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The Prehistoric Exploration and Colonization of Fuego-Patagonia

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The main goal of this paper is to review the earliest archaeological evidence for the presence of humans in Fuego-Patagonia. The paleoenvironmental and paleoclimatic framework is briefly introduced, followed by a discussion of its relevance to understanding the exploration and colonization of Fuego-Patagonia. Technological and faunal evidence from a number of sites from the southern extreme older than 10,000 B.P. is analyzed. This leads to the conclusion that an early entry, at least 12,000 years old, appears best to accommodate the available chronological evidence. On the other hand, data from the Northern fringes of Patagonia clearly suggest an earlier human colonization.

KEY WORDS: Late Pleistocene; Fuego-Patagonia; archaeology.

INTRODUCTION

The history of the early human exploration of Patagonia was until recently the subject of heated debate, as part of a larger discussion, involving South America as a whole. The main point of contention concerned the time depth for humans in the subcontinent, with some authors suggesting ages of 40,000 years or more (Schobinger, 1987; Parenti, 1996), and others proposing more conservative dates of around 12,000 years (Lynch, 1990). The issue is now basically settled. Not surprisingly the best evidence at hand tends to support yet a third position, in which humans arrived before

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Clovis times but not necessarily before the Last Glacial Maximum (Meltzer, 1995). The recent refutation of any possibility for an ice-free corridor for the movement of humans between the Laurentide and the Cordilleran ice sheets (Mandryk and Rutter, 1996) is an important part of the argument. Circulation was possible only around 14,000–13,000 B.P. Human dispersal into America before that time must consider alternative and less direct routes (Dillehay, 1999).

Only scattered sites provide information concerning the Late Pleistocene in South America as a whole (Dillehay *et al.,* 1992). However, there is clear evidence for a Late Pleistocene age for human populations in Fuego-Patagonia from a number of sites.

Several important concepts are worth discussing before reviewing the evidence from southern South America. First, the peopling of Fuego-Patagonia was, like that of Scandinavia (Nygaard, 1989; Eriksen, 1996) and various islands (Gamble, 1994), one of the last important colonization processes in human history. Archaeological sequences in the region are thus relatively short. This means that they have been less exposed to destructive or mixing processes than sites in much of the rest of the world.

Second, all the available evidence suggests that the direction of immigration was from the north. Decades ago Mendes Correa (Rivet, 1960) considered Australia as the source for the first human populations that arrived in Fuego-Patagonia, but no evidence was offered to substantiate that claim. Unexpectedly, this position has recently reemerged with the work of Augusto Cardich (1997), and, again, no evidence is offered. Apparently the southern Pacific, the southern Atlantic, the Sea of Drake, and Antarctica were effective barriers for humans during the late Pleistocene. Accordingly, we must look to the north in order to understand the colonization of Patagonia.

The purpose of this paper is to analyze, using the available archaeological and paleoclimatic records, the conditions under which the exploration and colonization of Fuego-Patagonia took place. I use the term Fuego-Patagonia to make reference to the continuous expanse of land ending near the Cape Horn, which constituted the southern end of South America before the opening of the Strait of Magellan. All ages are given in uncalibrated radiocarbon years.

THE GEOGRAPHIC SETTING

Extra-Andean Patagonia, which makes up most of Patagonia, consists of vast horizontal expanses of nearly continuous steppe dissected by a few major rivers, which flow predominantly from west to east into the Atlantic

ocean. The steppe is not uniform, but has important differences in the proportions of shrubs and grasses (Mancini, 1998; Prieto *et al.,* 1998; Páez *et al.,* 1999). The major rivers are the Negro, Chubut, Deseado, Chico-Chalía, Santa Cruz, Gallegos, and Southern Chico. All of them, except the Southern Chico, are located in what now is Argentina. The Southern Chico has its headwaters in Chile, not far from Laguna Blanca, and reaches the Atlantic in Argentina. There is evidence that these hydrographic units have been present at least since the end of the Pleistocene and, thus, throughout the whole period of human occupation. The rivers are important in terms of human use of space, since they dictate the distribution of water within a basically dry region. The only places where the water was not a limiting factor were near the Andean range and in the archipelagos of the southwest on the Pacific Ocean coast. Extensive plateaux characterize the spaces between rivers. Lower-lying areas within the plateaux have at least seasonal fresh water, which attracted human occupation.

The Andean region has belts of forest present on both sides of the range, but more important in the west due to the rain-shadow effect produced by the dominant westerly winds against the Andes. *Araucaria araucaria* characterizes the forests in northern Patagonia and is replaced in the south by *Nothofagus* sp. A mass of continental ice is present south of 46°, with a few peaks reaching over 3000 m above sea level. In Chile, the Patagonian territory is discontinuous, broken by the system of fiords and sounds, and is constantly remodeled by earthquakes and volcanoes.

The diversity of large Patagonian vertebrates is extremely limited. Guanacos (*Lama guanicoe*) and South American ostriches (*Pterocnemia pennata*) are the most abundant, with small populations of southern Andean deer (*Hippocamelus bisulcus*) and pudu (*Pudu pudu*) in the Andean forests. There are a few carnivores, including pumas (*Felis concolor*), small wild cats (*Felis geoffroi, F. colocolo*), and foxes (*Pseudolopex griseus, P. culpaeus*). The coasts offer scattered sea lion rookeries, which are more abundant in Tierra del Fuego, and the occasional stranding of whales and dolphins.

CLIMATIC AND ENVIRONMENTAL HISTORY

Tierra del Fuego is today separated from continental Patagonia by the Strait of Magellan, but in late Pleistocene times was still a part of the continent. The Strait of Magellan opened only in the Early Holocene, around 9000–8000 B.P., after a process of deglaciation and landscape reorganization that took nearly 6000 years to be completed (Clapperton, 1992; Heusser, 1998). During that period the connection with Tierra del Fuego

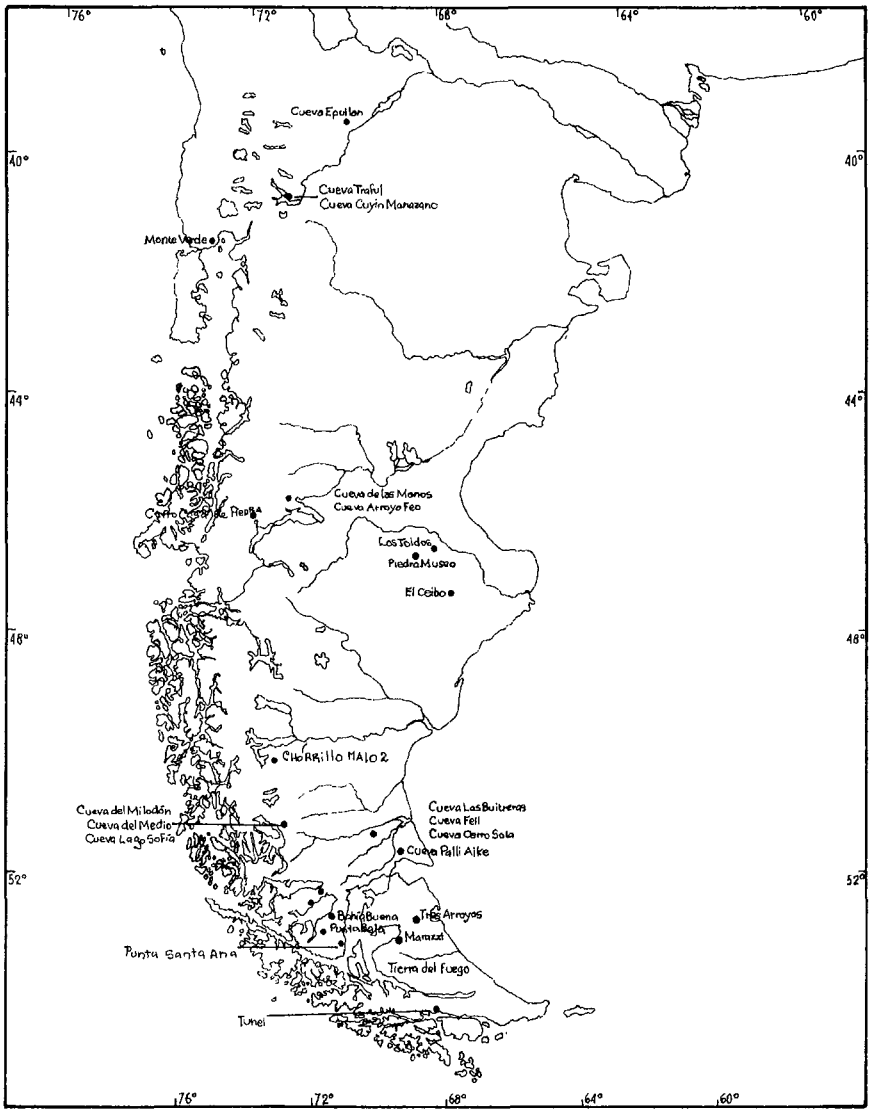

Fig. 1. Principal sites mentioned in the text (modified from Borrero and McEwan, 1997, p. 33).

was interrupted several times, but circulation was possible most of the time (McCulloch *et al.,* 1997; Coronato *et al.,* 1999).

