

Zooarchaeological studies in the humid Pampas, Argentina

ABSTRACT

This paper studies the adaptative strategies of the Pampean hunter-gatherers during the Holocene. It is a part of a larger multidisciplinary project, which involves not only archaeologists but also geologists, palaeontologists and palinologists.

Faunal remains coming from archaeological sites located in different environments of the Buenos Aires province, were analyzed from two points of view: 1) palaeozoogeographical-palaeoenvironmental and 2) cultural. The total of the remains was associated with lithic and ceramic materials and sometimes with human burials. The study was based on the taxonomic assignment of the bones, the MNI estimation, analysis of anthropic modification on bones and reviewing of the present corology of the species registered in the sites. Hypotheses about the palaeoenvironments in which the hunters had to be adapted since the Early Holocene until historical times were formulated.

RESUMEN

Este trabajo estudia las estrategias adaptativas de los cazadores-recolectores pampeanos durante el Holoceno. Esta contribución es parte de un proyecto multidisciplinario mayor, el cual involucra no sólo arqueólogos, sino también geólogos, paleontólogos y palinólogos.

Restos faunísticos provenientes de sitios arqueológicos ubicados en distintos ambientes de la Provincia de Buenos Aires han sido analizados desde

dos puntos de vista: 1) paleozoogeográfico-paleoambiental y 2) cultural. La totalidad de los restos fueron hallados asociados con materiales líticos y cerámicos, y a veces, con enterratorios humanos. El estudio fué basado en la asignación taxonómica de los huesos, la estimación del NMI, el análisis de la modificación antrópica de huesos y la revisión de la corología actual de las especies registradas en los sitios. Se han formulado hipótesis acerca de los paleoambientes a los cuales los cazadores tuvieron que adaptarse desde el Holoceno temprano hasta los tiempos históricos.

INTRODUCTION

The aim of this paper is to summarize the information related to zooarchaeological studies in the Pampean Region (Buenos Aires province sector) from two points of view. First, the palaeoenvironmental aspects, which could have affected the corology of some faunal species and second, the aboriginal adaptation to those palaeoenvironmental conditions and the strategies of subsistence employed.

Basically, the lifeway in the Pampas from the Late Pleistocene until the XVII century was based on hunting, and complementary, on gathering of various resources. Therefore, it is interesting to know in which way the adaptive strategies were changing during such a long period according to the availability of certain species.

In fact, this subject will be analyzed taking into account not only the archaeological information, but also chronicles of the voyagers that travelled across the present extent of the Buenos Aires province during the XVI, XVII, and XVIII centuries (ethnohistorical information), besides geological, palaeontological and palinological data.

Environmental aspects

The Pampean Region is a large plain extending from the foothills of the Andean cordillera to the west to the Atlantic Ocean to the east and from the Sierras Centrales and Río Paraná in the north to the Río Colorado in the south. It comprises about 600.000 sq.km that may be divided into "Humid

Pampa" and "Dry Pampa" (Daus, 1946). In this paper, archaeological sites studied are located in the Humid Pampa or Proper Pampa, which embraces the main part of the Buenos Aires province. This sector is separated from the Dry Pampa by the 600 mm isohyet.

The climate of the Humid Pampa is temperate with a warm period between November and March. Rainfall decreases from the east to the west (1.000 to 600 mm mean annual precipitation). Only two mountain ranges interrupt the pampean plains: the Ventania and Tandilia systems, with maximum elevation of 1247 m a.s.l. and 550 m a.s.l., respectively.

Phytogeographically, Pampean plains belong to the "Provincia Pampeana" (Cabrera, 1971), characterized by a gramineous steppe or pseudosteppe, without native autochthonous trees. However, the Spaniards described some native thorny species like "caldén" and "algarrobo", besides "sauce criollo" (red willow) along the river banks upon their arrival in the XVIth Century. From a zoogeographical point of view, the Humid Pampa corresponds to the Pampean Dominion (Ringuelet, 1955; 1961), in which mammals and birds are characteristic of open environments, although there is a great influence from the Subtropical Dominion.

Several subareas can be distinguished within the Humid Pampa (Fig.1), with different characteristics for each of them, not only from the environmental aspects but also from the archaeological viewpoint (see Salemme, 1987; Politis y Salemme, i.p.). In this sense, it is clear that the faunal remains received scarce or none attention since the beginnings of the archaeological Pampean studies. Except F. Ameghino (1880), who emphasized the findings of faunal remains in sites along the Río Luján (in the northeastern of Buenos Aires province), the other researchers did not pay attention to the bone remains. It was approximately ten years ago when the interest on the faunal wastes arised and then the study of prehispanic economy, techniques of hunting, palaeoenvironments, etc., began emphatically.

