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THE PLEISTOCENE–HOLOCENE TRANSITION AND HUMAN OCCUPATIONS IN THE SOUTHERN CONE OF SOUTH AMERICA

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The archaeology of the Pleistocene–Holocene Transition in the Pampas and Fuego-Patagonia is analyzed in light of the results obtained at recently excavated archaeological sites. These sites offer detailed artifactual, faunistic, chronological, and paleoecological information. Results from paleoecological research performed off site are also presented. Changes in climate, vegetation, and faunal composition are recorded, but the archaeological assemblages do not exhibit any clear-cut correspondent changes. © 1998 INQUA/Elsevier Science Ltd. All rights reserved

INTRODUCTION

The Pleistocene/Holocene Transition in the Southern Cone of South America was the subject of several recent studies. Some treated the 'Transition' at a general level for all the regions located south of 15°S (Borrero, 1996), while others concentrated on discrete regions such as Fuego-Patagonia (Miotti and Salemme, 1995; Borrero and Zárate, 1995), or the pampas (Flegenheimer and Zárate, 1993). We now intend to develop a comparative paper, in which capsule information of important sites from different regions located in the Southern Cone is considered. Only those sites for which basic chronological, faunistic, artifactual and paleoecological information is available are included. Radiocarbon dates presented here are mostly those obtained in the last couple of years. Extensive listings of radiocarbon dates can be consulted in other sources (Orquera, 1987; Borrero, 1996). We select the archaeology of the Pampas, Patagonia and Tierra del Fuego for comparison, since each of these regions includes more than one site that satisfies the specified conditions (Fig. 1).

THE PLEISTOCENE–HOLOCENE TRANSITION AND HUMAN OCCUPATION IN THE PAMPAS

The Pampas region is basically a grassland plain in eastern Argentina between latitudes 31° and 39° South. Two principal sub-regions are recognized. the 'humid Pampa' to the east, and the 'dry Pampa' to the west, divided by an isohyet of 600 annual millimeters. Two low altitude mountain ranges interrupt the eastern pampas, the Tandilia (525 m a.s.l.) and the Ventania ranges (1247 m a.s.l.). These ranges offer most of the raw material available for lithic artifacts in the region, mainly quartzite and chalcedony. Most of archaeological research to be presented here was concentrated on the Humid Pampa.

Arroyo Seco 2 is a multicomponent open-air site located in a floodplain environment. The earliest component is stratigraphically located within a loess layer and is characterized by unifacial artifacts with marginal retouch. Pleistocene and modern mammals were found in physical association with the artifacts. The faunal list is composed of extinct megamammals, including *Paleolama*, *Equus*, *Hippidion*, *Toxodon*, *Megatherium*, *Eutatus*, *Glossotherium*, *Macrauchenia* and *Glyptodon*, while modern fauna is represented by guanaco (*Lama guanicoe*), Pampean deer (*Ozotocerus bezoarticus*), and *Rhea*. American horses (*Equus*, *Hippidion*) and guanaco are abundant, represented mostly by limb bones which are fragmented and exhibit cut marks. The *Megatherium* may have been also part of the human diet at Arroyo Seco, but its role is less clear (Politis *et al*., 1995).

Eleven single and multiple human burials which record several burial episodes, were found at different depths below the levels containing extinct megamammals. The lower component of Arroyo Seco is currently interpreted as the result of several human occupation episodes, without clear vertical resolution. This record has to be seen as a palimpsest where it is very difficult to separate individual occupations. Radiocarbon dates for the early component ranges from 7320 to 11,590 yr BP. The span of the radiocarbon dates is interpreted as a result of the reoccupation of the site, and contemporaneity with megamammals is suggested by the overlap between datings (Table 1). A new set of radiocarbon dates is in process in order to check the validity of the early Holocene dates. The most ancient human burials are dated 8560 ± 316 and 8980 ± 100 BP with two posterior burial periods between 7000 and 6000 BP.

