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Archeological Hunter-Gatherer Landscapes Since the Latest Pleistocene in Fuego-Patagonia

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1. Introduction

Patagonia reminds the reader of a sort of fascination. It evokes without doubt a very far place on the Earth where time seems to have stopped in glaciers, volcanoes, arid plateaus and living beings (a "finisterre" in the sense of De Agostini, 1929; Darwin, 1983; Herrero Pérez and Salemme, 2005). Patagonia has been of vast and special interest for naturalists, explorers, missionaries, adventurers as well as anthropologists since the sixteenth century. In the last decades, the development of adventure tourism has generated a renewed interest in the search of this far and "mysterious" region. Sub-Antarctic environments, dinosaur bones and nests filled with eggs, fossil wood from huge, ancient trees and archeological sites containing histories about the earliest Americans hold a special attraction for voyagers. Patagonia is thought of as a pure or pristine landscape where scarce population has generated minor changes through time. Nowadays, many research projects inquire into the past and present of this extended territory of approximately 1 million km^2. As fast as the scientific knowledge on these attractive geological, biological and human landscapes grows, the interest for new findings increases as well and it enhances an inspiration source for arts and tourism. Quite a few recent books and films have had their source in this landscape and their inhabitants. As it has been mentioned elsewhere, Patagonia – as well as southern South America – appears as a paradox and, at the same time, as a very well-equipped laboratory for building images of the New World's human colonization (Miotti, 2003a, 147). A paradox, because according to the available models of the peopling of the Americas, it was the last segment of the continent to be occupied by humans and, in spite of this supposition, sites with the same antiquity or even older than those in North America have been discovered during the last two decades. A laboratory, because although there are many Pleistocene archeological sites in the southern Cone, the last 10 yrs have placed this southern end in an advantaged situation to rearrange previous ideas about the first inhabitants – who they were, when and how they came, what aims and ideas they brought with them to accomplish this colonization and how their ways of using space and resources of different Patagonian environments are displayed in the archeological record.

Patagonia displays, as does South America, this dual characteristic, with archeological sites both critical and challenging of the standard models. In this sense, the region has been identified since the sixteenth century as a landscape where the social and natural changes were extremely slow or did not even happen. Early chroniclers, as well as nineteenth-century naturalists – Charles Darwin among them – described the hunter-gatherers of Patagonia as "the last living exponents of Stone Age" or as "the missing link". Cave sites such as Fell Cave (Bird, 1938, 1988) and Los Toldos (de Aparicio, 1933/1935; Menghin, 1952; Cardich *et al.*, 1973) have been frequently taken as providing strong arguments for supporting a great antiquity for the peopling of South America. However, radiocarbon dates coming from the lower levels in Los Toldos Cave 3 have been considered at least as doubtful (Borrero, 1999; Miotti and Salemme, 2003; Waters and Stafford Jr., 2007).

New evidence from Cerro Tres Tetas, La María and Piedra Museo localities has lately questioned the Clovis migration model from the great North American plains (Martin, 1973; Haynes, 1984; Lynch, 1990; Dincauze, 1993; Fiedel, 2006). A reanalysis of the age range for this Clovis model "overlaps non-Clovis sites in North and South America" (Miotti, 2004; Waters and Stafford Jr., 2007), confirming that people would have been already settled elsewhere in the Americas before the arrival of Clovis hunters.

The peopling of the Americas, as a noteworthy issue in American archeology, has always caused a strange interest and fascination to specialists and nonspecialists around the world. Since the classical controversy between Ameghino (1880, 1910) and Hrdlicka (1912)

sector of this continent to be explored and colonized (Miotti, 1998, 2006b). Nevertheless, and even with the feeling that time had stopped there, social and environmental changes that took place were plentiful and diverse. In this sense, this chapter deals with the available archeological knowledge, building a history of the peopling, the mobility of human groups and their relationship with the environment until the arrival of the Europeans. Then, since the sixteenth century, the hunter-gatherer societies were shocked by the global free market rules. Their breakdown had started.

In this chapter, we have focused the attention on Patagonia (both east and west of the Andean ranges) and we will examine the archeological contexts and available radiocarbon dates for three chronological intervals:

1. the Pleistocene–Holocene transition and the Early Holocene: a hazardous life at the uttermost end of the continent;
2. the Middle Holocene: the most significant socio-economic and environmental changes for mobile hunter-gatherer societies occurred during this interval (Borrero, 1989–1990, 2001a; Miotti, 1998, 2001, 2003a, 2006c; Miotti and Salemme, 1999, 2003, 2004);
3. the Late Holocene: when the major population dispersal occurred, until the contact with Europeans took place.