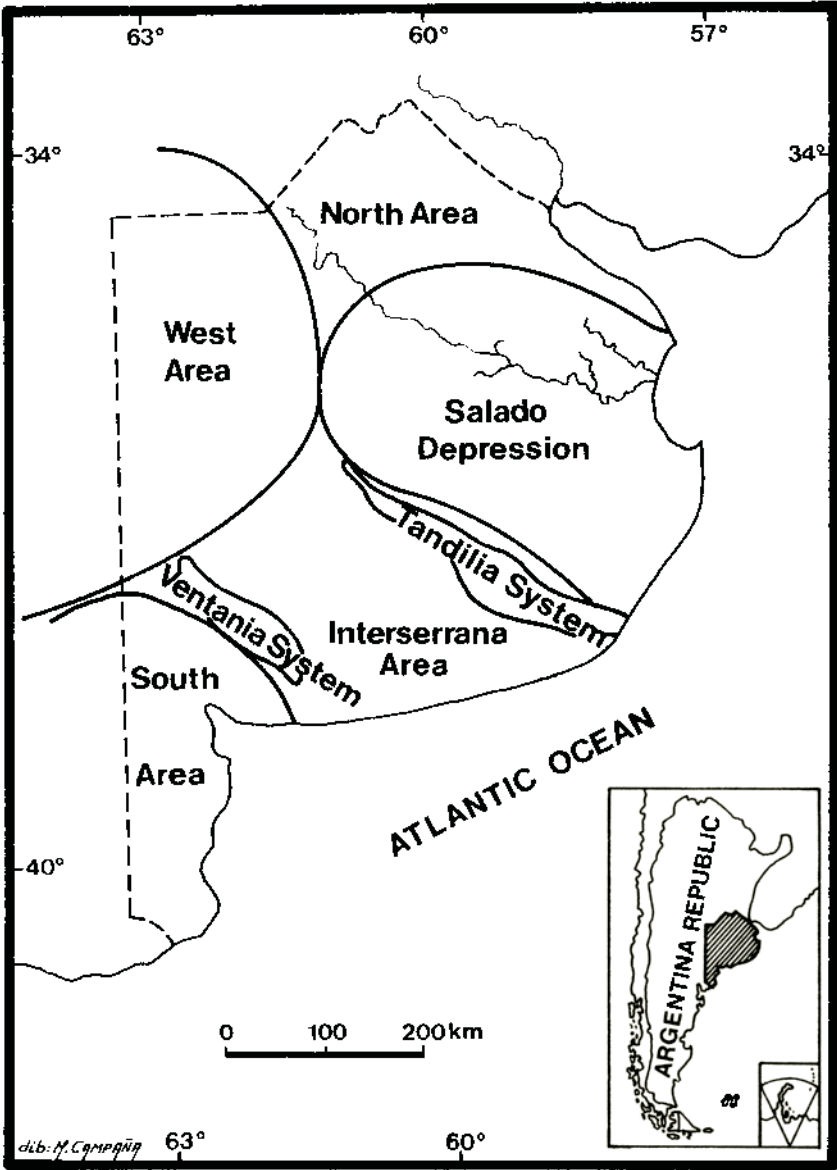


Figure 1. Geographical subareas in the Humid Pampas

ARCHAEOLOGICAL DATA

The information summarized in this paper comes from two kind of analytical levels: 1) faunal remains obtained from collections and/or our own excavations; 2) faunal information processed and published by other researchers, who have excavated their sites using similar methodologies. Therefore, and as a complement, the faunal comments included in the chronicles of the XVI to XIX centuries are also considered.

The main point taken into account was the location of the sites; they are localized in different subareas, which show distinct environmental characteristics at present. The goal was to find out how the environment was in those subareas in the past and consequently how the aboriginal behaviour was in such palaeoenvironments. The sites under my own analysis were 1) Cañada de Rocha, 2) Río Luján Site (both of them located in the Ondulate Pampa), 3) Tres Reyes 1, in the Interserrana area and 4) La Toma, close to the Ventania hilly area. The information coming from other authors corresponds to the following sites: 5) Lechiguanas Island (Delta sector), 6) Cañada Honda (Ondulate Pampa), 7) La Moderna (northeastern of the Interserrana area), 8) Fortín Necochea (northwest of the Interserrana area); 9) Tixi Cave, 10) Cerro La China, 11) Lobería 1 (all of them located in the Tandilia hilly area); 12) Zanjón Seco Locality, 13) Cortaderas and 14) Arroyo Seco S2 (the three of them in the southeast of the Interserrana area) (Fig.2).

The faunal remains were studied analyzing the previous bibliography, if it existed, and comparing them with reference collections. The study was based on the taxonomic classification of the bones, the counting of the minimum number of individuals (MNI), the analysis of the remains with anthropogenic modifications (bone implements) and the analysis of present distribution of the species registered in the sites.

A brief summary of each site is necessary to know the faunal and cultural contexts and their chronologies (for more details see Salemme, 1987 and the bibliography cited there). The location of the sites are shown in Fig. 2 and the species recovered in every site are shown in Tables 1 and 2, which are separated in the sites under my own analysis and the sites studied by the authors, as

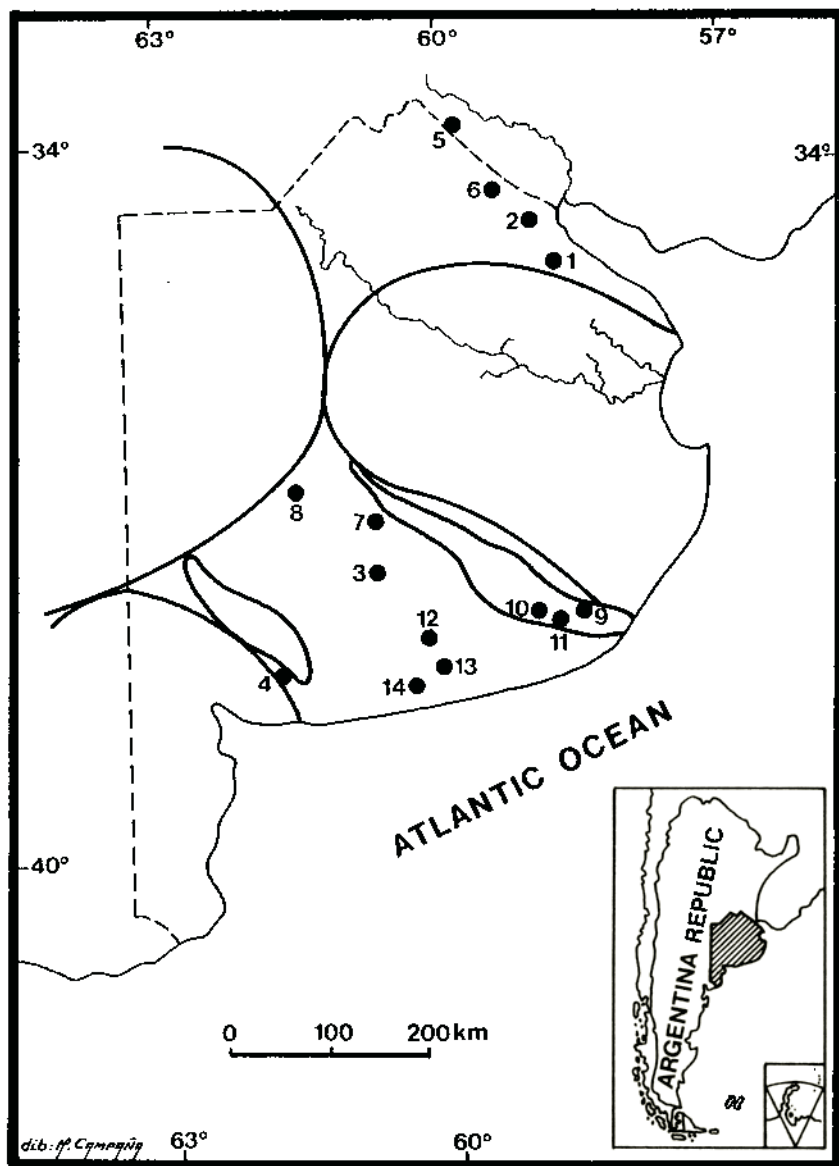


Figure 2. Location map of the sites.

it was explained before. Likewise, the chronological position of the sites is shown in Tables 3 and 4.

1) Cañada de Rocha is located in the Ondulate Pampa, close to a creek bank which goes downstream to the Luján river. The site was excavated by F. Ameghino (1880); he recovered a great amount of pottery sherds and faunal remains but a very few lithic implements. He described the geology and the stratigraphic position of the remains and emphasized on the species which were used by the aborigines; most of them were not living in the area at the end of the XIXth century (Salemme, 1983) (see list of species in Table 1).

2) Río Luján Site is an open-air site located along the Río Luján 90 km farther north than Cañada de Rocha, also in the Ondulate Pampa (see Fig.2). Two different sectors were excavated, one of them a place of human burials, and the other a campsite, where a few lithic artifacts and a great amount of pottery and faunal remains were recovered (Petrocelli, 1975). Except a piece assigned to *Lama* sp., the bones belong to a several species characteristic of the Subtropical Dominion (Salemme and Tonni, 1983; Salemme, 1987) (see Table 1).