> [S]ince ca. 12 to 10 14C ka B.P., when sea level was perhaps 60 m below present, a so called "land-bridge" existed between the primera Angostura and Segunda Angostura, where glacial moraines of different ages extended, at least in part, across the present Magellan Straits (Clapperton, 1992). This valley was then occupied by a meltwater discharge, braided stream, with many shallow channels and gravel islands in between which had probably been quite easy to go across on foot. (Coronato *et al.,* 1999, p. 88)

Deglaciation started around 14,000 B.P. and ended by 11,000 B.P. (Clapperton *et al.,* 1995; Lowell *et al.,* 1995). By the time of the opening of the Strait, the climate was turning milder, a process culminating ca. 8500 B.P. but punctuated by short cold spells.

A problem still to be solved concerns the intensity of those cold pulses. The existence of an equivalent to the Younger Dryas cold interval (ca. 11,000–10,000 B.P.) has been suggested for South America, mainly on the basis of pollen analysis (Heusser and Rabassa, 1987; Rabassa, 1990), but this evidence is heavily disputed by some (Ashworth *et al.,* 1991; Markgraf, 1993). In general, there is some support in geology (Marden, 1993), but other palynological and entomological data do not show the Younger Dryas signal. This issue must be resolved, since human populations were already present in Patagonia during that period. If they were exposed to the harsh climatic conditions of the Younger Dryas, even though they may have been milder than in the northern hemisphere, displacement or extinctions were probably occurring.

The archaeological record for the end of the Pleistocene is discontinuous, and the evidence points toward short-term occupations, mostly at sheltered places. While this evidence need not be explained by a model of use and abandonment of the region, it is at least coherent with it. However, it might also be simply the result of very low population densities. Low frequencies of artifacts at all of the sites dated between 12,000 and 10,000 B.P. indicate that human groups were small and very mobile. The scarcity of sites may also suggest that populations were small and dispersed. It is difficult to tell whether this is the result of harsh climate, and we must await additional evidence. In fact, a drop in population density is a consequence of geographic expansion, and recovery of density is expected immediately after the initial dispersal. The problem is the coincidence of the Younger Dryas with the period during which the process of human colonization was beginning to occur. It makes sense that the initial populations were small and dispersed, and even that they were experiencing problems in adapting because of any number of reasons, including volcanic activity, difficulty in finding adequate rock sources or abundant food (Borrero, 1994–1995). But it is also suggestive that the first indications of population recovery or

demographic success appear very late, around 9000 B.P. and are coincident with a climatic amelioration. This scenario suggests that the cold spells of about 11,000–10,000 B.P. did indeed have an effect on human populations. The way out of this difficulty appears to lie in high-resolution climatic and archaeological sequences.

In terms of the environments that were available to the first humans, it is clear that the floral communities recorded at the end of the Pleistocene in several Fuego-Patagonian localities lack any analogue in modern ecosystems (Markgraf, 1993; Heusser *et al.,* 1994; Páez *et al.,* 1999). Pollen data also tell us that conditions in many areas were probably inhospitable for humans, especially the treeless vegetation near the Cordillera (McCulloch *et al.,* 1997). However, paleontological data show that there was a diverse faunal community that may have constituted adequate prey for humans.

THE PLEISTOCENE FAUNAS

We first review the faunas available in Fuego-Patagonia before the arrival of humans. Information is scanty, but what emerges is important for understanding the adaptation of the first inhabitants. Pleistocene faunas were characterized by a number of large species, including ground sloths (*Mylodon darwinii*), American horse (*Hippidion saldiasi*), extinct [*Lama* [*Vicugna*] *gracilis, Paleolama*] and modern (*Vicugna* sp., *Lama guanicoe*) camelids, South American deer (*Hippocamelus bisulcus*), South American ostriches (*Rhea americana* and *Pterocnemia pennata*), puma, a large panther (*Panthera onca mesembrina*), and extinct (*Dusicyon avus*) and modern foxes. All these species are found at several sites in Patagonia and Tierra del Fuego. Many of them are now extinct, and others, like *Rhea americana,* no longer inhabit Patagonia. The best data come from southern Chile, especially from sites at the Seno de la Ultima Esperanza and from the Tres Arroyos site, in Tierra del Fuego. The chronology of the faunas from elsewhere in Patagonia rests mainly on indirect dates—that is, dates on the deposits containing megafauna—making it difficult to discuss chronological issues. The formation of mixed deposits, accumulated by both humans and other animal agents, such as carnivores, would have been a common situation at the end of the Pleistocene, when the first humans were taking over carnivore or herbivore dens in caves, and it is clear that we still lack a firm grip on the subject.

Since the megafauna from Ultima Esperanza is the best dated, we review the evidence from this area in some detail (Borrero, 1999a). The environmental history of Ultima Esperanza is not very well known, but there is evidence for the presence of a high-stand glacial lake during the

end of the Pleistocene (Prieto, 1991). With deglaciation, the ice damming the lake melted, and the lake emptied into the Pacific Ocean immediately after the explosive eruption of the Reclus volcano at around 12,000 B.P. A thick tephra layer of about 50 cm was deposited in several places in Ultima Esperanza, and 2- to 12-cm lenses are found as far as the eastern section of the Strait of Magellan (McCulloch *et al.,* 1997) and Tierra del Fuego (Stern, 1990). Charles Stern describes the eruption as "closer in size if not bigger than the 1932 Quizapu rather than the 1980 Mount St. Helens eruption" (Stern, 1990, p. 122).

It is probable, then, that the eruption of the Reclus produced a major ecological catastrophe that significantly affected herbivores. Twenty-six radiocarbon dates on ground sloth dung, hide, and bone at Cueva del Mylodon plus nine dates on ground sloth bones from four nearby sites suggest a ground sloth population decline immediately after the eruption (Borrero, 1999b). Moreover, the partially articulated remains of a ground sloth were found buried within the tephra at Rockshelter Dos Herraduras 3. All major vertebrates were probably affected by extirpation or by migration. It must be emphasized that, according to the existing archaeological record, the sloth decline took place before humans arrived at Ultima Esperanza, and our available knowledge on the effects of eruptions on local faunas suggests that, after a few years, the process of recolonization would have begun (Saba and de Lamo, 1994). Guanacos, horses, and sloths probably returned from nearby refugia or areas not affected by the eruption. These areas, based on the known distribution of the tephra, were probably located to the east of Ultima Esperanza. At this latitude the Andean range is easily negotiable, but its presence was nonetheless an important filter affecting the speed and success of recolonization for different species. Guanacos were probably the best adapted for quick recolonization, as attested to today by their distribution from the high Andean punas to the coast (Franklin, 1982). Guanacos continued to inhabit the region up to late Holocene times. In the case of sloths, the abundant radiocarbon dates at Cueva del Mylodon attest to some recovery after the eruption. However, this recovery was probably difficult, since sloths were a highly *k*-selected species with a low reproductive capacity. Horses, on the other hand, were present during the interval between 11,000 and 10,000 B.P. and, afterward, disappear from the record. The important question regarding horses is whether they were really abundant and widespread in Fuego-Patagonia. While there is a relatively rich record for sloths, there is almost no natural record for late Pleistocene horses (Alberdi *et al.,* 1987). It is possible that horses constituted a dwindling resource during the late Pleistocene. Studies of feral horses show that their social groups are very responsive to the distribution of resources, being more ephemeral and smaller where re-

sources are less abundant (Rubenstein, 1986; Pacheco and Herrera, 1997). Environmental conditions in extra-Andean Fuego-Patagonia near the end of the Pleistocene were unstable, and foraging resources were not necessarily abundant (Markgraf, 1988; Clapperton, 1993). However, being social animals, horses would have attracted the attention of human hunters, who may have preyed upon them extensively. This process of human exploitation may have increased the visibility of their bones, which are known to us primarily from archaeological sites (Bird, 1988; Nami and Menegaz, 1991; Prieto, 1991). In a paleontological sample from a felid den, Cueva Lago Sofía 4, dated between 13,400 B.P. ± 90 years (AA-11498) and 11,590 B.P. ± 100 years (PITT-0940), horse remains are not abundant (Borrero *et al.,* 1997). Thus, it is difficult to assess the probability of recovery of the horse populations in Ultima Esperanza.