Five subareas will be considered following a N–S direction (Fig. 1). The Andean Cordillera must be taken into account as a barrier, permeable only through a few paths and only after 10 ka BP when the last glaciation finished, thus allowing connection between the Pacific and Atlantic oceans. This mountain range – that runs from north to south across the continent but that changes into a W–E direction in the Fuegian Archipelago – is considered as a regional divide not only for most drainage basins and different landscapes but also as a filter for peopling processes since the earliest occupations during the latest Pleistocene. The criteria used to subdivide this region into subareas have been the main river basins on both slopes (as it has been already considered by Miotti, 2003b, and Miotti and Salemme, 2003). In the following description, the eastern basins are highlighted since they are larger and longer than their western counterparts:

1. Northern Patagonia: from the Río Colorado south to the Río Chubut
2. Central Patagonia: from the Río Chubut south to the Río Deseado
3. Southern Patagonia: from the Río Deseado to the Río Santa Cruz
4. The Magellan Basin: from the Río Santa Cruz to the southern margin of the Straits of Magellan
5. The Fuegian Archipelago

This latter sector, presently separated from the continent by the Straits of Magellan, became an insular area after 8 ^{14}C ka BP (Rabassa and Clapperton, 1990; Clapperton, 1992; Rabassa *et al.*, 2000). Note that all absolute dates herein presented are uncorrected radiocarbon ages, unless otherwise explicitly stated.

This region was the southernmost end of the South American continent until the Pleistocene glacial valley occupied by the "Magellan Glacier" (Bentley *et al.*,

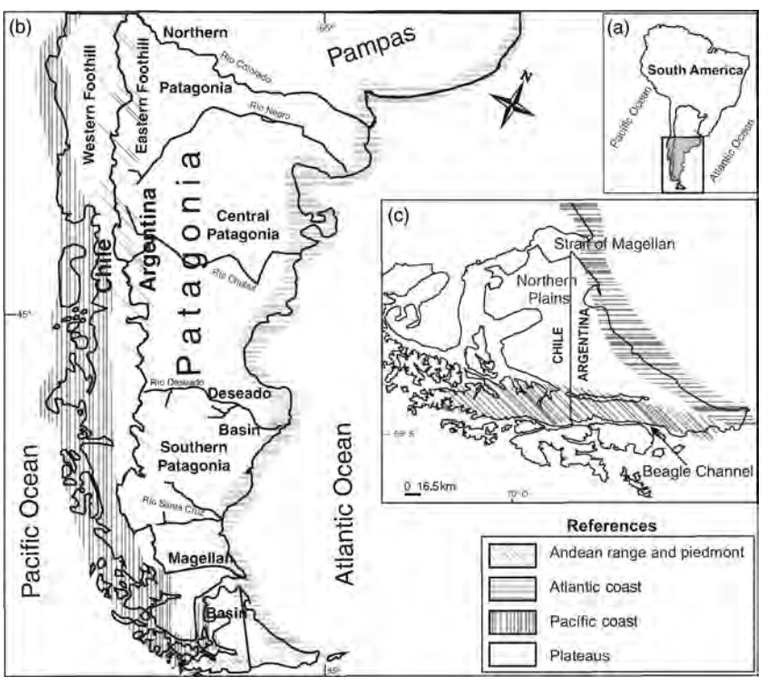

Fig. 1. Location map.

2005; McCulloch *et al.*, 2005) was flooded by marine waters, thus becoming separated from it. Today the archipelago is formed by a major island, Isla Grande de Tierra del Fuego, surrounded by hundreds of minor isles that formed a unique territory together with continental Patagonia during the last glaciation, including also a large extension of the present submarine platform, which was then exposed eastward. This geographic isolation is not a minor question since it affected not only the human population but also the regional ecosystems. Several plant communities are still living both north and south of the Magellan Straits; however, the evolution of fauna and people was different. The history of cultural divergence will be discussed below.

It must be taken into account that the environmental bands show a longitudinal exposure in continental Patagonia, whereas in the main island they are transversal, following the mountain range orientation, with the exception of the coastal zones that fully enclose them (Table 1, see Fig. 1). Three geomorphological/ecological areas have been considered for the continent; from west to east they are (a) the Andean Cordillera, which separates the Pacific Rim from the eastern piedmont, (b) the Patagonian plateaus and (c) the Atlantic coast. In the Fuegian Archipelago, these landscape stripes run from west to east (see Fig. 1 and Table 1).

The western side of the Andes is narrower; due to the shorter length of the streams that drain right away into the Pacific Ocean, narrow fluvial valleys and a few open plains were available landscapes for colonizers. The southern ice sheet was a permanent barrier but low passageways are found again south of 51° S. The northern ice cap has been another barrier for the occupation of the western side, but it was separated from the southern ice sheet since very early Late Glacial times (Chapter 8

Table 1. Main archeological localities and sites arranged in environmental stripes divided into five latitudinal subareas.