La Moderna is an open-air site near the banks of a small creek. The early component is situated in

FIG. 1. Regions with major archeaological research on the Pleistocene–Holocene Transition in South America below 10° south latitude: 1. Highlands of Peru, 2. Atacama Desert (Chile) and Puna (Argentina), 3. Brazilian Plateau, 4. Lowlands of Southern Brazil, 5. Tagua-Tagua Basin (Chile) and Precordillera of Mendoza (Argentina), 6. Pampas (Argentina), 7. Monte Verde, 8. Deseado Basin, Patagonia (Argentina), 9. Southern Patagonia and Tierra del Fuego (Argentina and Chile).

a fluvial sediment transitional between the Lujanense and the Platense units. Bone remains are associated with several unifacial quartz and quartzite artifacts. Radiocarbon dates range between 6555 and 12,350 yr BP (Table 1). The frequent presence of the water table in the dated level could have introduced some contaminants that may have rejuvenated the samples; consequently, the age of 6550 yr is taken as a minimum age (Politis *et al.*, 1995). The authors interpreted that the earliest component of La Moderna is a glyptodon kill site, 'where a single individual of *Doedicurus clavicaudatus* was butchered' (Politis *et al.*, 1995) (p. 196). Other faunal remains found at the site are considered as intrusive.

Cerro La China Locality is a low hill of the Tandilia Range which comprises three sites (Sites 1–3). Excavations by Nora Flegenheimer produced abundant information concerning the technology of the early inhabitants of the Pampas. Site 1 is a small rock shelter. In the lower component, a 'fishtail' projectile point preform and a stem were recovered, along with a great number of chipped debris and a plate of an extinct dasypodidae, *Eutatus seguini*, in association with two radiocarbon dates of ca. 10,700 yr BP. There were no faunal remains, probably due to bad preservation. Sites 2 and 3 are multicomponent open-air sites at the crestslope of the hillside. No cultural organic remains were recovered due to the low preservation potential in these microenvironments. At Site 2 the only identifiable tools recovered from the lower component are two 'fishtail' projectile points and a small graver with a lateral notch. No radiocarbon dating was possible. At Site 3, the most abundant artifacts found within the lower component include scrapers, piece esquillés, bipolar cores, small gravers, notches and cutters. Even when no truly bifacial tools were found, a few artifacts were manufactured on bifacial thinning flakes.

The Cerro El Sombrero Locality is situated in an elongated tabular butte of the Tandilia Range, 15 km away from Cerro La China. A high-density and variety of early types of artifacts have been found (Flegenheimer and Zárate, 1989). Archaeological remains were discovered in several rockshelters and in the hilltop, where surface material was collected (Site Cerro El Sombrero-cima). Cerro El Sombrero-cima is unique among early sites in the abundance of 'fishtail' projectile points. No bones or other organic remains were

TABLE 1. Radiocarbon dates on megamammals from Arroyo Seco 2 and La Moderna (Politis *et al.*, 1995)

Site	Sample	Lab number	Method	Age (yrs BP)
Arroyo Seco 2	*Toxodon platensis*	AA-7965	AMS	11,590 ± 90
Arroyo Seco 2	*Equus* (*Amerhippus*) *neogeus*	AA-7964	AMS	11,250 ± 105
Arroyo Seco 2	*Glossotherium robustum*	AA-9049	AMS	10,500 ± 90
Arroyo Seco 2	*Equus* (*Amerhippus*) *neogeus*	TO-1504	AMS	8890 ± 90
Arroyo Seco 2	*Megatherium americanum*	LP-53	Standard	8390 ± 240
Arroyo Seco 2	*Megatherium americanum*	TO-1506	AMS	7320 ± 50
La Moderna	*Doedicurus clavicaudatus*	Beta-7824	Standard	6555 ± 160
La Moderna	*Doedicurus clavicaudatus*	TO-1507	AMS	12,350 ± 370
La Moderna	*Doedicurus clavicaudatus*	TO-1507-1	AMS	7010 ± 100
La Moderna	*Doedicurus clavicaudatus*	TO-1507-2	AMS	7510 ± 370
La Moderna	*Doedicurus clavicaudatus*	TO-2610	AMS	7460 ± 80

recovered due to the low preservation potential of the site. Thus, no radiocarbon dates have been obtained yet. However, the artifacts exhibit lichens and mineral staining on their surfaces attesting to a large time of exposition. Flegenheimer (1998, in press) indicated that it is difficult to propose whether the various artifact concentrations resulted from one prolonged and dense occupation or from several more discrete reoccupations, and interprets Cerro Sombrero-cima as a retooling site, where tool replacement activities took place.