In eastern Patagonia the evidence is less detailed. Paleontological information for the Late Pleistocene is minimal, and most of the data are provided by archaeological sites.

This is the scenario found by the first humans in the far south around 11,000 B.P.: a depauperate fauna living in unstable habitats immediately after deglaciation (Pisano, 1975), with sloths painfully lingering on in a few spots and an apparent relative abundance of guanacos and other camelids. It is easy to imagine the negative effect of human hunting on such a fauna, but it would be excessive to blame humans for their extinction. The evidence for human consumption of sloths is good, but not necessarily as a result of hunting (see below). There is no question that the novelty of human consumers in the ground sloth habitat would have affected the functioning of the ecosystem, but we do not really know in what ways. It is likely that humans were just a concurrent factor in the process of extinction.

What was the situation farther north? A minimum of information is available, but what we do have suggests that in many regions the Pleistocene fauna was already gone when the first humans arrived. That appears to be the case near the Andean range in northern Patagonia. A single radiocarbon date from a paleontological site indicates that sloths were present between 12,600 and 10,800 B.P. (Nami, 1996). Ground-sloth bones found at Cueva Traful 1 were not associated with human occupations (Crivelli *et al.,* 1993, p. 35). Ground sloth ossicles also occurred at Baño Nuevo (Mena and Reyes, 1998a; Trejo and Jackson, 1998) and Cueva Las Guanacas in Aisén (Mena and Reyes 1998b; Velásquez, 1998), but they were not associated with the human occupations, which, in both cases, are later. This also appears to have been the case near the headwaters of the Deseado River. A layer of megafauna dung was recovered at the lower level of CCP7 and dated to ca. 10,400 years. Human occupations occurred above, with dates of about 9700 B.P. (Aschero and Civalero, 1998). In all of these cases,

it can be presumed that people arrived in the area after the extinction of megafauna.

CHRONOLOGY OF EARLY HUMANS IN FUEGO-PATAGONIA

As already noted, after intense discussion concerning the age of humans in Patagonia, recent studies have satisfied most of the critics of an early peopling model. Evidence for human occupation at Monte Verde, in Llanquihue Province, south–central Chile, is securely dated to around 12,500 B.P. (Dillehay and Pino, 1997a). Moreover, the recently excavated sites of Cerro Tres Tetas and El Puesto Rockshelter (Piedra Museo), both in Santa Cruz, Argentina, have produced dates of 11,560 B.P. ± 140 years (LP-525) (Paunero, 1993–1994) and 12,890 B.P. ± 90 years (AA 20125), respectively (Miotti and Salemme, 1998). These two sites are not yet fully published, but the evidence is encouraging. In both cases, there are other dates from the upper levels in stratigraphic order (Salemme and Miotti, 1999).

For years, a single radiocarbon date of 12,600 B.P. ± 500 years, obtained in the 1970s from the lower level (Level 11) of Los Toldos 3, was cited as evidence for early human occupation (Cardich *et al.,* 1973; Bryan, 1978). The problem is that the date, which lacks a laboratory number, was made on dispersed flecks of charcoal and the association of this material with the artifacts was never clear. No effort seems to have been made to replicate the date. Moreover, compared with the rest of Patagonia, the whole sequence is slightly out of phase (Borrero, 1989; Dillehay *et al.,* 1992). Thus, even when other sites such as Monte Verde and Piedra Museo exhibit dates older than 12,000 years, this changes nothing in the interpretation of Los Toldos. Only new radiocarbon assays on materials with clear provenience from Los Toldos itself will lead to acceptance of the chronology of the site.

Radiocarbon dates falling around 11,000–10,500 B.P. are available from various places in Fuego-Patagonia (Bird, 1988; Prieto, 1991; Nami and Nakamura, 1995; Miotti, 1996) including what today is Tierra del Fuego (Massone, 1987; Massone *et al.,* 1998; Salemme and Miotti, 1999). In all cases, the evidence is stratigraphic, backed by a solid radiocarbon chronology, and consists of bifacial lithic artifacts, basin-shaped hearths, and butchered faunal remains. Table I gives a list of the most important sites and numbers of available dates. Extensive listings of radiocarbon dates can be consulted in other sources (Orquera, 1987; Borrero, 1996).

Thus, the evidence for humans near the end of the Pleistocene in southern Fuego-Patagonia is clear and relatively abundant. It indicates that

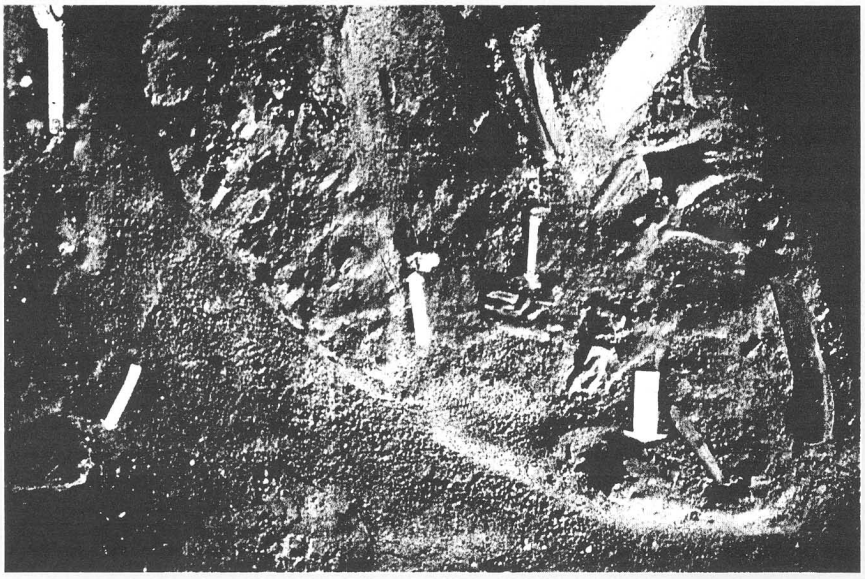

Fig. 2. Cueva del Medio, Ultima Esperanza, Chile. Hearth on Square 26/9 a. Fell Cave projectile point in association with horse teeth and camelid bones.

more than 2000 years before the transition there were human populations in several parts of the region.