3) Tres Reyes 1 is a multicomponent open-air site, close to a small lake in the Interserrana area. The human occupations took place during prehispanic times and several cultural differences among the Components were detected (Politis and Madrid, 1988; Madrid and Salemme, 1988) but they could not be observed in the faunal remains. In fact, the same species are registered through the entire sequence; so, it has been proposed that the guanaco (main resource) and the Pampean deer (complementary resource) were the species incorporated into the basic diet during the Middle and Late Holocene in this site (Salemme, 1987) (see Table 1).

4) La Toma is an open-air site localized in the Sauce Grande river banks, in the surroundings of the Ventania hilly area. The Central and Patagonian Dominions have a big influence on that area because of their proximity, though it is possible to find some species of Brazilian center like "mulita" (*Dasypus hybridus*) or "cuis" (*Cavia aperea*). The indigenous occupations detected took place under different environmental conditions; whereas the earliest one seems to have inhabited under an arid or semiarid cycle in the Middle Holocene, the latest human occupation (995 yr B.P., Table 3)

Table 1. Species recovered in sites 1, 2, 3 and 4.

Taxon	Sites				
	C.de Rocha	S.R.Luján	L.T.Reyes	La Toma	
			CS	NI	
<i>Adelomedon brasiliensis</i>	-	-	-	1	-
<i>Zidona dufresnei</i>	-	-	-	1	-
Volutidae	-	-	-	-	-
Doradidae indet.	-	x	-	-	-
Siluridae indet.	x	-	-	-	-
<i>Colossoma mitrei</i>	-	1	-	-	-
<i>Bufo cf. paracnemis</i>	-	-	1	-	-
<i>Ceratophrys</i> sp.	-	-	1	-	-
Chelyidae indet.	-	1	-	-	-
<i>Tupinambis cf. teguixin</i>	x	6	-	-	1
<i>Rhea americana</i>	-	1	-	2	-
Rheidae	x	-	1	-	-
<i>Ceryle torquata</i>	-	1	-	-	-
<i>Fulica leucoptera</i>	-	1	1	-	-
<i>Gallinula</i> sp.	-	1	-	-	-
<i>Chauna torquata</i>	-	1	-	-	-
<i>Ajaia ajaja</i>	-	1	-	-	-
Columbinae	x	-	-	-	-
<i>Nothura</i> sp.	x	-	-	-	-
<i>Ardea cocoi</i>	x	-	-	-	-
<i>Vanellus chilensis</i>	x	-	-	-	-
<i>Phoenicopterus</i>	x	-	-	-	-
<i>Coscoroba coscoroba</i>	x	-	-	-	-
<i>Cavia aperea</i>	x	6	-	1	-
<i>Ctenomys</i> sp.	x	3	4	4	3
<i>Dolichotis patagonum</i>	x	-	-	2	1
<i>Hydrochoerus hydrochaeris</i>	-	-	1	-	-
<i>Myocastor coypus</i>	x	92	1	-	-
<i>Reithrodon auritus</i>	x	-	-	-	-
<i>Calomys laucha</i>	x	-	-	-	-
<i>Mus musculus</i>	-	-	1	-	-
<i>Lagostomus maximus</i>	x	-	1	-	-
Chinchillidae indet.	-	-	1	-	-
<i>Zaedyus pichiy</i>	-	-	-	7	1
<i>Chaetophractus villosus</i>	x	-	2	5	1
<i>Dasypus hybridus</i>	x	-	1	2	-
<i>Tolypeutes naticus</i>	x	-	-	-	-
+Scelidotheriinae	-	-	1	-	-
<i>Lama guanicoe</i>	x	1	9	4	5
<i>Ozotoceros bezoarticus</i>	x	5	2	4	2
<i>Blastocerus dichotomus</i>	-	9	-	-	-
<i>Bos taurus</i>	-	1	-	-	-
<i>Ovis aries</i>	-	1	-	-	-
<i>Equus caballus</i>	-	-	2	-	-
<i>Felis concolor</i>	x	-	-	1	2
<i>Felis onca</i>	x	-	-	-	-
<i>Canis (P.) gymnocercus</i>	x	-	-	-	-
<i>Canis (P.) griseus</i>	x	-	-	-	-
<i>Chrysocyon brachyurus</i>	x	-	-	-	-
<i>Conepatus chinga</i>	x	-	-	-	-
<i>cf. Tursiops truncatus</i>	-	1	-	-	-

"x": presence

"-": absence

Numbers: MNI (minimum number of individuals)

Table 2. Species recovered in sites 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14.

TAXON	IL	CH	LM	FN	CT	LCh	L1	ZS	C	AS2
	5	6	7	8	9	10	11	12	13	14
<u>Diplodon paralellopedon</u>	x									
<u>Diplodon charruanus</u>	x									
<u>Ampullaria insularum</u>	x									
<u>Adelomedon brasiliensis</u>										x
<u>Amiantis sp.</u>										x
<u>Pseudoplatystoma</u>	x									
<u>Pterodoras</u>		x								
<u>Pimelodus sp.</u>	x									
<u>Rhea americana</u>		x	x					x		
<u>Rheidae indet.</u>				x						
<u>Rynchotus rufescens</u>				x						
<u>Plegadis sp.</u>		x								
<u>Eudromia elegans</u>										x
<u>Tinamidae indet.</u>				x						x
<u>Nothura maculosa</u>										x
<u>Anatidae indet.</u>	x		x							
<u>Athene cunicularia</u>										x
<u>Lutreolina crassicaudata</u>	x	x								
<u>Ltra platensis</u>	x	x								
<u>Canis (P.) gymnocercus</u>								x	x	
<u>Canis (P.) culpaeus</u>									x	
<u>Canis (D.) avus?</u>					x		x	x		
<u>Lyncodon patagonicus</u>										x
<u>Canidae indet.</u>				x						
<u>Conepatus cf. castaneus</u>					x					
<u>Felis cf. colocolo</u>					x					
<u>Felidae indet.</u>				x						
<u>Cavia aperea</u>	x	x			x		x			
<u>Dolichotis patagonum</u>							x	x		x
<u>Lagostomus maximus</u>	x			x	x		x	x		x
<u>Hydrochoerus hydrochaeris</u>	x	x								
<u>Myocastor coypus</u>	x	x	x	x						
<u>Ctenomys sp.</u>		x		x	x				x	x
<u>Galea musteloides</u>					x		x			

was under a moister and temperate cycle. It could be proved because of the faunal association (Table 1) and the palynological analysis (Salemme et al., i.p.; Salemme, 1987; Rabassa et al., i.p.).

5) Lechiguanas Island is an open-air site located in the Delta sector of the Paraná river, in the northeasternmost part of the Buenos Aires province (Caggiano, 1977). The older occupation is characterized by the absence of pottery and the

Table 2. Species recovered in sites 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14.