On the western hillside, a small rock shelter was excavated at about 250 m from the main hilltop. Only lithic artifacts, including two 'fishtail' projectile points and ochre fragments, were recovered. The stratigraphic setting suggests that the early inhabitants occupied the shelter when humid conditions were dominant. Four radiocarbon dates yielded ages between 10,700 and 10,400 yr BP, which are consistent with results obtained in other sites, and one which is younger and presumed to be contaminated (Flegenheimer *et al*., 1995).

The Cueva Tixi site is a small cave of about 50 m^2 formed in quartzite rock. The lower component is composed of lithic artifacts and bone remains of *Eutatus seguini*, *Canis* (*Dusycion*) *avus*, guanaco, Pampean deer and other species. Some *Eutatus* bones were found burned. Two radiocarbon dates of $10{,}370 \pm 90$ and $10{,}045 \pm 95$ yr BP were obtained (Mazzanti, 1994).

PALEOENVIRONMENT AND PALEOECOLOGY DURING TRANSITION TIMES IN THE PAMPAS

Between 10,000 and 11,000 yr BP, when most of the early occupations took place, there was a change toward more humid conditions in the Pampas. During this millennium landscape, stability started, while eolian sedimentation ceased. At the same time, present-day soils began to develop. Evidence coming from a section of Rio Quequén Grande (La Horqueta II) indicates a sudden change towards very humid conditions, or at least high water levels at around 10,250–9870 yr BP (Zárate *et al*., 1995). Small lakes were formed and lowland soils were flooded. From a geomorphologic and sedimentological perspective, the time interval between ca. 10,000 to 6000–5000 yr BP was one of stable landscape conditions in the fluvial basins. Almost no siliciclastic deposition occurred, except for volcanic ash. The sedimentological record is mostly composed of biogenic deposits (diatoms, mollusks, ostracods).

The pollen record indicates that prior to 10,550 yr BP, a clearly psammophytic herbaceous vegetation developed in the central pampas, suggesting a sub-humid-dry climate, whereas a xerophytic woodland associated with psammophylous and halophylous steppe was present at the southernmost part of the pampas. The vegetational shift towards a vegetation characteristic of ponds, swamps and floodplains, or toward environments with locally more effective moisture occurred at ca. 10,500 yr BP, when climate shifted to sub-humid–humid conditions (Prieto, 1998, in press).

The vertebrate paleontological record of the Transition is marked by a decrease in the frequency and diversity of grazing forms, particularly the Cervidae, and an increase of megaherbivore grazers of more than 1 t in weight. These changes are interpreted as the results of a climatic deterioration (Prado *et al*., 1987; Tonni and Cione, 1994). Species are typical of the Patagonian and central district of Argentina, suggesting arid and cold conditions. Tonni and Cione (1994) considered that the terminal Pleistocene wave of extinctions was extended to the early Holocene, which is regarded as an arid interval. This interpretation is in disagreement with other contextual evidence summarized above.

THE PLEISTOCENE–HOLOCENE TRANSITION AND HUMAN OCCUPATION IN FUEGO-PATAGONIA

Fuego-Patagonia comprises a huge and varied territory. It is usually divided in two main areas, the Cordillera to the west, with bare landscapes at high altitude, which occasionally turn into magellanic tundra, and a parallel belt of forest which in the north is dominated by *Araucaria araucaria* and is replaced in the south by *Nothofagus* sp. Extra-Andean Patagonia consists of vast horizontal expanses of nearly continuous steppe bisected by a few major rivers, with a predominant direction from west to east, flowing towards the Atlantic Ocean. The Patagonian steppe is varied in its floristic composition, which changes with precipitation. In the southern tip, separated from the continent by the Strait of Magellan are the main island of Tierra del Fuego and a system of channels and smaller islands. Several regions that have significant archaeological information can be distinguished.

Deseado Basin and Central Plateau

Located in southern Patagonia, this basin and the associated plateau offer a wealth of information. The Pinturas river is located near the headwaters of the Deseado basin. In this region, several archaeological sites were excavated by a team directed by Carlos J. Gradín, including Cueva de las Manos (Gradín *et al*., 1976) and Arroyo Feo (Aguerre, 1981–1982). In both sites, a lower component was found which was characterized by the presence of the so-called 'Toldense' industry. Triangular projectile points and large marginally retouched artifacts characterized this industry. Only modern fauna remains, mostly guanaco, are associated. Radiocarbon dates range between 9400 and 8400 yr BP (Gradín *et al*., 1989).