HUMAN REMAINS

Human remains relevant to the initial phases of colonization of Fuego-Patagonian are not abundant. There were claims of a Late Pleistocene antiquity for Mata-Molle in Northern Patagonia (Vignati, 1957–1959), but those remains have recently been dated to ca. 4500 B.P. (Fernández, 1983). The remains from Cerro Sota and Pali Aike, in the southern part of the continent, have traditionally been considered late Pleistocene (Bird, 1938, 1988; Turner, 1992), as has a sample from Cueva Lago Sofía 1, in Ultima Esperanza (Soto-Heim, 1994). However, three samples of human bone from Cerro Sota were dated by AMS to around 3900 B.P. (Hedges *et al.*, 1992), and two samples from Cueva Lago Sofía 1 were dated to around 4000 B.P. (Prieto, 1991). All that is left are the remains from Pali Aike, which clearly should be dated. A recent attempt was made to date them, but no collagen could be found. On the other hand,

Table I. Archaeological Sites and Number of Radiocarbon Dates (Years Before Present)

Site	Temporal Span	Number of Dates
	Northern Patagonia	
Monte Verde	13,565 ± 250; 11,790 ± 200	9
Cuyín Manzano	9,920 ± 85	1
Epullán Grande	9,970 ± 100; 7,550 ± 70	3
Traful 1	9,430 ± 230; 9,285 ± 105	2
	Deseado Basin	
Piedra Museo (El Puesto Rockshelter)	12,890 ± 90; 9,710 ± 105	8
Cerro Tres Tetas	11,560 ± 140	1
Arroyo Feo	9,410 ± 70; 8410 ± 70	4
Cueva de las Manos	9,320 ± 90; 7280 ± 60	3
La Martita	9,050 + 90; 7940 + 260	2
El Verano	8,960 ± 140; 7500 ± 250	2
Cerro Casa de Piedra 7	9,730 ± 110; 8300 ± 115	3
	Chico Basin	
Cueva Fell	11,000 ± 170; 10,080 ± 160	7
	Ultima Esperanza Sound	
Cueva del Medio	12,390 ± 180; 9,595 ± 115	17
Cueva Lago Sofía 1	11,570 ± 60; 10,910 ± 260	3
	Tierra del Fuego	
Tres Arroyos	11,880 ± 250; 10,280 ± 110	5

> . . . Free carbon molecules found during the pretreatment of the sample (acid washes) were dated and generated an age of 7,830 ± 60 B.P. (Beta-099066). This date must, however, be taken as a minimum age. (Neves *et al.*, 1999, p. 261)

Fortunately, work by Francisco Mena recently produced human remains at Baño Nuevo, in Aisén (Mena and Reyes, 1998a). Three newborns and two adults are associated with several radiocarbon dates of ca. 8000 B.P., two of which were run on the bones of one of the adults (Table II). The individuals were deposited in a flexed position against the back wall

Table II. Radiocarbon Dates Associated with Human Burials at Baño Nuevo (Mena and Reyes, 1998; Jackson and Trejo, 1998)

Individual	Age (years)	Sex	Contextual Dating	Direct Dating
BN-2	20–25	Male	8890 ± 90	8859 ± 50 (NSRL-3485) CAMS-36633; 8880 ± 50 (NSRL-3486) CAMS-36634
BN-3	40–45	Female	8530 ± 160	

Table III. Radiocarbon Dates Associated with Human Burials at Epullán Grande (Crivelli Montero *et al.*, 1996)

Individual No.	Contextual Dating	Position
1	9970 ± 100 (LP-213)	Charcoal close to burial
40	7900 ± 70 (Beta-44412)	Charcoal below burial
82	7900 ± 70 (Beta-44412)	Charcoal above burial
126	7550 ± 70 (Beta-47401)	Charcoal near burial

of the cave and covered with stones (Mena and Reyes, 1998a). The dated individual is a male about 160 cm in height, who died at 20–25 years. These findings, together with the human burials associated with dates of about 8000 B.P. in Epullán, Neuquén, northern Patagonia (Table III) (Crivelli *et al.*, 1996), are all that exist relevant to the early peopling of Fuego-Patagonia. In the case of Epullán, the dates were run on charcoal found in close association with the burials. The association appears to be secure, but more dates on the bones are needed. With one exception, the skeletons were placed on beds of rocks or grass. Ocher was extensively used in the burials.

The sample is small but it constitutes our best evidence for the analysis of the physical type and diet of early humans. Some somatic differences from later populations were observed in the Baño Nuevo sample, essentially that the skeletons can be described as members of a Mongoloid stock, but more gracile. An association with red fox remains was observed in at least three of the burials. Interestingly, canid teeth were also found with burials dated around 8500 B.P. in the Pampas (Politis, 1996).

Studies of recent samples of skulls from Patagonia and Tierra del Fuego demonstrate important morphometric differences (Guichón *et al.*, 1989–1990), and Marta Lahr observed that

> the populations from Tierra del Fuego and Patagonia . . . showing a very robust morphology that departs from a typical Mongoloid pattern, may be seen as a group that has retained to a greater degree the morphology of the first inhabitants of the Continent (Lahr, 1995, p. 190; see also Hernández *et al.*, 1997).

Evidence from mitochondrial DNA also supports the notion that different populations were involved in the peopling of America, with the Fuegian and Patagonian samples representing a population lacking haplogroup B (Lalueza Fox, 1996; García Bour *et al.*, 1998). These data clearly argue against the model of strictly Mongoloid origins for the Americans (Greenberg *et al.*, 1986) and highlight the importance of the Fuego-Patagonian samples for the wider issue of the peopling of the Americas.

THE LITHIC ASSEMBLAGES

I introduce the archaeological data most relevant to the initial peopling of Fuego-Patagonia, focusing on Late Pleistocene and Early Holocene

evidence. My presentation is organized using the major river basins. Most of the early assemblages, with one important exception, come from Santa Cruz, in Argentina, and Magallanes, in Chile. Evidence from Tierra del Fuego derives from a single site, Tres Arroyos. Thus, the archaeology from the southern portion of Fuego-Patagonia dominates the picture. The absence of Late Pleistocene evidence from the northern part of Patagonia, at latitudes between ca. 40° and ca. 48°, is noteworthy. The important exception, west of the Andean range, in an area not always included in Patagonia, is the site of Monte Verde.

Northern Patagonia

Monte Verde is an open-air site of about 3000 m^2 near the Chinchihuapi Creek, excavated by Tom Dillehay (1997a). The archaeological deposits were covered by a peat layer, which was dated between 12,000 and 10,500 B.P. (Dillehay and Pino, 1997b, p. 32), and several dates have a mean around 12,500 B.P. (Table IV). The foundations of log huts were preserved under the peat, together with a suite of organic remains, including bones, plants, and fragments of hide. Importantly, human footprints were identified in hardened muddy sand. The settlement occurred above two sandy, gravel-strewn beaches of the ancient stream. The presence of huts is inferred from the disposition of logs within the site and from cuttings and fragments of worked wood and tied stakes. Also, several features, including post holes and hearths, were found. The reality of the huts has been contested by some (i.e., Lynch, 1990, p. 26), and they do not necessarily constitute the best evidence at Monte Verde. However, it is not possible to dispute the artificial character of most of these features. It is also important to note the preservation of soft tissues, some of which have been interpreted as the Proboscidean (Cibull and Geissler, 1997). It is suggested that mastodon hides were part of the cover used in the huts (Dillehay, 1997c).

Table IV. Radiocarbon Dates from Monte Verde (Dillehay and Pino, 1997a)

Radiocarbon Date	Lab. No.	Material
11,990 ± 200	TX-3760	Bone
12,230 ± 140	Beta-6755	Wood artifact
13,565 ± 250	TX-3208	Charcoal
12,000 ± 250	OXA-105	Amino acids from collagen in ivory artifact
11,790 ± 200	TX-5374	Carbonized wood
12,450 ± 150	OXA-381	Wood artifact
12,650 ± 130	TX-4437	Wood artifact
12,740 ± 440	TX-5375	Wood artifact
12,780 ± 240	Beta-59082	Burned artifact

Lithic artifacts are not abundant at the site, which also led to some skepticism, but indubitable artifacts were found, including 3 lanceolate projectile points, 45 bola stones, and other modified rocks (Collins, 1997; Meltzer, 1997, p. 754). Other artifacts, such as "hammerstones" and "grinding stones," are more controversial. The majority of the artifacts can be seen as resulting from expedient technology (Collins, 1997). The rocks were all locally available. However, lithics form only a small part of the artifactual inventory. Apparently, most of the artifacts were made on wood, such as wedges, pointed implements, including possible lances, and possible digging sticks.

Perhaps the most impressive evidence of human presence at Monte Verde is the cordage and cordage impressions (Adovasio, 1997). Cordage was made primarily of *Juncus* sp. and *Scirpus* sp. and sometimes was tied with pieces of wood.

> The cordage assemblage from Monte Verde is presently both the oldest example of this perishable industry from South America and one of the earliest—if not the earliest—in the New World. (Adovasio, 1997, p. 227)

Its importance resides in the fact that no process other than human agency can be invoked to explain its presence. Together with the remains of plants (see below), it provides an impressive picture of a Late Pleistocene population using a variety of resources that are not well preserved in other kinds of sites.