Subareas \ Stripes	Andean range and piedmont	Plateaus	Atlantic coast
	Main archeological localities and/or sites		
1. North	Alero Marifilo Monte Verde Cueva Epullán Cueva Haichol El Trébol Cueva del Manzano Traful Cuyín Manzano Alero Nestares Aleros Las Coloradas Alero Los Cipreses El Manantial 1/88 CPO – Corralito Alero Cicuta Pilcaniyeu Cueva Sarita Alero La Figura Alero Larivière Valle Encantado 1 Los Sauces Los Álamos	Casa de Piedra Tapera Moreira Arroyo Quetrequile Angostura Colorada, de Calcatreu Negro Muerto Angostura 1 La Lomita La Petrona La Primavera Laguna Ganso Azul Vacalaufken Ham Ham Plan Luan Yamnago-Anekenk microrregion Sierra de Apas La Rural–Cerro Castillo Gastre 1	San Blas, Isla Jabalí San Matías Gulf, Northern coast
2. Central	Alero Sendero de Interpretación Río Ibáñez Cueva Las Guanacas	Piedra Parada Cerro Pintado	El Riacho La Azucena 1 El Golfito 1 Playa del Pozo Calle Tehuelches Punta León El Elsa Calle Villarino Rawson Bahía Solano 13 Bahía Solano 16 Cabo Tres Puntas 1 Sitio Moreno Cabo Blanco

(Continued)

Table 1. (Continued)

Subareas / Stripes	Andean range and piedmont	Plateaus	Atlantic coast	
	Main archeological localities and/or sites			
3. South	Arroyo Feo Cueva de las Manos Charcamata Alero del Búho Alero Cárdenas Alero Rosamel Meseta Lago Bs As Pto. El Rodeo Cerro Casa de Piedra Cerro de Los Indios Rio Robles Lago Salitroso Baño Nuevo Chorrillo Malo Chan Chan Guaitecas Quillén Morhuilla Lebu Alero Manuk Alero del León A. D. Guardaparque A Dirección Obligatoria A. Gorra de Vasco	Los Toldos Piedra Museo Aguada del Cuero Tito del Valle La Primavera Las Mercedes Cerro Tres Tetas La Reconquista La María El Ceibo Casa del Minero La Martita El Verano Lago Cardiel Guer Aike Las Buitreras Potrok Aike	Médano (1, 3, 4) Laguna del Telégrafo Punta Guanaco Médanos Canal 196 Cañadón del Puerto Cabo Curioso Monte León Punta Bustamante Punta Loyola	
4. Magellan Basin	Punta Bonita-Wualicho Campo del Lago El Sosiego Cerro Verlika Alice-Charles Fuhr Lago Roca Rincón Amigo Sitio Marchand Alero Dos Herraduras Lago Sofía Cueva del Medio Cueva del Mylodon Englefield Ponsonby Punta Colorada Bahía Buena Punta Santa Ana Km 44 Río Verde Camdem Alero Los Chilcos Pizzulic Los Noruegos	El Volcán 4 Cueva Fell Cueva PalliAike Cerro Sota Cañadón Leona Lago Thomas Gould		
5. Fuegian archipelago	**Strait of magellan** Canal Maule Punta Baxa Marazzi	**Steppe/Forest** Tres Arroyos Bloque Errático Cabeza de León Cerro Bandurrias San Genaro La Arcillosa Río Chico Avilés Las Vueltas Chacra Pafoy Marina 1 Río Ewan	**Beagle channel** Lomada Alta del Olivia Túnel Imiwaia Lancha Packewaia Shamakush Isla Salmón Tolkeyén Ajej Mischiuen Seno Lauta Grandi Áridos de Guerrico Caleta Segura Róbalo	**Atlantic coast** Espíritu Santo Punta María Cabo Peñas C. San Pablo María Luisa Rancho Donata Bahía Valentín

2. Paleoenvironments

The earliest peopling in the region took place during the Pleistocene–Holocene transition, a critical time for the dispersal of hunter-gatherer societies. Pioneers that explored and populated the southernmost end of the continent had to face great environmental instability, as a consequence of extreme climatic changes that thoroughly affected the abiotic and biotic structures in different regions; thus, the beginning of the colonization at higher latitudes had to be a long and complex process, as humans were trying to find shelter and successfully flourish in those new landscapes (Borrero *et al.*, 1998; Miotti, 1998, 2003a, 2006b; Borrero, 1999, 2004; Miotti and Salemme, 1999, 2003; among others). The ecosystem instability, which affected not only Patagonia but also other regions around the globe, was ameliorating during the Early Holocene (between 8500 and 7500 ^{14}C yrs BP); however, during the Middle Holocene, i.e. between 7500 and 3500/3000 ^{14}C yrs BP when temperature started to increase, sea level raised and changes in continentality as well as in the Patagonian biota occurred, societies had already begun to establish firm territorial and social networks in the higher latitudes of South America. This process would have continued up to historical times when hunter-gatherers' major dispersal and higher mobility took place, together with environmental trends that developed toward the present configuration of Patagonian landscapes. The acquaintance of the explored territory regarding water availability, raw materials, shelter and other resources, as well as the potential communication network (exchange of raw materials, technological and ideological items or extraregional goods) is shown by the high archeological and temporal variability (Miotti, 1995, 2003b; Flegenheimer *et al.*, 2003; Gnecco, 2003, 2006). However, there is imbalanced quality and quantity of information relating to human population during each period of the Holocene; in fact, such knowledge is very rich for the first and the last interval, but there are less data corresponding to Middle Holocene occupation. A feasible hypothesis to explain this shortage could be the record of deep environmental changes that would have caused the population migration of at least the southernmost area of the American continent (Neme and Gil, 2001; Zárate *et al.*, 2005). Nonetheless, an increase in information during the last years allows to verbalize other hypotheses, bearing in mind not really a removal of people but the introduction of new strategies to get resources or changes in the differential use of the space during the Middle Holocene, a tendency that continued to increase during the Late Holocene (Orquera and Piana, 1999; Salemme and Bujalesky, 2000; Aguerre, 2003; Miotti, 2006b; Salemme *et al.*, in press a). It seems that a potential decrease of human occupation during the Middle Holocene has to be examined from a regional point of view, according to not only paleoenvironmental and paleoclimate differentiation as well as local vegetation patterns (Páez *et al.*, 1999, 2003; Borromei, 2003; Mancini *et al.*, 2005), but also cultural knowledge.