Los Toldos 3 is one of several rockshelters in the Cañadón de las Cuevas, south of the Deseado river

(Cardich *et al.*, 1987). The lowest level includes the remains of Pleistocene megafauna, including fossil horse (*Onohippidium* [*Parahipparion*] *saldiasi*), extinct camelid (*Lama* [*Vicugna*] *gracilis*), and modern fauna, mostly guanaco, in association with a unifacial industry of marginally retouched flakes. This level (#11) produced one of the oldest radiocarbon dates from Argentina, with a result of 12,600 yr BP (Cardich *et al.*, 1973; Cardich, 1987). There is no agreement on the interpretation of this date, with some disputing its relevance (Borrero, 1989). Above level #11, materials attributed to the 'Toldense' were found, in which bifacial reduction is well-developed, mostly in the form of triangular projectile points. Fossil horse and guanaco remains dominate the faunal associations. South American ostrich (*Rhea* sp.) and an extinct canid (*Canis* [*Pseudalopex*] sp.) are also present. A single radiocarbon date of 8750 yr BP was obtained.

The Piedra Museo Locality is situated in the central plateau of the Santa Cruz Province. Centrpetal basins, deep canyons and shallow dells were explored and several archaeological contexts were recovered. The AEP-1 rock shelter is the first site in extra-Andean Argentine Patagonia where a 'fishtail' projectile point was found in stratigraphic context. The earliest occupation was dated by AMS in 10,400 ± 80 BP. Two fragments of projectile points were recorded at 1–1.20 m depth. The larger is made on red chert. A quarry-workshop of this excellent raw material, named 'Cerros Colorados, 17 de Enero', was located 6 km southeast of AEP-1. Another fragment of a projectile point is made on a rose-colored chalcedony from a source that was not detected. The rest of the industry is comprised of artifacts made on large flakes. The faunal assemblage includes remains of extinct fauna (horses, ground sloths, camelids), modern mammals (guanaco) and birds (the flightless *Rhea americana*). The latter is not present in the area today. Multivariate analysis was used to identify one species of small extinct camelid (*Lama* [*Vicugna*] *gracilis*) (Miotti, 1993b), while morphometric analyses were used to identify parts of the skull, vertebrae, metapodials and phalanges of *Hippidion saldiasi*, and ribs and a skull of *Mylodon* sp. The bones were found in piles, and were interpreted as the remains of the procurement and dismemberment of prey during the Late Pleistocene. Distributional data, taphonomic analysis and studies of bone modification all suggest that the first occupations of the rock shelter constituted loci of limited activities, principally the primary butchering of large megamammals and a large ostrich, probably hunted near a paleo-lake whose border was identified some 50 m to the Southeast. A similar functional context is that of Taguatagua in Central Chile, where the remains of kill and butchering activities, associated with 'fishtail' projectile points of approximately the same age, were found (Varela *et al.*, 1993; Núñez *et al.*, 1994).

The landscape of the central plateau includes many rockshelters that suggest facilities to ambush, kill and butcher prey. Nearby and contemporaneous open-air sites and off-site information were used to suggest that the procurement of raw materials was done locally (6–10 km). An upper component was identified at AEP-1, in which the faunal associations are all modern (Miotti, 1993a). A radiocarbon date of 7670 ± 110 BP is available. The technology is similar to that assigned to Fell 3 in the sequence of Cueva Fell (Bird, 1988), or what is called 'late Toldense' at the caves of Los Toldos and La Martita, and other contexts of similar age (Miotti, 1989). The situation is interpreted by Miotti as evidence for changes in the social landscape of colonists, probably implying alliances and exchange over large distances. Items like spear points and ocean shells are likely candidates for exchange among foragers. Territoriality is expected to appear, even when the degree of mobility appears to be similar during both late-Pleistocene and early-Holocene times.

These results are useful to model the process of peopling of regions like extra-Andean Patagonia, which look homogeneous but are varied in terms of potential habitation loci and in available resources. The magnitude of the environmental differences observed today suggest that they existed in the past. The archaeological research in Piedra Museo Locality focused on the differential use of space by hunter gatherers during Late Pleistocene times, in relation to concepts of social network communication and landscape. Spatial analyses, both at the scale of the site or the region, can be connected to recent results in ethnoarchaeology, experimental archaeology, taphonomy and ecology, and were used to explore issues of mobility, economy, symbolism and decision-making by hunter-gatherers (Miotti, 1989, 1991, 1992, 1993a).