The faunal remains include 414 fragments of mastodon bone (*Cuvieronius sensu* Casamiquela) and a single *Palaeolama* bone (Casamiquela and Dillehay, 1989; Dillehay, 1997b). This is a small sample for a site claimed to be residential and characterized by its good preservation. Moreover, dirt found embedded in some of the mastodon bones is not local (Karathanasis, 1997), suggesting that the bones were collected from a carcass elsewhere.

By any measure, plants appear to be the basic staple of the population using Monte Verde (Dillehay and Rossen, 1997; Rossen and Dillehay, 1997). Wild potatoes and other tuberous plants (Ugent, 1997) are among those with good nutritional potential. The remains of algae, *Sargassum,* are one of the most spectacular findings, since today *Sargassum* is not important on the Pacific coasts of South America (Ugent and Tindall, 1997). These algae are used today for human consumption and mark the presence of oceanic waters warmer than modern (Dillehay, 1997c, p. 768).

The evidence from Monte Verde can be seen as that of early explorers of the cold temperate forest, using the area for a short period. According to Dillehay, the site was probably used during a period of the order of 1 year. Apparently, the inhabitants of Monte Verde were using that portion of the Chinchihuapi creek immediately after deglaciation, which is indicated in the sequence by a gravel bed.

One of the strongest points for Monte Verde is the chronostratigraphy,

which is clear and well supported by radiocarbon dates (Table IV). Many interpretations of the evidence may be open to question, but it is clear that artifacts in good stratigraphic position within well-dated deposits were found at Monte Verde.

The discussions around Monte Verde were heated, and not always interesting. A visit to the site was arranged, and the publication of the impressions of the archaeologists invited paved the way toward the acceptance of the site by the archaeological community (Gibbons, 1997; Meltzer *et al.,* 1997). However, it is the publication of Volume 2, with the archaeology of Monte Verde (Dillehay, 1997), that is the most important argument for the reality of the site. Testimonies from visiting archaeologists are no more than arguments from authority and should not have an important role in a debate which should be confined to technical matters.

Arguments about Monte Verde are not going to subside, since there is at least one important controversy still to resolve: the MV-I possible habitation surface. This is a sector of the site in which "3 clay-lined pits, 26 stones, and 8 charcoal scatters" were found (Dillehay and Pino, 1997b, p. 36). The surface is dated 33,370 B.P. ± 530 years (Beta-6754) and >33,000 B.P. (Beta-7825). Dillehay (1997c, p. 774) distances himself from the interpretation of these data:

> . . . I cannot fully accept, in the absence of other valid archaeological sites of the same age . . . that historically related people were wandering around the continent of South America for more than 20,000 years before they returned to the same locality.

There is certainly room for the existence of previous occupations, however scattered and ephemeral, and there is no need to invoke historical continuity. If sustained, this evidence may point to initial colonizations that may have failed. The peak of the last glaciation, ca. 22,000 B.P. was an important inhibiting factor for the continuous use of this region (Lowell *et al.,* 1995).

The Chinchihuapi site, not far away from Monte Verde, also discovered by Dillehay, is dated to 12,420 B.P. ± 130 years (Beta-65842). Two flakes, one spheroid, and three wooden artifacts were recovered in a test pit (Dillehay and Pino, 1997a, p. 49). Chinchihuapi is also covered by peat, which is dated to 11,800 B.P. ± 80 years (Beta-68997). The discovery of Chinchihuapi clearly shows that there is still potential for colonization research in the wet environments of the cold forest.

The Limay Basin

East of the Andes, the only evidence is early Holocene in age and comes from three caves in the upper basin of the Limay River. Cueva

Traful and Cueva Cuyín Manzano, separated by about 7 km, are in the forest or forest–steppe ecotone, near the headwaters of the basin. Cueva Epullán is in the steppe on the left side of the Limay River, some 100 km east of the ecotone. The available palynological data suggest that the environment was similar at the beginning of the Holocene (Heusser, 1993). However, changes did occur, some minor and others more important for human settlement. For example, palynological research at Epullán Grande showed that between approximately 10,000 and 7,000 B.P., the availability of water near the cave was higher than today (Prieto and Stutz, 1996).

Cueva Traful is located on the right side of the Traful River near its confluence with the Limay. The initial, and very limited, occupations are dated 9430 B.P. ± 230 years (AC-2676) and 9285 B.P. ± 105 years (GX-1711AMS) (Crivelli Montero *et al.,* 1993, p. 33). The lithic assemblage consists mostly of unretouched flakes. No bifacial artifacts were found, but a few bifacial-reduction flakes attest to their existence (Cúneo, 1993, p. 165). The fauna includes fox remains and a low frequency of guanaco. It has been suggested that foxes were important in the diet of the initial inhabitants of the cave (Crivelli *et al.,* 1993, p. 38), but the faunal analysis is not yet published. Immediately after the initial occupation, the "Componente 1-Traful," dated to 7308 B.P. ± 285 years (LP-8113) and 7850 B.P. ± 70 years (LP-5133), includes well-defined hearths and lithic artifacts, including triangular projectile points. Guanaco remains are now more important, with additional findings of *Lagidium* sp., fox, and small rodents. The faunal remains have not yet been studied to assess which species were incorporated by humans and which by other agents.

Cueva Cuyín Manzano is located by a small tributary of the Traful River. The lower occupations were, again, ephemeral. They are dated 9920 B.P. ± 85 years (KN-1432). The faunal remains (not published in any detail) include guanaco, which is not abundant. Bifacial artifacts are absent, but end-scrapers are important (Ceballos, 1982).

Cueva Epullán is interesting in that the lower levels include a proportionally higher use of obsidian than do the upper levels (Crivelli *et al.,* 1996, p. 200). This argues for logistical mobility during the initial occupations—that is, a site intermittently used from a distant base. The initial occupations are dated between 9970 B.P. ± 100 years (LP-213) and 7550 B.P. ± 100 years (Beta-47401). Lithic artifacts were made of obsidian and basalt, and bifacial work was important. A small hearth was found. The fauna is composed of guanaco, skunk, red and gray fox, Felidae, and South American ostrich (cf. *Pterocnemia pennata*). The site was also used as a burial place. The initial occupations of several sites in northern Patagonia, both west and east of the Andes, show that guanaco, the most abundant vertebrate today, was not necessarily the most important prey. Plants, perhaps foxes,

and other small mammals appear as the targeted resources. Since the evidence comes from both caves and at least one open-air site, we should consider the existence of adaptations that were not centered on the guanaco. Megafauna, even when present as at Monte Verde, does not appear to have been important. In sites east of the Andes, megafaunal remains are always found below the cultural levels. It is interesting to notice the importance of fox remains. If their presence can be attributed to human activities, this evidence, together with that from Baño Nuevo and the Pampas, informs us of the importance for the early explorers of a resource which later was to become secondary or ignored.

It has been suggested that some of the early deposits east of the Andes represent a unifacial lithic tradition (Crivelli *et al.*, 1993), but this concept is difficult to defend. In the first place, it is necessary to accept that samples are small and that functional requirements, within the context of initial colonization, may better explain the unimportance of bifacial work. We believe that bifacial reduction, blade technology, and other "sophisticated" technologies were always available to the initial explorers of Fuego-Patagonia, as indicated by findings at several early sites (Yacobaccio and Gura-

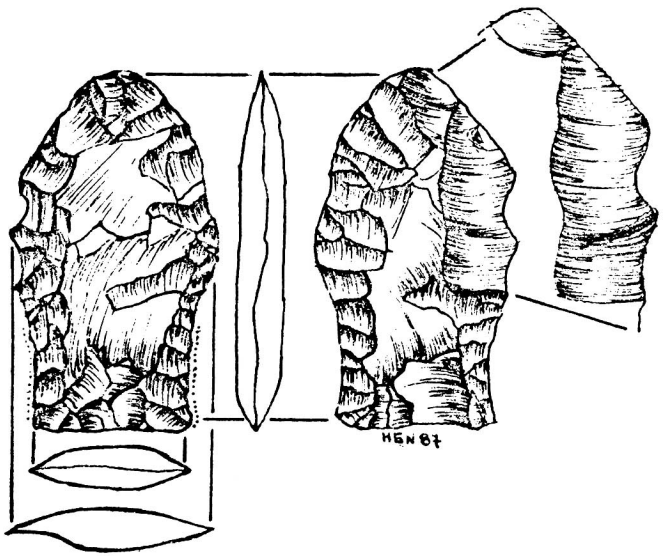

Fig. 3. Fell Cave type or "fishtail" projectile point, Cueva del Medio, Ultima Esperanza, Chile, found within a hearth dated 10,550 B.P. ± 120 years (GrN-14911) (Square 26/9 a). Length, 48 mm. (Drawing by Hugo G. Nami.)

ieb, 1994; Nami, 1993–1994; Paunero, 1993–1994; Aguerre, 1997; Scheinsohn, 1997). During the early period of human adaptation to the various Fuego-Patagonian habitats, lithic artifacts were routinely and expediently made on rocks available in the immediate vicinity, with an emphasis on the transport of bifacial artifacts and/or preforms, as is appropriate for situations of high mobility. Predominantly local raw material was used, and high-quality, heavily curated exotic rocks are present at very low frequencies. In the cases where they are relatively abundant, as in Epullán Grande, they plainly point toward logistical mobility.

