remains recovered in 1942.

**AC-0277.** **2240 ± 100**  
 $\delta^{13}C = -25.3\text{‰}$

Peat, Mata Molle Profile 1, 1.56 to 1.6m depth.

**AC-0278.** **1930 ± 90**  
 $\delta^{13}C = -24.6\text{‰}$

Peat, Mata Molle Profile 1, 0.9 to 1m depth; end of Mata Molle aggradational cycle.

**AC-0577.** **2070 ± 90**  
 $\delta^{13}C = -26.9\text{‰}$

Peat, Mata Molle Profile 2, 2.01 to 2.06m depth. Sample was in same strat position as AC-0277, 5km in headwaters direction.

**AC-0593.** **2000 ± 120**  
 $\delta^{13}C = -26.8\text{‰}$

Peat, Mata Molle Profile 3, 0.8 to 0.85m depth. Sample has same significance and was in same strat position as AC-0277, 6.5km in headwaters direction.

*General Comment (JF):* data correspond to three strata of peat overlying and postdating human skeletal remains. Following data correspond to probable max age.

**AC-0573.** **4930 ± 150**  
 $\delta^{13}C = -26.5\text{‰}$

Peat, Mata Molle Profile 4, 5.85m depth.

**AC-0575.** **4550 ± 110**

Peat, Mata Molle Profile 5, 6.3m depth. Closest to human remains.

**AC-0574-I.** **7300 ± 150**

Sapropel, Mata Molle Profile 6, upper portion of stratum, 6.5m depth. Basal portion of sedimentary sequence bearing human bones. Sample is not directly related to archaeol remains.

**AC-0574-II.** **8200 ± 150**  
 $\delta^{13}C = -25.2\text{‰}$

Sapropel, basal portion of stratum. Mata Molle Profile 7, 6.5m depth, not directly related to archaeol problem. Sample is only of palynol and palaeoclimatic interest.

*General Comment* (JF): date establishes age of Mata Molle fossil man between  $2430 \pm 130$  (peaty sediments) and  $4550 \pm 110$  BP (sapropelic muds) (Fernández, 1983b).

## PALEOENVIRONMENTAL SAMPLES

**AC-0099.** **3400 ± 150**  
 $\delta^{13}C = -25.2\text{‰}$

Peat from E coast of Lago Mascardi, Bariloche dept, Río Negro prov ( $41^{\circ} 16' S$ ,  $71^{\circ} 30' W$ ) 1000m asl. Peat layer at 4m depth in outcropping formed by volcanic ash, gravel strata, and peaty materials. Sample antedates deposition of third stratum from top of volcanic ash. Coll and subm 1980 by J Fernández. *Comment* (JF): profile is interesting for paleoclimatic events and  $^{14}C$  data provide chronol framework for tephros sequence established by Auer (1950; 1974) and palynol profile in Mallin Book site (Markgraff 1979; 1983).

**AC-0280-I.** **7500 ± 150**  
**AC-0280-II.**  $\delta^{13}C = -25.3\text{‰}$

Peat interstratified with volcanic ash and sandy material, 2km W of lago Caviahue, Ñorquin dept, Neuquén prov ( $37^{\circ} 52' 30'' S$ ,  $71^{\circ} 02' W$ ), 1500 asl. Coll and subm 1980 by J Fernández. *Comment* (JF): ligneous peat (*Araucaria araucana* branches) from basal peat stratum, 5.25m depth, coll for palynol and paleoclimatic research.

**Guayatayoc series**

Peat from Guayatayoc creek, Rinconada dept, Jujuy prov ( $22^{\circ} 18' S$ ,  $66^{\circ} 02' W$ ), 3500m asl, short tributary of Laguna de los Pozuelos; modern hydrologic regime is characterized by downcutting. Cuts show accumulation of basal gravel, clay, limes, and peat, 3m thick, covered by laminated clay with peat and marl layers, lacustrine sediments, and finally peat and diatomite. Coll and subm 1981 by J Fernández.

**AC-0283.** **2800 ± 100**  
 $\delta^{13}C = -24.8\text{‰}$

Peat, 0.6m thick, under diatomite, upper portion of layer.

**AC-0284.** **3250 ± 110**  
 $\delta^{13}C = -23.8\text{‰}$

Basal fraction of same stratum.

*General Comment* (JF): dates check regional significance and extension of climatic changes developed in Andes through considered interval. Palynol and diatomol studies are in progress. Human occupation of site, ca 2800 BP, signaled by lithic materials. Samples are correlated with Caballo Muerto, Río Abajo, and Azul Pampa-Ésquinas Blancas series. Basal peat remains are undated.

**Azul Pampa-Esquinas Blancas series**

Peat from headwaters of Río Grande de Jujuy, Humahuaca dept, Jujuy prov (22° 58' S, 62° 25' W) 3690m asl. Coll and subm 1981 by J Fernández.