Chico Basin

This region is one of the first in which stratigraphic research was conducted in Patagonia, with the work by Junius Bird during the 1930s (Bird, 1938). The sequence of occupations observed by Bird at Cueva Fell was used during a prolonged period as the master sequence for Patagonia. Now, after several decades of research, the utility of the type site approach is necessarily decreasing (see below), and it appears that a more flexible framework is needed.

Several sites were excavated by Bird, but the most important one is the Cueva Fell, which is a small cave located on the right bank of the Chico river. Its lowest levels produced an association of ground sloth (*Mylodon darwinii*), American horse and guanaco bones with 'fishtail' projectile points and an industry of marginally retouched artifacts, mostly made on basalt (Bird, 1988). Recent studies of the horse bones, deposited at the American Museum of Natural History at New York, suggested that at least some of the horse bones may have been the result of the activity of carnivores instead of humans (Borrero and Martin, 1993). Pollen analysis indicates that prior to 11,000 yr BP a treeless, herbaceous steppe was dominant, with xeric

taxa beginning to appear between 11,000 and 10,000 yr BP (Markgraf, 1988).

The Pali Aike cave, located some 50 km from Fell produced remains of at least seven ground sloths together with artifacts, but this evidence is difficult to use due to the lack of detailed publication. The sloth remains do not display clear indications of human intervention (L.A. Borrero, *unpublished observations*). A single radiocarbon date of 8639 yr BP should be considered as a minimal date (Bird, 1988).

Ultima Esperanza

This region, located around an inlet near the Pacific Ocean, is well known for the Cueva del Mylodon site, where fragments of a well-preserved *Mylodon* hide were found at the end of the last century (Lehman-Nitsche, 1899). Excavations at that site produced hundreds of ground sloth bones, some of them within a matrix of sloth dung. Insects, pollen, plants and hair were well preserved, rendering the site an important reservoir of paleoecological information. No evidence of human occupation contemporaneous with the ground sloth was found (Borrero *et al*., 1991). Pollen analysis from dung samples produced evidence of a tundra environment for the period 13,500–11,300 yr BP (Markgraf, 1985; Heusser *et al*., 1994). Other sites, like Cueva Lago Sofía 4 (Prieto, 1991; Borrero *et al*., 1994) and Dos Herraduras 3 (Massone *et al*., 1994), produced additional paleoecological information. The former is considered to be an extinct carnivore den dated between 13,000 and 12,000 yr BP, and the latter a natural death place of a ground sloth probably hunted by extinct carnivores around 12,000–11,300 yr BP. None of these sites presented human associations.

In any event, early archaeological sites are definitely present in the region. Two caves contain some of the most important evidence for the association of megafauna and humans. Cueva Lago Sofía 1 is a narrow rock-shelter with deposits containing ground sloth, horse and guanaco remains in association with hearths, side-scrapers and flakes (Prieto, 1991). Some of the bones are broken and burnt. Radiocarbon dates of ca. 11,000 yr BP are available. Megafauna remains were also recorded below the archaeological levels, and dated to 12,900 yr BP. Pollen spectra indicate an open environment with scattered *Nothofagus* trees around 11,000 yr BP.

Cueva del Medio is a large cave located at less than 1 km south of Mylodon Cave. 'Fishtail' projectile points and other lithic artifacts were found in association with hearths, and the remains of Pleistocene and modern fauna (Nami, 1987). Radiocarbon dates clearly show the existence of human occupations between 11,200 and 9500 yr BP (Table 2) (Nami and Nakamura, 1995). A date of 12,390 yr BP is not accepted by Nami (see below). Bones of *Mylodon* and the extinct panthera (*Panthera* [*onca*] *mesembrina*), associated with a date of 12,720 yr BP were recovered below the archaeological levels.