TAXON	IL 5	CH 6	LM 7	FN 8	CT 9	LCh 10	L1 11	ZS 12	C 13	AS2 14
<u>Cricetidae</u> <u>indet.</u>				x						
<u>Reithrodon</u> <u>auritus</u>					x					
<u>Akodon</u> <u>azarac</u>					x					
<u>Holochilus</u> <u>brasiliensis</u>			x		x					
<u>Cabreramys</u> <u>obscurus</u>					x					
<u>Calomys</u> <u>musculus</u>										
<u>Oryzomys</u> <u>nigripes</u>					x					
<u>Oxymycterus</u> <u>rutilans</u>					x					
<u>Chaetophractus</u> <u>villosus</u>				x	x		x	x	x	x
<u>Dasypus</u> <u>septemcinctus</u>			x							
<u>Dasypus</u> <u>hybridus</u>					x		x			
<u>Zaedyus</u> <u>pichiy</u>					x				x	x
<u>Tolypeutes</u> <u>sp.</u>									x	
<u>Tayassu</u> <u>tajacu</u>	x									
<u>Lama</u> <u>guanicoe</u>	x	x	x	x	x		x	x	x	x
<u>Ozotoceros</u> <u>bezouarticus</u>		x		x	x		x	x	x	x
<u>Blastocerus</u> <u>dichotomus</u>	x	x								
<u>Ovis</u> <u>aries</u>				x						
<u>Bos</u> <u>taurus</u>				x						
<u>Equus</u> <u>caballus</u>				x						
<u>Monodelphis</u> <u>dimidiata</u>					x					
<u>Lestodelphis</u> <u>halli</u>					x					
<u>Didelphidae</u> <u>indet.</u>		x								
<u>Chiroptera</u> <u>indet.</u>					x					
+ <u>Eutatus</u> <u>sequini</u>					x	x				x
+ <u>Glyptodon</u> <u>sp.</u>			x							x
+ <u>cf. Mylodon</u> <u>sp.</u>										x
+ <u>Mylodontinae</u> <u>indet.</u>			x							
+ <u>Glossotherium</u> (G.) <u>robustum</u>										x
+ <u>cf. Hemiauchenia</u> <u>patachonica</u>										x
+ <u>Hemiauchenia</u> <u>cf. wedelli</u>										::
+ <u>Equus</u> <u>cf. E.</u> (Amerhippus)										x
+ <u>Hippidion</u> - <u>Onohippidium</u>										x
+ <u>Boedicurus</u> <u>clavicaudatus</u>			x							
+ <u>Sclerocalyptus</u> <u>sp.</u>			x							

presence of bone projectile points. The faunal remains correspond mainly to subtropical species but a few bones assigned to Lama sp. were found associated (Table 2). Radiocarbon dates place this episode in the beginnings of the Late Holocene (2,200 yr B.P., Table 3). Later occupations lacks of guanaco remains and pottery fragments are associated with subtropical species remains and mollusk shells.

6) Cañada Honda is a stratified site localized

along the homonymous creek, that was inhabited during the Late Holocene (Table 4); lithic implements, a great amount of pottery fragments and abundant faunal remains were associated. Also, a human skeleton with funerary goods accompanying the burial was found. The species represented in the site are, most of them, characteristic of the Subtropical Dominion, like Swamp deer (*Blastocerus dichotomus*), "capibara" (*Hydrochoerus hydrochaeris*), "coipo" (*Myocastor coypus*); but a few remains of guanaco (*Lama guanicoe*) were also found (Table 2), some of them decorated with geometrical drawings made by incision (Bonaparte, 1951).

7) La Moderna is an open-air site, in the margins of Azul creek, where two different human occupation succeeded. The former one could have been a glyptodon kill site because quartz instruments were associated with of *Doedicurus clavicaudatus* remains indicating that this big armadillo would have been swamped to be killed there (Politis, 1985). Besides this giant armadillo, the guanaco was present. A radiocarbon date for this Component (6,550 yr B.P., Table 3) has been considered as a minimum age. The Upper Component is characterized by quartz and quartzite instruments associated with guanaco and deer bones. That means that the earliest inhabitants used, at least occasionally, some of the pleistocenic megamammals still living at the beginning of the Holocene and then, during the second settlement -a campsite-, guanaco and deer were the basis of the diet (see list of species in Table 2).

8) Fortín Necochea, situated near a pampean pond in the Interserrana area, is an open air campsite, where several occupational episodes were detected. The latest one has been proposed as a posthispanic occupation in the XIXth century; thus, cultural materials and faunal remains reveal the hispanic influence. Cow, horse and sheep bones associated with guanaco and fossorial mammal remains were recorded (Crivelli et al., 1987). Before the Spaniards' arrival, the site was inhabited by a hunter-gatherer group using quartzite instruments; they lived on the guanaco and Pampean deer hunting; although this occupation took place during the Holocene, this level was not radiocarbon dated; however, two radiocarbon dates performed on guanaco bones, coming from cultural lower levels still incompletely described, place earlier occupations

between 6,300 and 3,060 yr B.P.(Table 3). (Crivelli et al., 1985).

9) Tixi Cave in the hilly area of Tandilia, is a small rockshelter which was occupied temporarily by hunters. An assemblage of quartzite instruments and abundant mammal bones were recorded by Arana and Mazanti (pers.comm.). The faunal analysis revealed good climatic indicators, such as several species of rodents (see Table 2) and only a few bones of megamammals like guanaco and deer. Probably these last ones were used by the aborigines. The stratigraphic distribution of the taxa in the archaeological levels led to separate two faunal groups that show changes in the faunal composition from the lower up to the upper levels, that is fauna related with arid environmental conditions was replaced slowly by fauna that indicates wetter conditions. Two experimental radiocarbon dates performed on carbonates and coming from the upper levels (1,730; 1,220 yr B.P., Table 3) would indicate that the shelter was inhabited, at least, during the Late Holocene, and the fauna registered shows a period of transition from the cold, arid-semiarid conditions of the Holocene to a cycle more temperate and wetter. In fact, species characteristic of the Central Dominion were replaced by subtropical species (Table 2), which are moving from the north of Buenos Aires province (Tonni et al, 1988; Salemme, 1987). However, remains of an extinct armadillo were recorded in the lower levels in sediments assigned probably to the Late Pleistocene or Early Holocene, though the human occupation was not proved.

10) Cerro La China Locality, where three archaeological sites were found in small rockshelters, is located approximately 60 km farther northwest from Tixi Cave, in the Tandilia hilly area. In site 1 two archaeological levels were identified; the lower was dated at 10,730 +/- 150 and 10,790 +/- 120 yrs B.P. (Table 3) and included a preform of Fell's Cave Stemmed point and a fragment of a stem (Flegenheimer, 1980, 1987); no faunal remains were found there, except a scute of *Eutatus* sp., an extant armadillo which was deposited in related levels with those containing the projectile points. The upper level yielded triangular stemless points, pottery fragments and glass beads; there is no radiocarbon dating for this level (Zárate and Flegenheimer, i.p.).

Table 3. Chronological situation of the sites dated by C14.