*Esquinas Blancas profile*

<b>AC-0298.</b> 0.8m depth.	<b>1950 ± 90</b>
<b>AC-0297.</b> 2.3m depth.	<b>2980 ± 120</b> $\delta^{13}C = -24.6\text{‰}$
<b>AC-0296.</b> 8.1m depth.	<b>4950 ± 130</b> $\delta^{13}C = -24.5\text{‰}$

*Azul Pampa profile*

<b>AC-0306.</b> 0.65m depth.	<b>1830 ± 100</b> $\delta^{13}C = -22.5\text{‰}$
<b>AC-0300.</b> 1.35m depth.	<b>2880 ± 90</b> $\delta^{13}C = -25.0\text{‰}$
<b>AC-0301.</b> 7.03m depth.	<b>3690 ± 100</b> $\delta^{13}C = -22.8\text{‰}$
<b>AC-0303.</b> 8.8m depth.	<b>3940 ± 170</b> $\delta^{13}C = -25.2\text{‰}$
<b>AC-0304.</b> 10.93m depth.	<b>4140 ± 110</b> $\delta^{13}C = -25.2\text{‰}$
<b>AC-0310.</b> 12.5m depth.	<b>4770 ± 130</b> $\delta^{13}C = -25.2\text{‰}$

*General Comment* (JF): fine-grained stratified sediment sec, 10m thick, exposed in narrow canyon where Río Grande cuts across Andes Orientales. Topographic position of such fine-grained deposits in narrowest portion of Valley disagrees with classical principle of sedimentation. Also, sediment type composed of pelitic fraction (clays and limes), interbedded with

organic layers of peat and marl, is incongruent with modern hydrologic regime of river, characterized by downcutting. Modern climate of torrential summer rains (238mm between Dec and March) activates erosion and increases solid load of river. During rest of year, water levels are very low, depending only on spring runoff. Therefore, accumulation of sandy, silty, and clayey sediments (aggradational cycle) that occurred in past, reflect paleoclimate different from present with simultaneous, significant changes in vegetational composition. Sedimentologic features suggest that climate during deposition of fine-grained sediments must have been colder and more arid.

### Bajada de Rahue series

Peat from Bajada de Rahue, 10km E of Rahue (39° 22' S, 70° 56' W), Aluminé dept, Neuquén prov, 1000m asl. Coll and subm 1980–1981 by J Fernández.

**AC-0175.** **28,800 ± 1100**  
 $\delta^{13}C = -26.1\text{‰}$   
8.5 to 8.7m depth.

**AC-0176.** **29,000 ± 1400**  
 $\delta^{13}C = -26.6\text{‰}$   
9.39 to 10.49m depth.

**AC-0282.** **27,900 ± 1200**  
 $\delta^{13}C = -26.6\text{‰}$   
10.74 to 10.79m depth.

**AC-0177.** **32,600 ± 1500**  
 $\delta^{13}C = -26.6\text{‰}$   
17.36 to 17.51m depth.

*General Comment* (JF): Auer (1956) attributed interglacial age to this profile. Outcropping is composed of strata of volcanic ash, peat, and diatomite, 21m thick. Age is interstadial; comparison with  $\delta^{18}O$  values established for Antarctica by Johnsen *et al* (1972) indicates Denekamp/Hengelo (Plum Point) (Fernández, Angiolini, & Ancibor, 1983).

### Salina del Bebedero series

Lacustrine shells and eggshells (*Rhea* sp) from Salina del Bebedero, San Luis prov (33° 30' S, 66° 40' W). Samples dated to establish climatic-changes chronology for Late Pleistocene and Holocene. Coll and subm 1980–1981 by M A González.

**AC-0105.** **13,000 ± 140**  
 $\delta^{13}C = -3.4\text{‰}$   
*Chilina parchappi* from yellowish-green fine sand and tephra level, interstratified with coarse sand and fine gravel, corresponding to old lacustrine shores, 410m asl, 2.1m depth.

**AC-0360.** **8270 ± 180**  
 $\delta^{13}C = -3.0\text{‰}$

Eggshell fragment (*Rhea* sp) from archaeol site interstratified in lacustrine sediments, 385m asl, 1m depth. *Comment* (MAG): human presence indicates better environmental conditions than present ones (Hypsithermal?).

**AC-0361.** **5240 ± 100**  
 $\delta^{13}C = -3.9\text{‰}$

Eggshell fragments (*Rhea* sp) from top of poorly developed paleosol covered by arid eolian sediments, 430m asl, 1m depth. *Comment* (MAG): age corresponds to covering of Hypsithermal soil by eolian sediments (arid climate).

**AC-0368.** **17,500 ± 300**  
 $\delta^{13}C = -0.3\text{‰}$

*Chilina parchappi* from sand level interstratified with lacustrine sands and gravel, 410m asl, 4m depth.

**AC-0369.** **13,260 ± 200**  
 $\delta^{13}C = -0.8\text{‰}$

*Chilina parchappi* from same profile AC-0368, 2.3m depth.

**AC-0371.** **13,200 ± 200**  
 $\delta^{13}C = -0.8\text{‰}$

*Chilina parchappi* from same profile AC-0368, 2m depth.

*General Comment* (MAG): occurrence of three max lake levels was defined at 17,500, 15,500, and 13,000 BP (second one by previous dates). Meltwaters from Cordillera de los Andes feed lake through Desaguadero R. The three max lake levels are probably related to glacial advances during Wisconsin-Würm glaciation. Human presence, ca 8200 BP, indicates better environmental conditions than at present (Hypsithermal). Eolian sediments developed ca 5200 BP and buried Hypsithermal soils.

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