Paleoecological and climatic oscillations occurred all over Patagonia since the end of the Pleistocene and they had deep consequences on the dispersal and distribution of the people during the Holocene (Coronato *et al.*, 1999). In spite of this, the main focus has been directed to the earliest populations because they explored territories under more difficult and changing conditions during the Late Pleistocene–Early Holocene transition. However, weaker archeological indicators and/or sampling bias hide the changes that took place during the Middle Holocene, though Late Holocene times are better documented. In this sense, many research publications on the first and the last stages of human colonization in Patagonia are available, but human dispersal during the Middle Holocene has been treated in a different way (Tables 2–4; Miotti and Salemme, 2003, 2004; Miotti, 2006c). Some recently published papers (Gil *et al.*, 2005; Zárate *et al.*, 2005) as a result of discussions during a symposium (Neme and Gil, 2001) have coupled the scattered and new archeological and paleoenvironmental evidence assigned to the interval 8–4 ka BP. Some reports added significant and differential patterns to the record for this period, compared to previous and later ones, as it will be presented herein.

In Table 5, we have summarized the available information generated through multidisciplinary joint projects, developed along continental and insular Patagonia during recent years. There, pollen analyses, geological data (based upon glaciological, sedimentological, geomorphological, sea level change and volcanological studies), and paleontological and zooarcheological information are integrated showing the main characteristics and processes involved in Patagonia (Heusser and Rabassa, 1987; Rabassa, 1987; Mancini, 1993; Markgraf, 1993; Ariztegui *et al.*, 1997; Páez *et al.*, 1999, 2003; Bennett *et al.*, 2000; Borromei, 2003; Hajzda *et al.*, 2003; Heusser, 2003).

Basically, the scheme suggests the existence of cold and dry conditions at the end of the Pleistocene (ca. 13.0 ka BP), mainly in the Andean and piedmont areas. That was the time of first exploration by humans in the southernmost end of Patagonia, which was apparently different on the western slopes compared to the eastern side and in northern Patagonia in relation to southern Patagonia (see Miotti and Salemme, 2004). Glacier readvance and retreat had a strong influence on the displacement of the *Nothofagus* forest along the Andean Range, but also in the development of shrubby or gramineous steppes during the Pleistocene–Holocene transition in extra-Andean areas. Also, a typical Pleistocene grazer fauna is shown in the record of several sites of the Río Deseado Basin (Miotti and Salemme, 1999, 2005; Paunero, 2003a, b; Paunero *et al.*, 2005); this faunal stock of Pleistocene megamammals or large flightless birds disappeared or was replaced by extant fauna in the Early Holocene, by ca. 9.0 ka BP (Miotti and Salemme, 1999, 2005), when temperature and aridity were increasing. After a period of climatic amelioration during the Pleistocene–Holocene transition, the trend during the Holocene was toward rising aridity for the extra-Andean steppes, whereas the forests were definitively and progressively established along the Cordillera (Heusser, 2003). The only disruption with higher temperature and humidity took place in conjunction with sea level rise by ca. 6.5 ka BP. This worldwide event

Table 2. Pleistocene/Holocene Transition and Early Holocene radiocarbon dates (ca. 13.0–8.5 ka BP).