PERIOD	C14 DATES	NORTH AREA	TANDILIA HILLY AREA	INTERSERRANA AREA	VENTANIA HILLY AREA
Historical times	440 ± 60		Loberia 1		
	- 995 ± 65 1150 ± 70 1185 ± 35				La Toma CS La Toma 1 La Toma 1
Late Holocene	1220 ± 70		Cueva Tixi		
	1560 ± 70 1730 ± 80		Cueva Tixi		La Toma 2
	2075 ± 70 2240 ± 55 2550 ± 90	Lechiguanas Island Lechiguanas Island			La Toma 1 La Toma 1
	2740 ± 80				
Middle Holocene	3630 ± 60			Fortin Necochea 2	
	3895 ± 100				La Toma 1
	5505 ± 200 5700 ± 120 5740 ± 120 6010 ± 400			Arroyo Seco Arroyo Seco Fortin Necochea 2 La Moderna	La Toma 1
	6550 ± 160				
Early Holocene	8390 ± 140 8558 ± 318 9780 ± 140			Arroyo Seco Arroyo Seco	La Toma 2
Late Pleistocene	10720 ± 150 10790 ± 120	Cerro La China Cerro La China			

11) Another rockshelter in the same area, 50 km to the southeast of the previous one, named Loberia 1 presents an abundant faunal assemblage (see Table 2), showing different environmental characteristics through the holocenic sequence; in fact, the lower levels include quartzite flakes associated with species from the Central and Patagonian Dominion and the upper levels yield fauna similar to the present one in the area, with a clear subtropical influence, although the guanaco would have been still present, probably. Numerous small triangular projectile points were recovered associated with the bones (Ceresole y Slavsky, 1985). A radiocarbon date place this latter human episode close to the Spanish Conquest (440 +/- 60

yr B.P., Table 3) and it is supposed that the guanaco would have been refuged in the "sierras" and would have constituted the main aboriginal food. The other faunal remains found correspond to rodents and dasypodids, that could be used as complementary resources, but probably they were deposited by other factors. Both micromammals indicate, as in Tixi Cave, a transitional moment in the environmental conditions.

12) Five sites in Zanjón Seco Locality yielded abundant information about the human occupations during the Late Holocene in the Interserrana area (Politis y Tonni, 1982, 1985; Politis, 1984). From all of them, lithic instruments, pottery fragments, grinding stones and faunal remains were recovered, both superficially and from stratigraphic positions. Site 3 represents a place where the feeding wastes were thrown and then approximately 3.000 bone remains were recovered, including mainly guanaco bones and secondarily Pampean deer bones; only a flake was deposited there. Unfortunately, there are no radiocarbon dates for any of these occupations (Table 4).

13) Cortaderas is an unicomponent open-air site, situated close to a creek. Faunal remains, lithic artifacts and a few fragments of pottery were associated. The bones corresponded to species coming from the Central and Patagonian Dominion and indicate clearly an open arid-semiarid environment (Politis et al, 1983; see also Table 2). Unfortunately, there are no published data about cultural materials and none radiocarbon dates are available for this site. Anyway, it could be assigned to the Late Holocene, according to its stratigraphic position and the presence of the ceramic (Politis, 1984; see Table 4).

14) Arroyo Seco S2 is a campsite between a creek and a presently dry lake, which was occupied three times during the Holocene. The lower Component is an assemblage of lithic artifacts, like scrapers, flakes with retouched edges, a half bola stone, knives, and bone remains of extinguished species as well as extant species (see Table 2). Likewise, seventeen human skeletons were recovered below this assemblage; there were single burials and communal burials, some of them with funerary goods associated, such as marine shells, glyptodon scute, ochre powder over the cranium. This component was radiocarbon dated at 8,550 and 8,390 yr B.P. (Politis et al, 1987, see Table 3).

The Middle Component contained medium triangular stemless projectile points, a portion of a grinding stone and quartzite flakes associated with bones remains of living species, like guanaco, Pampean deer, the autochthonous hare and armadillos. No radiocarbon dates exists for this occupation but it was assigned to the Middle Holocene (Table 4). Finally, the Upper Component is located in a ploughzone and some aboriginal materials (flakes, pottery, bone remains) are mixed with European material (glass, pieces of iron, but no bone remains corresponding to exotic species were found). Probably this episode took place just before the Spaniard's arrival in the area, and the mixture would be due to the present anthropic activity (see Fidalgo et al, 1986; Saleme, 1987; Table 4).

After this brief summary, a series of hypotheses can be formulated, which are developed below.

DISCUSSION

According to the evidence, two groups of hypotheses have been formulated. First, the hypotheses related to the palaeoenvironments in Buenos Aires province (Pampean Region) during the Holocene; second, the adaptative strategies of hunter-gatherers in the area. In fact, the interpretation of geological aspects and the presence of faunal species led us to infer the environmental conditions to which the aborigines were adapted in that period. Thus, the following hypotheses have been proposed:

H 1: During the Early Holocene (10,000 to 6,000 yr B.P.) and Middle Holocene (6,000 to 2,500 yr B.P.), a big portion of the Buenos Aires territory was under arid to semiarid environmental conditions; the faunal species were characteristic from open areas and the more frequent correspond to those living at present in the Central and Patagonian Dominions. They were *Dolichotis patagonum* (the autochthonous hare), *Lyncodon patagonicus* (ferret), *Lama guanicoe* (guanaco), *Zaedyus pichiy* (piche, an armadillo) and *Canis (P.) griseus* (grey fox). Remains of these species were found within eolian and fluvial sediments which indicate colder and drier climatic conditions than the present ones in the area.

Remains of pleistocenic megamammals such as *Equus cf. E. (Amerhippus)* (an equid), *Megatherium*

Table 4. Chronological situation of the sites without absolute dates

PERIOD	NORTH AREA	TANDILIA HILLY AREA	INTERSERRANA AREA	VENTANIA HILLY AREA
Historical times			Fortin Necochea	
Late Holocene (2500 B.P. - 1500 A.D.)	Sitio Rio Lujan Canada Honda Canada de Rocha		Zanjon Seco 2 y 3 Cortaderas Tres Reyes 1	
Middle Holocene (6000 B.P. - 2500 B.P.)			La Moderna Arroyo Seco Tres Reyes	La Toma CI
Early Holocene (10000 B.P. - 6000 B.P.)				
Late Pleistocene				

americanum and Mylodon sp (giant sloths), Glyptodon sp., Eutatus sp. and Doedicurus clavicaudatus (extinct armadillos), Macrauchenia patachonica (a notoungulate) and Canis (Dusicyon) avus were found associated with cultural elements in several sites from the Interserrana area, like Arroyo Seco S2 (Fidalgo et al., 1986; Politis et al., 1987), and La Moderna (Politis, 1985) and from the Tandilia hilly area, like Cerro La China (Flegenheimer, 1980, 1987). Radiocarbon dates obtained from these sites roughly go from the Pleistocene-Holocene boundary (around 10,000 yr B.P.) into the Early Holocene.

Certainly, the "guanaco" is the species always present in the sites assigned to the Early and Middle Holocene. That is not only because of the environmental conditions but also, and mainly because of the anthropic activity (selectivity) and adjustment between the hunters and this prey .