Tierra del Fuego

Tres Arroyos is a small rock-shelter located on the isthmus between Bahía Inútil and Bahía San Sebastián, in the northern part of the Isla Grande of Tierra del

TABLE 2. Radiocarbon dates from Cueva del Medio, Ultima Esperanza, Chile (Nami and Nakamura, 1995)

Component	Dated material	Taxon	Age	Lab Number
Fell 1	Charcoal	—	9595 ± 115	PITT-0344
Fell 1	Bone	—	9770 ± 70	Beta-40281
Fell 1	Charcoal	—	10,310 ± 70	Gr-N-14913
Fell 1*	Burned bone	—	10,350 ± 130	Beta-58105
Fell 1	Charcoal	—	10,430 ± 80	Beta-52522
Fell 1*	Fragment metapodial	*Lama* cf. *owenii*	10,430 ± 100	NUTA-1734 (AMS)
Fell 3	Phalange	*Lama guanicoe*	10,450 ± 100	NUTA-1735 (AMS)
Fell 1*	Burned bone	—	10,550 ± 120	Gr-N-14911
Fell 1	Vertebrae	*Hippidion saldiasi*	10,710 ± 100	NUTA-1811 (AMS)
Fell 3	Rib	*Lama guanicoe*	10,710 ± 190	NUTA-2332 (AMS)
Fell 3	Phalange	*Lama guanicoe*	10,850 ± 130	NUTA-1812 (AMS)
Fell 1*	Tibia	*Hippidion saldiasi*	10,860 ± 160	NUTA-2331 (AMS)
Fell 1	Charcoal	—	10,930 ± 230	Beta-39081
Fell 1	Phalange	*Lama* cf. *owenii*	10,960 ± 150	NUTA-2330 (AMS)
Fell 1*	Fragment diaphysis	*Lama* cf. *owenii*	11,040 ± 250	NUTA-2197 (AMS)
Fell 1	Metapodial epiphysis	*Lama* cf. *owenii*	11,120 ± 130	NUTA-1737 (AMS)
Fell 1*	Burned bone	—	12,390 ± 180	PITT-0343
Not cultural	Indet. bone	*Mylodon*	12,720 ± 300	NUTA-2341 (AM)

*From the same hearth.

Fuego. In its lowest levels one bifacially retouched fragment, perhaps part of a 'fishtail' projectile point (Jackson, 1987) was found, together with a marginally retouched industry and the remains of guanaco, fossil horse, extinct fox (*Canis* [*Dusicyon*] *avus*) and *Mylodon*. Radiocarbon dates range between 10,200 and 11,880 yr BP (Massone, 1987). The presence of a tephra layer resulting from an eruption of the Reclus volcano suggest that the date of 11,880 yr BP is closer to the actual time of occupation (Stern, 1992), but clearly more work needs to be done before accepting this interpretation. At the time of the early occupation, the region was part of the continent, since the Strait of Magellan was not yer formed (Clapperton, 1992). Another site on the isthmus, Marazzi, located near a large erratic boulder, produced a single date of 9550 yr BP in association with a unifacial industry and modern fauna (Laming-Emperaire *et al*., 1972).

PALEOENVIRONMENT AND PALEOECOLOGY DURING TRANSITION TIMES IN FUEGO-PATAGONIA

The existence of an equivalent of the Younger Dryas cold interval, defined in the Northern Hemisphere, is widely debated in South America (Heusser and Rabassa, 1987; Heusser, 1989; Ashworth and Markgraf, 1989; Rabassa *et al*., 1990; Markgraf, 1991, 1993a, b; Clapperton, 1993; Marden, 1993; Ariztegui *et al*., 1995). It is important to settle this issue since a cooling event, perhaps accompanied by an advance of the ice front, may have had important consequences for humans. Even when the timing and magnitude of this episode is not necessarily correlatable with that of the Younger Dryas, available evidence clearly indicates climatic deterioration prior to the Transition (see review in Clapperton, 1993). Extinctions of human demes, migrations or at least a reorganization of settlement are some of the possible alternative responses to the extensive cooling associated with the Late-Glacial. However, except for discontinuity in occupation, as evidenced in different regions (see below), no evidence of impact on human populations has been detected so far. If the case for discontinuity in occupation can be sustained in the future, it may imply some delay in the process of human colonization of different regions.