Localities/Sites	^{14}C years BP	Lab. Code #	References
	Northern Patagonia		
Alero Marifilo-1	10,410 ± 70	Beta-164473	Mera and García, 2004
	10,190 ± 120	Beta-164475	
	8420 ± 40	Beta-138919	
Monte Verde II			Dillehay, 1997; see Table 3.1, pp. 43–44, in which lab codes are shown
MV-6 Layer	12,780 ± 240/11,920 ± 120		
MV-5 Layer	11,800 ± 80/10,860 ± 130		
El Trébol Cave, lower levels	ca. 8000–10,000		Hajduk *et al.*, 2004
Cueva del Manzano, Arroyo Corral	ca. 10,000		Hajduk, 1998
Cuyín Manzano	9,920 ± 85	KN-1432	Ceballos, 1982: 31
Traful 1	9,285 ± 105	GX-1711G	Crivelli Montero *et al.*, 1993
	9,430 ± 230	INGEIS 2676-571	
Cueva Epullán	9,970 ± 100	LP213	Crivelli Montero *et al.*, 1996
	Central Patagonia		
No archaeological data			
	Rio Deseado Basin		
Los Toldos			Cardich *et al.*, 1973
Nivel 11 (Level 11b)	12,600 ± 650	FRA 98 (doubtful)	
Toldense (Level 9)	8750 ± 480	FRA 97 (doubtful)	
Piedra Museo AEP-1	12,890 ± 90	AA-20125	Miotti *et al.*, 1999
1st Occupation U6	11,000 ± 65	AA-27950	Miotti *et al*., 2003
	10,925 ± 65	OxA8528	
Transition U6/U5	10,390 ± 70	OxA8527	
Base U5	10,470 ± 60	OxA9249	
2nd Occupation U5/U4	10,470 ± 65	GRA9837	
	10,400 ± 80	AA8428	
Top U4	9710 ± 105	LP 859	
	9230 ± 105	LP 949	
Cerro Tres Tetas	11,560 ± 140	LP525	Paunero, 2003a
	11,100 ± 150	OxA9244	
	11,015 ± 66	AA39368	
	10,915 ± 65	AA22233	
	10,853 ± 70	AA39366	
	10,850 ± 150	LP781	
	10,260 ± 110	LP800	
Casa del Minero 1 Cave	10,999 ± 55	AA37207	Paunero, 2003b
	10,967 ± 55	AA37208	
La Mesada Cave	9090 ± 40	Beta 135963	Paunero, 2003b
El Ceibo	ca. 9500		A. Cardich, pers. comm.
El Verano Cave 1, IVb	8960 ± 140	I.13,797-1	Durán, 1986/87
	7500 ± 250	INGEIS 2854	
La Martita	8050 ± 90	CSIC-506	Aguerre, 1987
	7940 ± 260	CSIC-506	
	Piedmont, Eastern and Western Andean Basins		
Cueva de Las Manos	9320 ± 90	CSIC-138	Gradín and Aguerre, 1994
	9300 ± 90	CSIC-385	
Arroyo Feo	9410 ± 70	CSIC-514	Gradín and Aguerre 1994
	9330 ± 80	CSIC-396	
	8610 ± 70	CSIC-515	
CCP7	9730 ± 100	n/d	Aschero, 1996
	9100 ± 150	n/d	
	8300 ± 115	n/d	

Table 2. (Continued)

Localities/Sites	^{14}C years BP	Lab. Code #	References
Chorrillo Malo 2	9740 ± 50	GX-25279	Franco and Borrero, 2003
	9690 ± 80	CAMS 71152	
Baño Nuevo 1	13,480 ± 35	UCIAMS-10100	Mena *et al.* 2000
Only Mylodon dermal bones without human association	12,510 ± 30	UCIAMS-10107	Mena *et al*., 2003
	12,400 ± 30	UCIAMS-10111	Mena and Stafford, 2006
	12,325 ± 30	CAMS-32685	
	12,320 ± 30	UCIAMS-10109	
	12,000 ± 35	UCIAMS-10110	
	11,480 ± 50*	CAMS-72356	
	11,410 ± 25	UCIAMS-10104	
	11,265 ± 35	UCIAMS-10106	
	11,255 ± 30	UCIAMS-10105	
	11,250 ± 50	CAMS-71702	
	11,240 ± 40	UCIAMS-10094	
	9530 ± 25	UCIAMS-10093	
	9435 ± 25	UCIAMS-10097	
	9260 ± 25	UCIAMS-10103	
	9245 ± 25	Beta 90888	
	9200 ± 80	CAMS-80532	
	9155 ± 25	UCIAMS-10087	
	9070 ± 50	CAMS-80532	
	9070 ± 25	UCIAMS-10091	
	8990 ± 30	UCIAMS-10098	
	8975 ± 20	UCIAMS-10095	
	8950 ± 50	CAMS-79933	
	8950 ± 60	CAMS-101893	
	8945 ± 45	CAMS-101894	
	8890 ± 90	Beta 90889	
	8850 ± 50	CAMS-36633	
	8880 ± 50	CAMS-36634	
	8695 ± 25	UCIAMS-10099	
	8530 ± 160	Beta 90892	
Magellan Basin			
Cueva Lago Sofía 1	11,570 ± 60	PITT-0684	Borrero, 1999
Fell I	11,000 ± 170	I-3988	Borrero, 1999
	10,080 ± 160	I-5146	
	10,720 ± 300	W-915	
Cueva del Medio	12,390 ± 180**	PITT 0343	Nami and Nakamura, 1995
	11,120 ± 130	NUTA 1737	Borrero, 1999
	11,040 ± 250	NUTA 2197	
	10,960 ± 150	NUTA 2330	
	10,930 ± 230	Beta-39081	
	10,860 ± 160	NUTA 2331	
	10,850 ± 130	NUTA 1812	
	10.710 ± 100	NUTA 1811	
	10,710 ± 190	NUTA 2332	
	10,550 ± 120	GrN-14911	
	10,450 ± 100	NUTA 1735	
	10,430 ± 80	Beta 52522	
	10,430 ± 100	NUTA 1734	
	10,350 ± 130	Beta 58105	
	10,310 ± 70	GrN-14913	
	9770 ± 70	Beta-40281	
	9595 ± 115	PITT-0344	
Alero Marazzi	9590 ± 210	GIF-1034	Morello *et al.*, 1999; Morello, 2000