Southern Patagonia

The Deseado Basin (Santa Cruz)

Cueva Los Toldos 3 (LT3) is one of the best-known archaeological sites in Patagonia (Menghin, 1952; Cardich *et al.,* 1973; Cardich, 1977, 1978, 1987; Cardich and Flegenheimer, 1978; Cardich and Miotti, 1983; Mansur-Franchomme, 1983). As mentioned, this cave, in the cañadón de las Cuevas south of the Deseado river, is usually cited as evidence for a late Pleistocene human presence in Fuego-Patagonia.

The earliest level (Level 11), which produced the date of 12,600 B.P. ± 500 years, is characterized by unifacial marginally retouched tools, most of which are side-scrapers. There are also remains of extinct horse [*Onohippidium (Parahipparion) saldiasi*], an extinct camelid [*Lama* (*Vicugna*) *gracilis*], and guanaco. The dating is inconclusive, but the evidence for people is clear. A level above (level 10) has a single radiocarbon date of 8750 B.P. ± 480 years (no laboratory number). The butchered remains of *Lama* (*Vicugna*) *gracilis,* extinct horse, and guanaco were found together with triangular projectile points and large end-scrapers. *Rhea* sp. and *Canis* (*Pseudalopex*) sp. were also found.

Cueva Los Toldos 2 (LT2), located near LT 3, was one of the key sites used by Osvaldo Menghin (1952) in his sequence of Patagonian cultures or phases. The relevant information is only partially published (Crivelli Montero, 1976–1980; Mengoni Goñalons, 1976–1980) and is essentially similar to that on the sequence recorded at LT 3. Menghin defined the Toldense industry, characterized by triangular projectile points and megafauna, on the basis of the lower levels (Menguin, 1952; Aguerre, 1979).

Some 150 km south, in the central plateau, is the site Cueva El Ceibo 7. An assemblage comparable to that of the lower level of Los Toldos 3 was found. Bones include those of extinct horse, extinct camelid, *Lama* (*Vicugna*) *gracilis,* puma, and probably guanaco. No radiocarbon date has

been published by the excavators for this or any other level at El Ceibo 7, but Coronato and others (1999, p. 88) refer to a date of "ca. 9.5 14C ka."

El Puesto Rockshelter (AEP), at Piedra Museo, in the lower plateau of the Deseado river, is one of the most promising sites in Fuego-Patagonia. Two stratigraphic units yielded Pleistocene human occupations. Unit 5, was radiocarbon dated to 12,890 B.P. ± 90 years (AA-20125) (Miotti and Salemme, 1998), but its contents are still unpublished.

Unit 4, with two radiocarbon dates of 10,400 B.P. ± 80 years (AA-8428) and 9710 B.P. ± 105 years (LP-859) (Miotti and Salemme, 1998), produced a fragment of a bifacial tool, probably a projectile point. The shape and technology are of the Fell Cave type. End-scrapers and side-scrapers usually made on large flakes were also found. Guanaco, extinct horse, ground sloth, *Lama* (*Vicugna*) *gracilis,* and South American ostriches (*Pterocnemia pennata* and *Rhea americana*) dominate the faunal assemblage (Miotti, 1996). *Rhea americana* is not present in the area today.

Cave 1 of Cerro Tres Tetas is some 55 km north of El Ceibo (Paunero, 1993–1994). At Unit 5, two hearths were found, one of which was dated to 11,560 B.P. ± 140 years (LP-525). The lithic technology is basically unifacial, but bifacial retouch was recorded. End-scrapers, side-scrapers, knives, and retouched flakes characterize the lithic assemblage. The faunal remains are dominated by guanaco bones. No Pleistocene fauna was found.

In addition, two sites in the plateau, El Verano and La Martita, offer important insights early Holocene human settlement. (All of these sites also include long Holocene sequences that attest to the later history of human occupation of the region.) El Verano is located west of El Ceibo (Duran, 1986–1987) and is a small cave with occupations dated to 8960 B.P. ± 140 years (I-13797) and 7500 B.P. ± 250 years (AC-0887). The butchered remains of guanaco were found in association with triangular points, large end-scrapers, and other edge-trimmed tools. La Martita is similar, with an association of guanaco remains, large end-scrapers, and triangular points dated between 9050 B.P. ± 90 years and 7940 B.P. ± 260 years (Aguerre, 1997). Both sites are used to characterize the Toldense unit.

Thus, the plateau immediately south of the middle Deseado river is an important research area for the study of the colonization of Fuego-Patagonia. In general, the sites reviewed display slight evidence of use before the Pleistocene–Holocene transition, and more intense and repetitive occupation during the early Holocene. Megafauna is present in the earliest levels of some of the sites, but not in large numbers. Instead, guanaco is the dominant large vertebrate.

Farther up the Deseado basin toward its headwater, less than 100 km to the west, another concentration of sites was discovered. One of the most important is Cueva de las Manos, at the base of a stepped cliff above the

Pinturas River (Gradín *et al.,* 1976, 1979, 1987; Mengoni Goñalons and Silveira, 1976; Alonso *et al.,* 1984–1985). Wall paintings that include hand negatives and depictions of guanacos have made this site world famous. The lower occupations are dated to 9320 B.P. ± 90 years (CSIC-138) and 9300 B.P. ± 90 years (CSIC-385), and some of the paintings may be of that age on the basis of the stratigraphic position of painted rock fragments fallen from the roof of the cave (Gradín *et al.,* 1976, p. 224). Triangular projectile points, a fragment of a bola stone, and large side-scrapers are associated with the remains of modern fauna, mainly guanaco. Fox, puma, birds, and small mammals are present in small quantities.

Arroyo Feo is a cave located near the high plateau (Gradín *et al.,* 1976, 1979, 1987; Silveira, 1979; Aguerre, 1981–1982; Alonso *et al.,* 1984–1985). The lower levels, dated between 9410 B.P. ± 70 years (CSIC-514) and 8410 B.P. ± 70 years (CSIC-516), have a lithic inventory comparable to that from Level 11 at Los Toldos (Gradín *et al.,* 1987, p. 122). The absence of projectile points may be the main reason for the overall similarity. However, the excavators classified these deposits as pertaining to the Toldense (Aguerre, 1997), a position that makes sense in terms of chronology as well as assemblage content.

In sum, all of these upper Deseado sites consistently display traces of human occupation around 9000 B.P. In contrast with the sites located south of the middle Deseado River, such as Piedra Museo and Los Toldos, megafaunal remains are never found in association and guanaco is always the more important resource.

Finally, two sites located near the Andes, CCP7 and CCP5, may represent the first incursions into the forest from the east (Aschero and Civalero, 1998). Even when guanaco is dominant, the remains of Southern Andean deer are present in the earliest levels. West of the Deseado headwaters, in Chile, is the Baño Nuevo site. No detailed report on the lithic and faunal assemblage is yet published for this important site, which has produced the earliest human burials known in Patagonia. However, it is reported that modern fauna (primarily guanaco), lithics (but no projectile points), and fragments of an atlatl were found within the early Holocene levels (Mena and Reyes, 1998a; Velásquez, 1998).