DISCUSSION

There are some issues which make for significant comparisons. One concerns the antiquity of the colonization of the different regions. Generally speaking, a late date for the arrival of human groups, around 13,000–11,000 yr BP, can be defended if we include, in addition to the evidence discussed here, that from Monte Verde (Dillehay, 1989) and other sites in South America (Meltzer, 1995). So it can be safely stated that human populations were well established in the Pampas and in Fuego-Patagonia by the time of the Pleistocene–Holocene Transition, although they probably were in the process of adapting (Borrero, 1996). Climatic instability may have been an important factor, resulting in delayed colonization. In the Pampas, the first humans were using the broader pampean environment, which extended eastward to include the marine shelf up to a distance of 160–200 km from the present shoreline. A similar situation but perhaps covering wider distances applies in many sectors of the Patagonian coast. In the period between 11,000 and 10,000 yr BP the sea was still low (ca 100 m), but was rising very rapidly around 10,000 yr BP. We emphasize that this process prompted the formation of the Strait of Magellan, cutting off the island of Tierra del Fuego, probably isolating human populations there.

This different paleogeographic post-Pleistocene panorama has meaningful implications in terms of paleoclimatic conditions, marine resources and coastal archaeological records. Numerous sites are probably under the present sea level. It is probably not a coincidence that the earliest coastal sites are dated around 6500 to 6000 yr BP (Orquera, 1987), precisely the time of the Holocene transgression (Rabassa *et al*., 1990). That bias toward sites located in the interior must be taken into account. The analysis of the archaeological record shows some inconsistencies primarily based on insufficient chronological dating control, and on the different geological settings which constrain the comparison and interpretation of results.

Also, the information available is still of low resolution in terms of the ability to recognize human scale processes of adaptation. This must be considered when we try to depict a regional scenario for the human occupations. Some generalization can be outlined. The populations arriving around 11,000–10,500 yr BP lived under cooler and subhumid dry conditions, which shifted to more humid ca. 10,500 yr BP. Parallel changes in the fauna and flora took place, and the response of hunter-gatherers to these changes is still not well known (see below).

We already mentioned that chronology is not well developed at most of the crucial sites, and only a few present more than a few radiocarbon dates (see Orquera, 1987; Borrero, 1996). We will discuss the case of Cueva del Medio, which is one of the better dated sites.

Nami identified two components at Cueva del Medio, which he termed 'Fell 3' and 'Fell 1', with the latter considered to be the older. The sequence at Cueva del Medio, then, is evaluated in the light of the sequence at Cueva Fell. Bones of extinct fauna found in the upper 'Fell 3' levels were considered as the result of postdepositional movement (Nami and Menegaz, 1991). The recently published dates on modern fauna from the upper levels are observed to intermingle with those from the lower levels, which were produced on bones of extinct fauna and charcoal (Table 2). Even when a clear technological distinction can be sustained between both components (Nami, 1987), it appears difficult to maintain a chronological distinction (Nami

and Nakamura, 1995). The problem, posed by the comparative approach by which Nami constructs the distinctions he made within the sequence at Cueva del Medio, is that both components do not overlap at Cueva Fell. There are two alternative solutions: the distinction between 'Fell 1' and 'Fell 3' components is not useful, lacking in chronological specificity and cultural meaning (Borrero, 1989), or the chronology of the 'Fell 3' component at Cueva del Medio needs further discussion. Full publication of this site may clarify the issue. In addition, the evidence from Cueva del Medio highlights the need to test the radiocarbon results which appear to defy our expectations. A date of 12,390 yr BP was obtained from the same hearth which produced several dates between 10,300 and 10,800 yr BP (Table 2), a situation that suggests that the 12,390 result is anomalous.

We do have some information for the period immediately before the Transition, but the situation changes for the period thereafter. The cases of Cueva del Medio and Cueva Lago Sofía 1 in Ultima Esperanza, the available information for Tierra del Fuego and the general chronology of the Pampas clearly display a temporally discontinuous archaeological record. The period between 10,000 and 8000 yr does not offer evidences with which to discuss early Holocene occupations in those regions in any detail. This is not the case in several extra-Andean localities like in the Chico Basin or the Deseado headwaters, where the situation is different. In the Chico Basin the radiocarbon dates can inform us about the question of temporal continuity (Bird, 1988), but the evidence is not well published. What is available does not suggest continuous use by humans. In the Deseado headwaters, all the evidence for human occupations is post-10,000 yr BP, suggesting that the area was not in use before that time. More research is clearly needed in order to dismiss this pattern as a sampling artifact. In the meantime, hypotheses of discontinuity in the human use of several regions of the Southern Cone can be entertained. If discontinuity is related to climatic instability, this is a subject in need of further research.