H 2: Towards the Late Holocene, approximately 2,500 years B.P., the climatic and environmental conditions would have started to change from cold, arid-semiarid cycles to temperate, wet cycles similar to the present one. So the record in the palaeontological and archaeological sites shows some differences in the presence and frequency of the species. This is easily proved, specially in sites from the northeastern of Buenos Aires province, where the proportion of guanaco remains decreased and other elements from the Subtropical Dominion are registered, such as *Blastocerus dichotomus* (the swamp deer), *Hydrochoerus hydrochaeris* (capibara, a giant rodent), *Cavia aperea* (cuis), *Dasypus hybridus* (mulita, an armadillo) and *Myocastor coypus* (coipo). In the case of the coipo, it is necessary to point out that the essential requirement is a close water body because it is an ubiquitous species. However, important differences respect to its frequency in the record were detected in two sites very close each other, located in northeastern Buenos Aires province. In that sense, the remains of *Myocastor coypus* are very scarce in Cañada de Rocha meanwhile they are abundant in Rio Luján Site. This fact could be an indicator of different conditions of humidity in an environment that today is very similar in both sites; moreover, it could be pointing out occupational episodes during different times.

The great abundance of fish remains in the records from the northernmost sites, such as Rio Luján Site, Lechiguanas Island and Cañada Honda, is remarkable. Most of them are burned. However, scarce fish remains were present in Cañada de Rocha. So, alternative hypotheses about the high or low frequency and the use of fish species in those sites could be formulated: a) the fish richness was changeable in different epochs, although this is impossible to prove; b) a low frequency of megamammals (guanaco, swamp deer, pampean deer) during certain times, so the exploitation of fishes increased; c) distinct cultural customs in the feeding habits, which implied the use of other faunal resources.

In the sites of the hilly areas of Ventania and Tandilia a transitional fauna is observed, in which species from the subtropical and Patagonian environments are associated. That is the case of Tixi Cave (upper levels 1730 ; 1220 yrs. B.P.),

Loberia 1 cave (440 yrs B.P.) and La Toma, Upper Component (995 yrs B.P.). Both, the first and the second sites showed a great faunal diversity, mainly of rodents deposited by natural agents, which are very good climatic indicators. On the other hand, La Toma is an open-air site and so the megamammals are more frequent. Anyway, the association of "mulita" and "cuis" in La Toma and the rodents contexts in the caves, indicate a transitional environment.

In terms of chronology, some sites of the northern areas as Arroyo Frias and Cañada de Rocha could be assigned to the beginnings of the Late Holocene, because of the presence of species from the central environments, like "guanaco", Patagonian fox and the autochthonous hare. But other sites as Cañada Honda, Rio Luján Site and Lechiguanas Island presented subtropical species, though there was scarce records of guanaco in their sequencies. If the radiocarbon date of Lechiguanas Island first occupation (2.220 yrs B.P.) where guanaco remains were found is considered, it seems that the environmental conditions were in transition to wetter cycles and some species were going towards the south and the west and some others were moving south of the Subtropical Dominion (see Table 5). Thus, all of these sites were inhabited during the Late Holocene, though under different environmental conditions, that is in two different moments, at least (see H3 below and Table 4).

According to this environmental scheme, several adaptive strategies are proposed; they are referred to the most useful resources and to the way they were employed.

H 3: The "guanaco" was the main resource during the Holocene. In Arroyo Seco S2 Lower Component, this camelid represents 50% of the record; in Zanjón Seco S3 comprises 99%; in Zanjón Seco S2, 80%; in La Toma, 60% and in Cortaderas, 80%. In that sense, Politis (1984) has proposed that the use of the "guanaco" can be considered as the basic annual resource for hunters living in the Interserrana area, at least for the occupational episodes registered. This affirmation can be extended to other areas of the Pampean Region, according to the data from the sites assigned to the beginnings of the Late Holocene in the Northern area and the corresponding ones to the hilly areas of Ventania and Tandilia.

The Pampean deer was a complementary resource in the aboriginal diet and in a similar way the armadillos (piche and peludo) and the flightless bird "ñandú" were used. These resources would have been available the entire year around, but the guanaco was, obviously, the prey of best yield. Although the meat of the ñandú would have been incorporated, the eggs were the most appreciable part of it; they were available from the end of winter and during spring and summer. Actually, abundant fragments of the shell eggs but only a few bone fragments of this species were found at the sites.

Extinct megamammals were an useful resource during the Late Pleistocene and Early Holocene, but only as occasional and complementary resources. Remains of several extinct species were found in Arroyo Seco S2, associated as feeding wastes and as funerary goods in human burials. Some other remains were recorded in Cerro La China Site and La Moderna Lower Component. These three sites have been radiocarbon dated (Table 3).

The records indicate at least two different episodes of occupation for the Northern area during the Holocene: 1) Arroyo Frias and Cañada de Rocha sites, which present the same characteristics of the Interserrana and hilly areas sites respect to the frequency of guanaco, Pampean deer and ñandú as the main resource the first one, and as complementary resource the others. They would have been inhabited during the earliest Late Holocene. 2) In other sites from the northeastern part of the territory (Cañada Honda, Lechiguanas Island and Río Lujan Site), the Swamp deer and the coipo have been the main resource, whereas Pampean deer and fishes were complementary resources. Because of their stratigraphic position, the presence of pottery and an elaborated bone industry, these sites could be assigned to the rest of the Late Holocene (Table 6).

Meanwhile, in the hilly areas of Ventania and Tandilia and in the Interserrana area, the environmental conditions during the Late Holocene were changing, but the guanaco was present and it was abundant yet. This affirmation may also be verified with the late records of the sites Tres Reyes 1, Fortín Necochea, La Toma, Cueva Tixi, Lobería 1, Zanjón Seco 2 and 3. In all of them, the camelid has been the main resource for the aborigines during the Late Holocene.

Table 5. Corology of the species registered at the Holocenic sites.

PERIOD	NORTH AREA	INTERSERRANA AREA	HILLY AREAS
LATE HOLOCENE (2500 B.P. 1500 A.D.)	Swamp deer Pampean deer Otter Mulita Rea	Guanaco Pampean deer Peludo (armadillo) Mulita (armadillo) Rea Tuco-tuco (rodent)	Guanaco Pampean deer Peludo Mulita Rea
MIDDLE HOLOCENE (6000 B.P. 2500 B.P.)		Guanaco Pampean deer Peludo Piche (armadillo) Vizcacha (rodent) Grey fox Tuco-tuco Rea	Guanaco Pampean deer Peludo Piche Small rodent Rea Tuco-tuco
EARLY HOLOCENE (10000 B.P. 6000 B.P.)		Guanaco Pampean deer Piche Peludo Grey fox Pleistocenic megamammals Rea	Guanaco Pampean deer Piche Peludo Small rodent Pleistocenic megamammals

As proposed by Tonni and Politis (1980), the guanaco disappeared completely from the Buenos Aires province by the time of the Spanish Conquest; none of the chronicles of the XVI and XVII centuries mentions the presence of guanacos in the Northern and Interserrana areas. Thus, they tell frequently the hunt of Pampean deers and ñandúes in both areas, where the first of the species would have been the main resource during the historical times, probably due to the easy catch and its major availability.