All of the sites reviewed for the Deseado basin have very similar contents, probably because they are all caves. Thus, functional requirements associated with the use of caves may be shaping the record as we know it. The lack of open-air sites may result from a lack of archaeological visibility or even differential destruction. Sites are usually included in the cultural unit named Toldense (Aguerre, 1976, 1997). The earliest deposits at Los Toldos, even though seen by Patagonian archaeologists as distinctive (Cardich, 1997), can be accommodated within that unit (i.e., Bate, 1982;

Lynch, 1990; Gradín *et al.,* 1987; Dillehay *et al.,* 1992). The use of the Toldense unit makes it difficult to recognize the variability inherent to the cultural manifestations of the Deseado basin. When Aguerre speaks of the Toldense, she refers to a homogeneous kind of adaptation, dated between ca. 9500 and 6500 B.P. (Aguerre, 1997). It is not important whether the Level 11 and the Toldense Industries are discrete entities or whether they can be subsumed under some more general classification. What we need to know is the degree of variation exhibited by early cultural contexts. To accomplish this, we will need more sophisticated sampling and recovery techniques, together with full descriptions of the findings.

The Gallegos Basin (Santa Cruz)

Las Buitreras is a cave located on a basalt cliff, near the Gallegos River (Sanguinetti, 1976; Sanguinetti and Borrero, 1977; Caviglia and Figuerero Torres, 1976; Caviglia *et al.,* 1986; Prieto *et al.,* 1998). In the lowest levels of the long sequence of occupations, bones of at least two ground sloths were closely associated with several flakes and an end-scraper. Mandibles of extinct fox and two American horse teeth were also found. A vertebra, which was previously described as from a dolphin (Caviglia, 1976), probably is a caudal vertebra of a ground sloth. There are no radiocarbon dates for these levels due to the absence of collagen in the sloth bones. A radiocarbon date from the base of a level directly above the deposit with megafauna gives 7670 B.P. ± 70 years (CSIC-372).

The Chico Basin (Magallanes, Chile, and Santa Cruz, Argentina)

Fell is a small cave on the right bank of the Chico River, some 50 km south of Las Buitreras. The site is important not only because it was used by Junius Bird to construct the first systematic sequence for Fuego-Patagonia (Bird, 1937), but also for the quality of its information (Emperaire *et al.,* 1963; Bird, 1988; Clutton-Brock, 1988). Bird divided the cave sequence into five periods. Of concern here are the lower deposits, named Periods I, II, and III by Bird (1988). In the lower deposits, hearths, artifacts, and bones of ground sloth, guanaco, and extinct horse were found in association. The artifacts include abundant projectile points of what has come to be known as the "fishtail" or Fell Cave type. Their abundance suggests intensive activity at the site. Pollen analysis indicates that prior to 11,000 B.P. a treeless herbaceous steppe was predominant, with xeric taxa appearing between 11,000 and 10,000 B.P. (Markgraf, 1988).

However, not only humans contributed to the formation of the deposits. A recent study of the bones stored at the American Museum of Natural History (AMNH), New York, revealed not only cut marks on horse bones, but also carnivore punctures on horse, *Lama* sp., and ground sloth bones (Borrero and Martin, 1996). The size and location of the marks point toward the Patagonian panther (*Panthera onca mesembrina*), a felid well represented in the late Pleistocene of Ultima Esperanza and recently found at Tres Arroyos, Tierra del Fuego (Massone *et al.,* 1998). Moreover, the Fell Cave deposits also include the abundant remains of hawks, falcons, and terrestrial carnivores (Saxon, 1979), further suggesting natural deposition. Human presence can be safely assumed for the lower levels of Fell, as testified by cut marks on bones and abundant artifacts and hearths, but humans were not the only contributors.

Pali Aike is a small cave within the caldera of an extinct volcano (Bird, 1938, 1946, 1988). Bird found the bones of seven ground sloths, American horse, and guanaco, together with human bones and artifacts. He excavated the cave completely, so that its history can be reconstructed only by studying the collections stored at the AMNH. A single radiocarbon date of 8639 B.P. ± 450 years (C-485) should be considered a minimum age (Hyslop, 1988). It is difficult to determine what proportion of the bones should be attributed to human activities. From personal examination of the sloth bones, I cannot argue that they were consumed by humans.

Cerro Sota is a small lava tube, where 12 individuals were found buried (Turner and Bird, 1981; Bird, 1983, 1988). The remains of American horse, ground sloth, and guanaco were also found. Horse hair was analyzed by Whitford, who classified it as being from *Parahipparion saldiasi,* an extinct form (Hyslop, 1988, p. 209). Bird defended the association between megafauna and the human burials, a position that was repeated in the literature (Turner, 1992) until the recent publication of the mid-Holocene dates for the human remains (Hedges *et al.,* 1992). It is now clear that there is no true archaeological association between the megafauna and the humans.

Ultima Esperanza Sound (Chile)

Cueva del Medio is a large cave with evidence of relatively intensive early occupations (Nami, 1987). "Fishtail" projectile points, side-scrapers, and other lithic artifacts were found in association with hearths and the remains of Pleistocene and modern fauna. The Pleistocene fauna includes abundant horse and ground sloth (Nami and Menegaz, 1991). Radiocarbon dates clearly show the presence of humans between 11,200 and 9500 B.P. (Nami and Nakamura, 1995). One radiocarbon date of 12,390 B.P. ± 180

years (Pitt-0343) was obtained on burned bone from within a hearth that also produced dates around 10,500 B.P. At least two layers with human occupation were recognized, but it is difficult to separate them chronologically (Borrero *et al.,* 1998, p. 197). Bones of ground sloth and Patagonian panther were found below the archaeological levels, and the ground sloth bone yielded a date of 12,720 B.P. ± 300 years (NUTA-2341).

Cueva Lago Sofía 1 is a narrow rock-shelter with deposits containing broken and burnt ground sloth, horse, and guanaco remains in association with hearths. The predominant artifacts are side-scrapers and flakes (Prieto, 1991). The cultural layer is radiocarbon dated to 11,570 B.P. ± 60 years (Pitt-0684). Megafauna remains were also recorded below the archaeological levels and dated to 12,990 B.P. ± 490 years (Pitt-0939). Pollen spectra indicate an open environment with scattered *Nothofagus* trees at the time of occupation of the rock-shelter.

Big Island of Tierra del Fuego

Information relevant to the initial peopling of what now is the Big Island of Tierra del Fuego comes from Chile. The Marazzi site, located south of Bahía Inútil on the Strait of Magellan, was excavated in the 1950s by the French Mission (Laming-Emperaire, 1968; Laming-Emperaire *et al.,* 1972). Human occupations near an erratic boulder gave a date of 9590 B.P. ± 200 years (Gif-1023). This site has always been problematical, since the remains were never fully studied. Recently, Flavia Morello (1998) began a study of the collections, after some 30 years of inadequate storage. This study, together with the reopening of the site, should help place the materials within their proper context.

The best evidence from Tierra del Fuego was obtained in several campaigns by a team led by Mauricio Massone at Tres Arroyos (Massone, 1987; Mengoni Goñalons, 1987; Jackson, 1987). Tres Arroyos is a small rock-shelter on the isthmus between Bahia Inutil and Bahia San Sebastian on the north of the island. In its lowest levels were one bifacially retouched fragment, perhaps part of a "fishtail" projectile point (Jackson, 1987), together with marginally retouched artifacts and the remains of guanaco, horse, ground sloth, and extinct fox. There were at least five hearths. A single radiocarbon date of 11,880 B.P. ± 250 years (Beta-20219) is usually interpreted as dating the initial human use of the shelter (Coronato *et al.,* 1999). However, four additional radiocarbon dates range between 10,280 B.P. ± 110 years (Dic-2732) and 10,600 B.P. ± 90 years (Beta-101023 AMS) (Massone *et al.,* 1998). Below the archaeological level was a tephra layer resulting from the 12,000-B.P. eruption of the Reclus volcano. At the time

of occupation of Tres Arroyos, Tierra del Fuego was still connected to the continent.

DISCUSSION

Exploration

There are reasons to defend a slow mode of human advance and colonization, with the successive filling of the areas more highly ranked in terms of food and other resources. This would give a pattern of discontinuous occupation, which is more or less in line with the available record (Borrero, 1989–1990). A major point concerning the first human populations of Fuego-Patagonia is that they were living at low densities. Space and other resources were probably abundant in relation to human needs. Density-independent adaptations are thus indicated. Under these conditions, there was no major need for niche differentiation and it is not necessary to postulate the specialized use of parts of the ecosystem.