An additional problem for the archaeology of the 'Transition' is the theme of Holocene survival of Pleistocene megafauna. For years it was maintained that *Mylodon* persisted until mid-Holocene times (Saxon, 1976), but a reanalysis of the stratigraphy sustained on 26 radiocarbon dates found compelling evidence to defend an extinction date of around 10,500 yr BP for that species (Borrero *et al*., 1991). Other cases, like those from Pali Aike or Los Toldos 2 are sustained on only one radiocarbon date each, the former clearly needing to be considered a minimal age (Borrero, 1994). In sum, the situation in Fuego-Patgonia does not strongly support the Holocene survival of megafauna. In comparison, the case is open for the Pampas, where recent claims for Holocene survival are supported on more than a few radiocarbon dates. Evidence from Arroyo Seco 2 and La Moderna respectively present an early Holocene date for *Megatherium*, and a mid-Holocene date for *Doedicurus clavicaudatus* (Table 1). Preliminary evidence may suggest, then, differential responses of fauna to the demographic, environmental and climatic changes that accompanied the 'Transition'. If humans were a factor in the extinction, then their effect was more important in Fuego-Patagonia. A question for the future, if the present chronology of extinctions can be sustained, is why the velocity of extinction was faster in the periphery. It appears difficult to find the explanation in human demography, which would not have been significant anywhere at that time. Alternatively, it might be asked if, at the time of initial human colonization, the megafauna populations were in fact already dwindling in Fuego-Patagonia while they were still robust in the Pampas.

As a result of the late-Pleistocene extinction of megafauna in Fuego-Patagonia, there are sites, like those of Las Pinturas in the Deseado river or Marazzi in Tierra del Fuego, which, exhibiting very early Holocene dates, include only modern fauna in association with the archaeological remains. This is probably testimony to an important change in the availability of fauna after Transition times. The importance of this change from an economic point of view should be evaluated in the light of the detailed study of the evidence form Fell, Cueva del Medio and Cueva Lago Sofía 1, which are some of the sites at which Pleistocene horses have some quantitative importance. For the rest of the Fuego-Patagonian sites it is difficult to maintain that megafauna were critical resources (Salemme and Miotti, 1987; Borrero, 1994). As for the Pampas, Politis *et al*. (1995) point out that although 12 extinct genera from the Late-Pleistocene Lujanense Land Mammal Age co-existed with Pampean hunter-gatherers, only four seem to have been exploited (*Equus*, *Hippidion*, *Megatherium* and *Doedicurus*). Since this coexistence can be estimated to have been about 3000 yr or more, the lack of interaction is a problem that needs clarification in the future. In sum, what the available data show is that people played at most a secondary role in the megamammal extinctions, perhaps accelerating a process already underway before human arrival in South America.

CONCLUSION

One point that needs to be emphasized is the regular presence of so-called 'fishtail' projectile points in the early contexts of all the regions that we discussed. These projectile points were also found at the early site of Taguatagua in central Chile (Varela *et al*., 1993; Núñez *et al*., 1994) as well as in other regions (Schobinger, 1969). Studies of these projectile points are in progress (Flegenheimer, 1991; Politis, 1991; Nami, 1994) and, together with better chronologies, will help to detemine whether they constitute evidence of rapid human dispersal or technological convergence.

Some preliminary information from southern Patagonia and the Pampas shows the American horse

to have been a more important resource than previously thought. If this is confirmed, then our preception of exploitation strategies at the time of the 'Transition' changes significantly. In the first place, if horse was an important resource, its extinction by the end of the Pleistocene caused an important dietary change for the first human colonizers. That change would also have consequences for the selection of exploitation, mobility and perhaps technological strategies by members of those populations. For that reason, it is important to assess the real importance of the American horse for humans in late-Pleistocene times.

Finally, site formation processes still need to be fully considered in the Southern Cone. Almost every archaeological site reviewed here includes faunas which are not related to human activities. This situation signals the necessity of being very careful in the interpretation of faunal remains. We propose that a combination of geoarchaeological and taphonomic approaches combined with an emphasis in dating are sorely needed in order to disentangle some of the faunal associations and, in turn, associations with artifacts. Only in this way will it be possible to tackle the important themes of human dependence on extinct megamammals, on which hinge our perception of human responses to the Transition.

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