(Continued)

Table 2. (Continued)

Localities/Sites	^{14}C years BP	Lab. Code #	References
Tres Arroyos	11,880 ± 250	Beta 20219	Massone, 1987, 2003
	11,085 ± 70	OxA-9248	
	10,685 ± 70	OxA-9247	
	10,630 ± 70	OxA-9246	
	10,600 ± 90	Beta 101023	
	10,580 ± 50	Beta 113171	
	10,575 ± 65	OxA-9245	
	10,280 ± 110	Dic. 2732	
	10,420 ± 100	Dic. 2733	
	10,130 ± 210	OxA-9666	

Notes: Localities and sites listed by subareas.
*Dating performed on *Mylodon* dermal bones. They come from the underlying level of the burial context (Mena *et al.*, 2000); they are probably in a secondary association within human burials from the upper level.
**Dating considered equivocal by the authors

AU14 *Table 3. Middle Holocene radiocarbon dates (ca. 8.5–3.5 ka BP).*

Localities/Sites	^{14}C years BP	Lab. Code #	References
	Northern Patagonia		
Alero Marifilo-1	7000 ± 40	Beta-164476	Mera and García, 2004
	5940 ± 40	Beta-164474	
	4870 ± 40	Beta-138918	
Monte Verde II			Dillehay, 1997
MV-3 Upper	6530 ± 110	Beta-52012	
MV-3 Middle	4750 ± 90	Beta-6753	
Cueva Epullán	7900 ± 70	Beta 44412	Crivelli Montero *et al*., 1996
	7550 ± 70	Beta 47401	
	7060 ± 90	Beta 41622	
	5140 ± 70	Beta 611470	
Cueva Haichol	7020 ± 120	n/d	Fernández, 1988-1990
	6775 ± 75		
Casa de Piedra	8620 ± 190	I-12,067	Gradín, 1984 (pp: 42)
	7560 ± 230	I-12,159	
	6080 ± 190	I-12,067	
Tapera Moreira,	4590 ± 60	Beta 91937	Berón and Curtoni, 2002;
lower levels	3900 ± 60	Beta 82556	Politis and Madrid, 2001
	Central Patagonia		
Campo Moncada 2	5080 ± 100	AC 666	Bellelli, 1988
Early occupation	4885 ± 135	AC 1110	Pérez de Micou *et al*., 1992
	4770 ± 90	AC 671	Bellelli, 1991
	Río Deseado Basin		
Central Plateau			
Piedra Museo AE P-1,	7670 ± 110	LP-450	Miotti, 1996;
UE 2	7470 ± 90	LP-850	Miotti *et al*., 1999
La Ventana Cave	7665 ± 75	AA-35237	Paunero, 2003b
	7970 ± 40	Beta-135965	
Los Toldos, Cave 3 "Casapedrense"	7260 ± 350	FRA 96	Cardich *et al*., 1973
Maripe Cave	5084 ± 49	AA65173	Miotti *et al*., in press b AU11
Los Toldos, Cave 13, layer 9	ca. 5500	n/d	Miotti, 1998; A. Cardich, 1990 (pers. comm.)
Cerro Tres Tetas	5220 ± 70	LP-538	Paunero 1994, 2003a
Los Toldos Cave 3	4850 ± 90	LP-136	Cardich, 1984–85

Table 3. (Continued)