It has been noted that during the end of the Pleistocene, when the process of human expansion into Patagonia took place, the general geography and composition of the ecosystems were completely different from today. For example, Tierra del Fuego was not an island and the continent was wider due to glacial low sea levels (Isla, 1989). In addition, those ecosystems were characterized by extinct faunas, as well as floral districts that have no modern analogs. Moreover, we have evidence of a rapidly changing climate, with alternating episodes of cooling and warming (Markgraf, 1993; Heusser, 1994). Tundra and steppe environments, or some related variants, covered most of the landscape. Under these conditions, there were probably changes in the home ranges of humans and other animals. In low-productivity ecosystems like the Magellanic tundra (Dollenz, 1991), where resources are dispersed, mammals require large areas. An increase in the size of the home range also increases prey-search costs and, in general, creates time stress. Time available to obtain food was limited, as was time to search for lithic raw materials. Under such conditions, large social groups are difficult to maintain and only small societies would be really viable. The observed predominance of locally abundant raw materials, intensive utilization of prey, and brevity and lack of redundancy of most occupations are in general agreement with this interpretation of the mode of exploration of Patagonia (Borrero and Franco, 1997). Only Monte Verde, with longer or more repeated occupations, contradicts this scenario. This may suggest that Monte Verde was not a part of the initial exploration of the area, but the result of a more mature phase of settlement, when there was good

knowledge of local resources. Since Monte Verde, located at the northern extreme of the sites considered in this paper, is the oldest site in the region, this, in turn, suggests that southern Patagonia was explored very late in the Pleistocene. This is not unexpected, since environmental conditions before 12,000 B.P. in the south were inhospitable for humans (McCulloch *et al.,* 1997).

As already mentioned, there may have been an equivalent to the Younger Dryas in Fuego-Patagonia, and this would have had an effect on human populations that were living in an almost empty world. Extinctions of human demes, migrations, or at least a reorganization of settlement are possible responses to increasing cold. Minimally, there would be discontinuity in the occupation of near-cordilleran areas and a corresponding delay in the process of human settlement. For the moment, the archaeological record lacks the temporal resolution required to test the hypothesis that the Younger Dryas was a problem to be solved by humans during initial installation (Borrero, 1999a).

An important conclusion follows from this scenario: that only a few regions were colonized during the initial period. It is likely that not all the regions were equally productive, and some were probably well below the levels necessary to sustain or attract human populations during the late Pleistocene. Most of the plateaux were probably habitable only during short periods, in summer. Thus, the basic pattern for the plateaux in the earliest period was probably one of transient use, associated with nomadism. Only with the amelioration of climate of the early Holocene was more intensive settlement of the plateaux possible.

Adaptation and Continuity

A major point is that the human settlement was not necessarily the result of a lengthy process of adaptation to Fuego-Patagonian environments (i.e., Orquera, 1987). In fact, the changing of the environment as a response to changing climate actually precludes this explanation. Instead, humans had to adjust to changing sets of circumstances, which would require different adaptations.

Most of the lithic technologies that were used during the Holocene were already available at the very beginning of the colonization process. Bifacial reduction and blade technology are present in the earlier levels of several sites. Their proportionally low frequencies are best explained in relation to functional needs during the exploration and early colonization of the region. The use of one or another variant, then, was the result of conscious or unconscious selection under different environmental and

situational conditions. This also applies to bone artifacts, which were to become abundant during the Holocene in the southwestern channels (Scheinsohn, 1997).

The faunal evidence from the early sites points toward a generalized subsistence, and it is difficult to maintain the notion that the early inhabitants of Patagonia were specialized hunters of megafauna. In fact, even when Pleistocene mammals were exploited, whether by hunting or scavenging, apparently they were never a critical resource. Thus, although most of the early archaeological faunas contain remains of extinct species, the bones of guanaco, an extant animal, dominate these faunas. This is true even for Cueva del Medio, one of the few sites for which it has been claimed that the American horse was the most important resource (Nami and Menegaz, 1991). Only at Monte Verde do we have a predominance of megafauna, but in this case faunal remains are very few, and the subsistence appears to have been based primarily on plants. General indications, therefore, are of the opportunistic use of Pleistocene mammals together with a more systematic use of guanaco. As for ground sloths, scavenging was probably the main strategy used to obtain this dwindling resource at the end of the Pleistocene.

With the exception of the fringes of northern Patagonia, the available evidence for continental Patagonia supports a model of subsistence based on the consumption of guanaco, sometimes supplemented with South American ostrich. The role of plants, previously hinted at at Las Buitreras, is highlighted by the Monte Verde findings. Small birds and mammals were probably used, but the evidence for this is minimal. Only in northern Patagonia is there some support for the notion that large vertebrates were not important in the human diet. Using the evidence from Cuyín Manzano, Traful 1, Epullán Grande, and Monte Verde, we find support for that scenario up to the Early Holocene. Starting in the Holocene, guanacos became important prey near the Andes.

The Beginning of the Holocene: Living in a Warmer Land

What happened at the beginning of the Holocene? It is necessary to consider the importance of the climatic changes associated with the Pleistocene–Holocene transition for human populations. We have already pointed out the need to solve the Younger Dryas issue and, by extension, the impact of climatic cooling on humans, which may well have slowed the process of colonization. However, the case can be made that the transition itself had no major impact on human populations, since at that time pro-

cesses of adjustment to new environments were only beginning (Borrero, 1996).

There were, indeed, important environmental changes taking place, such as the retreat of the ice masses, the rising of sea levels, and the extensive reforestation. However, from the point of view of humans, these were probably loops within a pattern of environmental instability. The disruption of the Pleistocene trophic chains produced by the extinction of the megafauna coincided with the transition, but, as noted, it did not have any lasting impact on human populations, who appear to have subsisted mainly on guanaco. The sparse human presence in an unpredictable environment was not a particular response to the Pleistocene–Holocene transition, but a pattern probably reflecting the earliness of the stage of colonization.

After the short-term climatic changes of the transition, there was an amelioration in climate. The tundra environment of the Cordilleran region was replaced by *Nothofagus* forest and the grass steppe of the eastern plateau by a shrub steppe of Asteraceae (Paez *et al.,* 1996). The increase in temperature was accompanied by the formation of new biogeographical barriers, such as the Strait of Magellan and the Beagle Channel (Clapperton, 1992; Clapperton *et al.,* 1995). This probably resulted in the isolation of human populations, triggering "founder effects" and leading to high rates of innovation in technology. In any case, nondirectional change is the inevitable result of geographic isolation. On the continent, the strong geographic contrast between the Andes and the vast flat lands of the east would have been critical in molding human adaptations. We must take into account the fact that an increase in seasonality in the west would have made the human exploitation of the Cordillera difficult during winters. On the other hand, low annual rainfall in most of the eastern pampas created conditions under which water sources were magnets for human groups.

In sum, conditions for the colonization of most of the Patagonian ecosystems were better than they had been in the Late Pleistocene. Indeed, there is evidence to support the existence of higher populations, including the relative increase in the number of radiocarbon dates falling within the period 10,000–8000 B.P. (Borrero, 1996), the number of sites with occupations dated within that period, and the depositional rates of artifacts (Borrero, 1994–1995). None of these measures is enough to demonstrate that populations increased, but they are consistent with it. If an increase in population is accepted, then we probably can also accept that a diminution of the size of home ranges took place. The home range is a measure not only of the quantity and distribution of resources, but also of the effectiveness of the exploitation strategies used. Archaeological evidence suggests redundancy in the use of places, and the use of the best locally

available rocks for the exploitation of the more abundant and widespread resource, the guanaco. Indications of increasing use of a diversity of resources, which is a general trend in South America (Stahl, 1996), appear everywhere in Patagonia (Borrero, 1994–1995). Costly adaptations focusing their subsistence on scattered resources, within a more densely populated Patagonia, completely changed the social landscape, in which isolation and, consequently, divergence had previously been the basic characteristics. Competence and territoriality would continue to characterize the subsequent history of human adaptations.

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