However, several populations of guanaco could have been remained isolated in the Tandilia hilly area, which had been acted as a refuge until historical times, as it was suggested in the records of Lobería 1 and Tixi Cave sites. In the Ventania hilly area, troops of guanaco can be still found today, but they are composed by a few individuals. Anyway, it is remarkable that, from a zoogeographical point of view, the area is an "enclave" from the Central Dominion in the Pampean Dominion (Ringuelet, 1955; 1961).

Likewise, according to the cites of the chroniclers, the introduction of the European horse in the culture would have modified the food preferences. In fact, this is evidenced through the comments of the voyagers of the XVII and XVIII centuries.

Table 6 summarizes the evidence proposed for H3 and then a general hypothesis can be formulated, based in the previous H1, H2 and H3:

H : The boundaries of the Pampean Dominion have changed back and forth in several occasions during the Holocene. In fact, during the Early and Middle Holocene, some species from the Patagonian and Central Dominion migrated northwards and eastwards of their present habitats. On the other hand, since 2,500 yrs. B.P. and during the Late Holocene, some species from the Subtropical Dominion began to move southwards, yielding the retraction of the Patagonian and Central species to their own present environments. Finally, at present, the Pampean Dominion is clearly influenced by Brazilian species of the Subtropical Dominion.

In the second group of hypothesis about the faunal exploitation and the aboriginal adaptation to the environment, the following ideas were formulated:

H 4: The aborigines of the Buenos Aires sector of the Pampean Region were hunter-gatherers who selected their preys from the species available during the entire year. The hunting techniques employed could have been similar to those suggested from the ethnohistorical information. Communal hunting could have been employed for the guanaco, ñandú and probably for the swamp deer, whereas the Pampean deer would have been hunted by men alone. Probably, both techniques were used frequently by the men of those bands; however, some other species like rodents (coipo, vizcacha) and armadillos could have been hunted by anybody within the band, even the children (Politis and Saleme, i.p.).

The cooperative hunting technique could have been applied also to the Pleistocenic megamammals, in the same way for those of lonely habits (*D. clavicaudatus*, *Glyptodon* sp., *Myloodon* sp) as those that used to live in herds (*Equus* [*Amerhippus*]). In the case of the sloths and giant armadillos, they would have been swamped to kill them.

Table 6. Available resources during the Holocene

AVAILABLE RESOURCE	NORTH AREA				INTERSERRANA AREA				HILLY AREAS			
	H1	H2	H3	Th	H1	H2	H3	Th	H1	H2	H3	Th
Guanaco	-	-	C	-	M	M	M	C	-	M	M	C
Pampean deer	-	-	M	-	C	C	C	M	-	C	C	P
Swamp deer	-	-	M	M	-	-	-	-	-	-	-	-
Piche-Peludo	-	-	-	-	C	C	C	C	-	C	C	C
Mulita	-	-	C	-	-	-	-	-	-	-	C	-
Otter	-	-	M	C	-	-	-	-	-	-	-	-
Rea	-	-	C	C	C	C	C	C	-	C	C	C
European horse	-	-	-	-	-	-	-	C	-	-	-	C
Pleistocenic megamammals	-	-	-	-	C	-	-	-	C	-	-	-

References

- M: main resource
- C: complementary/occasional resource
- : without data
- H1: Early Holocene
- H2: Middle Holocene
- H3: Late Holocene
- Th: Historical times

A new technique for hunting the guanacos was employed after the introduction of the European horse; it was hunted by men alone, riding horses. This assertion is valid for the Historic Tehuelches in northern Patagonia, but probably the same technique had been used in the south of Buenos Aires province at that time, where some guanacos could have remained there, as they do that today.

The fishing techniques used by the aborigines are still unknown, but probably the utilization of harpoons from the river banks would have been the more efficient method to catch any of the species of Doradidae. Several species of this family lived, and are living today, in the northeastern streams of Buenos Aires province; commonly, they are swimming on the surface, so that the fishing with harpoons probably was the more frequent technique employed. The other possibility could be the fishing from canoes, but there is neither archaeological nor ethnohistorical evidence available.

It is interesting to point that the only sites where fish remains have been recovered were those localized in the northeastern sector of the studied

region, even though the other sites were located close to body waters as well. The aforementioned sites are Cañada de Rocha (although fish remains are not abundant), Sitio Río Luján, Cañada Honda and Lechiguanas Island.

H 5: The Pampean aboriginal diet based on animal proteins would have been complemented not only with the gathering of ñandú eggs, available during spring/summer and easy to get, but also with products of some vegetable species. These could be the fruits of "algarrobo" and "chañar", both species living today in the phytogeographical Provincia del Espinal, but they could have invaded the Pampean Dominion during the arid or semiarid Holocene phases (Frenguelli, 1941) and possibly during the Late Pleistocene. Some chroniclers mention in their comments the presence of several xerophitic and thorny species surveyed during their travels in the XVII and XVIII centuries; other evidences were recognized in the Sierra de la Ventana area (southwestern of Buenos Aires province) (J.Frangi, pers. comm.).

The gathering had to be performed mainly during the spring and summer, because the fruits of these species are available in these seasons. There is no direct evidence of gathering, but some implements like mortars, pestles and "manos" suggest that their main function was the grinding of grains and fruits.

H 6: The megamammals were used wholly, i.e. meat and fat for feeding, leather and skin for clothes and tents, bones as raw material to make instruments and ornaments (Salemme and Miotti, 1987), and occasionally, the blood was employed for drinking (Schmidel, 1969).

As it was previously mentioned, the guanaco has been the main resource and the Pampean deer was a complementary resource. Although both of them were available all year around, the bigger size, the social behaviour and the well-known territoriality of guanaco would have been the principal fact of adaptation between the prey and its predator. In fact, the MNI tables of the studied sites (Salemme, 1987) show that *Lama guanicoe* is predominant compared with *Ozotoceros bezoarticus*, except in those sites of the northeastern area where the guanaco was scarce during the Late Holocene, thus been later replaced

by *Blastocerus dichotomus*. Anyway, the recorded frequencies of both cervids are similar.

In summary, the Buenos Aires sector of the Pampean Region had been inhabited by hunters, probably organized in bands, at least since the Early Holocene. They were efficiently adapted to the changing environmental conditions that took place during the last 10.000 years. The climatic oscillations occurring since the Early Holocene until historical times have influenced the corology of several mammal species and, likewise, the human group adaptation to those changing conditions.

In a smaller scale, it is possible to detect modifications in the distribution of some species in the Pampean Dominion from the Northeast to the Southwest of it and since the Early Holocene to the historical times.

It must be emphasized that since 1.500 A.D., exotic species brought by the Spaniards, like horse, cow and sheep were added to the autochthonous fauna. Those introduced species modified the aboriginal adaptive systems. Remarkable changes in the economic structure of the hunters produced a sudden transculturation, which ended shortly with the absorption of the aborigines and their extermination.