Localities/Sites	^{14}C years BP	Lab. Code #	References
La Martita Cave 4	4520 ± 50	CSIC-505	Aguerre, 1987
Lower Component	4475 ± 95	I-11904	
La Mesada cave	4500 ± 40	Beta-135964	Paunero, 2000
Atlantic Littoral			
Médano 1	6300 ± 90	LP-1544	Castro *et al*., in press AU11
Médano Alto	5790 ± 80	LP-1579	Castro *et al*., in press AU11
Sitio 2, 3, 4 y 5, Cabo Tres Puntas	5480 ± 80	LP-1647	Castro *et al*., in press AU11
Sitio 1, Cabo Tres Puntas	6060 ± 70	AA 1363	Castro and Moreno, 1998
	5420 ± 80	LP-1692	Castro *et al*., in press AU11
CCH 1, lower level	5550 ± 90	LP-1539	Caratcoche *et al*., 2005
	Piedmont, Eastern and Western Andean Basin		
Chan Chan Uch 22 Uch18	5340 ± 80	n/d	Navarro Harris and Pino, 1999
	5320 ± 150		
	5000 ± 70		
GUA 010	5020 ± 90	n/d	Rivas *et al*., 1999
Quillén 1	4750 ± 150	n/d	Navarro Harris and Pino,1999
Morhuilla Lebu LE-2 Level II	4690 ± 50	Beta-110334	Quiroz *et al*., 2000
Morhuilla Lebu LE-2 level IV	4900 ± 60	Beta-110335	Quiroz *et al*., 2000
Río Ibáñez RI-16	5340 ± 180	n/d	Mena, 1983
Río Ibáñez RI-22	4720 ± 60	n/d	Lucero and Mena, 2000
Baño Nuevo 1	7990 ± 20	UCIAMS-10090	Mena and Stafford, 2006
	7450 ± 20	UCIAMS-10092	
	7165 ± 25	UCIAMS-10089	
	4180 ± 25	UCIAMS-10086	
	3925 ± 25	UCIAMS-10088	
Las Guanacas Cave	4830 ± 60	n/d	Lucero and Mena, 2000
Alero Cárdenas (7b)	7750 ± 125	AC-497	Alonso *et al*., 1984–1985
	7300 ± 200	AC-499	
De las Manos Cave	7280 ± 60	NOVA-117	Gradín *et al*., 1976
Arroyo Feo	6000 ± 60	CISC-518	Alonso *et al*., 1984–1985
	5500 ± 50	CISC-519	
	5500 ± 60	CISC-800	Gradín and Aguerre, 1994
	4900 ± 50	CISC-397	
	4480 ± 60	CISC-521	Alonso *et al*., 1984–1985
	4050 ± 50	CISC-520	
Alero Charcamata	5290 ± 60	CISC-800	Gradín and Aguerre, 1994
	5040 ± 60	CISC-801	
Puesto El Rodeo	4860 ± 150	AC-1075	Gradín and Aguerre, 1994
CCP 7	8300 ± 115	LP384	Aschero, 1996
	7060 ± 105	LP397	
	6130 ± 90	LP-286	Aschero *et al*., 1992
	5610 ± 100	LP-374	
	5320 ± 90	LP-300	
	5310 ± 110	LP-282	
	5120 ± 80	n/d	Rindel, 2004
	4270 ± 90	n/d	
CCP 5	6780 ± 110	n/d	Rindel, 2004
	6540 ± 110	Beta-27796	Aschero *et al*., 1992
	5170 ± 70	Beta-59924	Aschero, 1996

(Continued)

Table 3. (Continued)

Localities/Sites	^{14}C years BP	Lab. Code #	References
	5120 ± 80	Beta-59926	
	4930 ± 160	AC-1102	Aschero *et al*., 1992
	4850 ± 110	Beta-27797	
	4735 ± 110	AC-11101	
	4590 ± 60	Beta-59923	Aschero, 1996
	4330 ± 120	AC-1103	Aschero *et al*., 1992
Alero Manuk I (level 12)	6790 ± 40	UGA 10011	Goñi *et al*., 2004
Alero del León (great crevice)	6550 ± 440	UGA 8714	Goñi, 2000–2002
Chorrillo Malo 2	6170 ± 50	CAMS 71153	Franco and Borrero, 2003
Alero Destacamento Guardaparque	6700 ± 70	n/d	Rindel, 2004
	5570 ± 70	n/d	
	4900 ± 70	n/d	
Cerro de los Indios 1 Layer 17	3860 ± 90	LP 455	Aschero *et al*., 1992; Aschero, 1996; Aschero *et al*., 1999; Figuerero Torres, 2000; Aguerre, 2003
	Magellan basin		
Las Buitreras Layer V	7670 ± 70	n/d	Sanguinetti, 1976
Cueva del Medio	4290 ± 13	Beta 37167	Nami and Nakamura, 1995
Fell III Layer 8	6740 ± 130	I-5138	Bird, 1988
	6560 ± 115	I-5141	
	6485 ± 115	I-5140	
Pizzulic	6225 ± 70	n/d	San Román and Prieto, 2004
Los Noruegos	5585 ± 65	n/d	San Román and Prieto, 2004
Ponsonby layer D	7450 ± 80	Gif-10139	Legoupil and Fontugne, 1997
layer D	6690 ± 130	Gif-10140	
layer B	4605 ± 55	Gif-10138	
layer B	4580 ± 70	GifA-93233	
layer B	4430 ± 50	Gif-9567	
layer B	4150 ± 100	Gif-10141	
layer B	4130 ± 75	Gif-10142	
Bahía Colorada	5500 ± 70	n/d	Legoupil, 1997 (in Manzi, 2004)
Punta Santa Ana 1	6810 ± 70	GrN 7612	Legoupil and Fontugne, 1997
	6020 ± 120	Gif 2928	Ortiz Troncoso (in Manzi, 2004)
	5620 ± 120	n/d	
Bahía Buena	5895 ± 65	GrN 7614	Legoupil and Fontugne, 1997
	5770 ± 110	GrN 7613	
	5210 ± 110	Gif 2927	
Potrok Aike	4480 ± 60	n/d	Gómez Otero, 1996
	4050 ± 50	n/d	
Laguna Thomas Gould III (equivalent to Fell IV)	4560 to 4280	n/d	Massone, 1989–1990; Borrero *et al*., 1991
Cerro Sota	3900	n/d	Borrero, 1993
Lago Sofía 1, human cremation	3950 ± 60	PITT-0526	Prieto, 1991
	3915 ± 60	PITT-0527	
	Tierra del fuego archipelago		
Beagle Channel			
136 Áridos Guerrico	6495 ± 60	A10918	Ocampo and Rivas, 2000
Seno Grandi 1	6160 ± 110	Gif-8851	Legoupil 1993–1994
	6120 ± 80	Gif-9314	
Caleta Segura, 169B	5635 ± 70	A10913	Ocampo and Rivas, 2000