REFERENCES

- Ameghino, F. 1880. La antigüedad del Hombre en el Plata. Impr. Coni 2 Vol., 1000 pags. Bs.As.
- Bonaparte, J. 1951. Nota preliminar de un paradero aborigen en la Cañada Honda (partido de Baradero). *Arqueología* 2. Mus. Cs. Nat. Carlos Ameghino. Mercedes (B).
- Cabrera, A.L. 1971. Fitogeografía de la República Argentina. *Bol.Soc.Arg. Botanica*, XIV (1-2): 1-42
- Caggiano, M.A. 1977. Contribución a la arqueología del Delta del Paraná. *Obra Centenario Mus.La Plata, Antrop.*, II: 301-324.
- Ceresole, G. & L. Slavsky 1985. Informe preliminar sobre la Localidad Lobería 1 (provincia de Buenos Aires). VIII Congr.Nac.Arqueol.Arg., resumen: 4. Concordia.
- Crivelli, E.; M. Silveira; E. Eugenio; P. Escola; M. Fernández & N. Franco. 1987/1988. El sitio Fortín Necochea (Pdo. de Gral. Lamadrid, Pcia. de Buenos Aires). Estado actual de los trabajos. *Paletnología*, 1: 7-37. Buenos Aires.

- Fidalgo, F.; L. Meo Guzmán; G. Politis, M. Salemme & E. Tonni. 1986. Investigaciones arqueológicas en el sitio 2 de Arroyo Seco (Pdo. de Tres Arroyos, Pcia. de Buenos Aires, Rep. Argentina). *New Evidence for the Peopling of the Americas*, A. Bryan (Ed.), pag.: 221-269. Univ. of Alberta, Canada.
- Flegenheimer, N. 1980. Hallazgos de puntas "cola de pescado" en la provincia de Buenos Aires. *Rev. Relaciones, Soc. Arg. Antrop.*, XIV (1): 169-176.
- Flegenheimer, N. 1987. Recent research at Localities Cerro La China and Cerro El Sombrero. *Current Research in the Pleistocene*, Vol. 4. Maine.
- Frenquelli, J. 1941 Rasgos principales de la fitogeografía argentina. *Rev. Mus. La Plata*, III, Botánica: 65-181.
- Madrid, P. & Salemme, M. 1988. La ocupación tardía del Sitio 1 de la Laguna Tres Reyes (Pdo. de González Chaves, Pcia. de Buenos Aires). IX Congr. Arqueol. Arg., abstract: 57. Buenos Aires, november 1988.
- Petrocelli, J. 1975. Nota preliminar sobre hallazgos arqueológicos en el valle del río Luján (Población Río Luján, Campana, Pcia. de Buenos Aires). *Actas I Cong. Arq. Arg.*: 251-2700. Rosario. (1970).
- Politis, G. 1984. Arqueología del área Interserrana bonaerense. Tesis doctoral, Fac. Cs. Nat. y Museo, 397 pags.
- Politis, G. 1985. Hombre temprano y gliptodóntidos en la Región Pampeana (Argentina): el sitio de caza "La Moderna". *Simp. Cazad.-Recolect. de America*, 45 Cong. Intern. Americ., Bogotá, Colombia.
- Politis, G. & Madrid, M. 1988. Un hueso duro de roer: análisis preliminar de la tafonomía del sitio Laguna Tres Reyes 1 (partido de Gonzales Chaves, Pcia. de Buenos Aires). *Semin. Arqueofauna de Vertebrados e Invertebrados de sitios arqueológicos*, Fac. Fil. y Letras, Buenos Aires, 12 pags.
- Politis, G. & E. Tonni. 1982. Arqueología de la Región Pampeana: el sitio 2 de Zanjón Seco (Distrito de Necochea, Pcia. de Buenos Aires, Rep. Argentina). *Rev. Pre-Historia*, Vol. III (4): 109-142, Univ. de São Paulo, Brasil.
- Politis, G. & E. Tonni. 1985. Investigaciones arqueológicas en el sitio 3 de Zanjón Seco, partido de Necochea. *Tras. Jorn. Antrop. Pcia. Bs. As., Chivilcoy*.

- Politis,G. & M. Salemme. in press. Prehispanic mammal exploitation and hunting strategies in the Eastern Pampa Subregion of Argentina. Symp.on Communal Land Mammal Hunting and Butchering. The World Archaeol. Congr., Oxbow Books, London.
- Politis,G.; E. Tonni & F. Fidalgo. 1983. Cambios corológicos de algunos mamíferos en el área Interserrana de la provincia de Buenos Aires durante el Holoceno. *Ameghiniana*, 20 (1-2): 72-80.
- Politis,G.; E. Tonni; F.Fidalgo; M. Salemme & L. Meo Guzmán.1987. Man and Pleistocene megamammals in the Argentine Pampa: Site 2 at Arroyo Seco. Current Research in the Pleistocene, Vol.4:159-161. Center for the study of Early Man, Univ. of Orono
- Rabassa,J.; A.Brandani; M. Salemme & G.Politis.in press. "La Pequeña Edad del Hielo" (siglos XVII a XIX) y su posible influencia en la aridización de áreas marginales de la Pampa Húmeda (Pcia. de Buenos Aires). Actas I Jorn.Geol.Bonaer. Tandil. 1985.
- Ringuelet,R. 1955. Panorama zoogeográfico de la provincia de Buenos Aires. Notas Pelim.Mus.La Plata, Zool. 18 (156): 1-45.
- Ringuelet,R. 1961. Rasgos fundamentales de la zoogeografía de la Argentina. *Physis* 22 (63): 151-170.
- Salemme,M. 1983. Distribución de algunas especies de mamíferos en el Noreste de la Provincia de Buenos Aires durante el Holoceno. *Ameghiniana*, 20 (1-2): 81-94.
- Salemme,M. 1987. Paleoetnozoología del sector bonaerense de la Región Pampeana, con especial atención a los mamíferos. Tesis Doctoral, Fac.Cs.Nat., Univ.Nac.La Plata.267 pags. La Plata
- Salemme,M. & E.Tonni. 1983.Paleoetnozoología de un sitio arqueológico en la Pampa Ondulada: Sitio Río Luján (Pdo. de Campana, Pcia. de Buenos Aires). *Rev. Relaciones, Soc.Arg.Antrop.*, XV: 77-90.
- Salemme,M. & L.Miotti. 1987. Zooarchaeology and palaeoenvironments:some examples from the Pampean and Patagonian Regions (Argentina). *Quat. of South Amer. & Antarct.Penin.*, Vol.5 : 33-57. Balkema Publ., Holland.
- Salemme,M.; G.Politis; P. Madrid; F. Oliva & L. Guerci. in press. Informe preliminar sobre las investigaciones arqueológicas en el sitio La Toma, Pdo de Cnel. Pringles, Prov. de Buenos Aires. VIII Congr. Nac.Arqueol.Arg., Actas, Concordia, 1985.

- Schmidel,U. 1969. Viaje al Río de La Plata y Paraguay. Col. Obras y Docum., P.de Angelis. T.VI: 245-346. Edit.Plus Ultra.
- Tonni,E.; M.S. Bargo & J.L.Prado. 1988.Los cambios ambientales en el Pleistoceno tardío y Holoceno del sudeste de la provincia de Buenos Aires a través de una secuencia de mamíferos. *Ameghiniana*, 25 (3-4).