Table 3. (Continued)

Localities/Sites	^{14}C years BP	Lab. Code #	References
Cleta Segura, 171 Bahía Honda	4895 ± 60	A10914	Ocampo and Rivas, 2000
Túnel I 1st Comp.	6980 ± 110	Beta 2517	Orquera and Piana, 1999
	6680 ± 210	AC 674	
2st Comp.	6470 ± 110	Beta 21969	
	6200 ± 100	Beta 3270	
	6150 ± 220	AC 883	
	6140 ± 130	Beta 2819	
	6070 ± 100	CSIC 310	
	6020 ± 120	AC 1028	
	5960 ± 70	CSIC 309	
	5950 ± 170	AC 838	
	5850 ± 70	CSIC 308	
	5840 ± 185	AC 845	
	5700 ± 170	AC 236	
	5690 ± 180	AC 238	
	5630 ± 130	AC 683	
	5050 ± 520	AC 844	
	4590 ± 130	AC 833	
3rd Comp.	4300 ± 80	Beta 4385	
Lancha Packewaia Older Component	4900 ± 70	CSIC-307	Orquera and Piana, 1995;
	4215 ± 305	MC-1068	Roquera and Piana, 1999
Mischiuen	4890 ± 210	AC 1626	Piana *et al*., 2004
	4330 ± 180	AC 1648	
Imiwaia I	6490 ± 120	AC 1400	Roquera and Piana, 2000
	6274 ± 119	AC 1398	
	6048 ± 111	AC 1399	
	5872 ± 147	AC 1397	
Lomada Alta del Mte. Olivia	5600 ± 125		Roquera and Piana, 1999
	5410 ± 160		
Peninsula Mitre			
Bahía Valentín 11	5900 ± 80	Beta 23138	Vidal, 1988
	4939 ± 43	AA 66713	Vázquez *et al*., in press AU11
	4359 ± 42	AA 66714	
Northern Area			
Marazzi Rockshelter	5570 ± 400	n/d	Laming Emperaire, 1968,
	5440 ± 30		Morello *et al*., 1998
Cerro Bandurrias	5700 ± 180	AC 1599	Favier Dubois and Borrero, 2005
Río Chico 1	5856 ± 44	AA65165	Santiago *et al*., in press AU11
AU13	5918 ± 44	AA65166*	Salemme *et al*., in press a AU11
La Arcillosa 1	5410 ± 70	CSIR-7685	Salemme and Bujalesky, 2000
La Arcillosa 2	5508 ± 48	AA60934	Salemme *et al*., in press a AU11
	5205 ± 58	AA60935	
	4440 ± 60	LP 994	Salemme and Bujalesky, 2000;
	3690 ± 70	CSIR-7682	Bujalesky, 1998
La Arcillosa 3	5353 ± 53	AA65164	Salemme *et al*., in press a

brought several changes in the distribution of people along Patagonia; it matched also with different volcanic events and the collapse of rockshelter roofs, which are mirrored in the abandonment of some archeological localities in Patagonia and/or in the improvement of landscape use in different ways (Orquera, 2005; Zárate *et al.*, 2005; Miotti, 2006c).

Thus, in Table 5, temporal disturbance of some climatic or environmental events is observed. It could be considered whether data come from the Andean

Table 4. Late Holocene radiocarbon dates (ca. 3.4 ka BP–AD 1500).

Localities/Sites	^{14}C years BP	Lab. Code #	References
		Northern Patagonia	
Alero Marifilo-1	590 ± 50	UCTL-1278	Mera and García, 2004
Cueva Epullán	2740 ± 50	n/d	Crivelli Montero *et al*., 1996,
	2360 ± 50	n/d	Crivelli Montero and Fernández, 2004
	1720 ± 50	Beta 61145	
	320 ± 60	Beta 54769	
Alero Nestares	1550 ± 50	LP 1157	Chauvin, 2000
Alero Las Coloradas	1525 ± 80	I 11308	Crivelli Montero and Fernández, 2004
Alero Los Cipreses	3490 ± 80	LP 159	Silveira, 1996
	2890 ± 100	INGEIS 2814-936	
	1510 ± 90	LP 145	
	840 ± 90	INGEIS 2813-954	
Cueva Haichol	2440 ± 100		Fernández, 1988–1990
	2130 ± 110		
Cueva Traful I	2230 ± 40	LJ 5130	Crivelli Montero *et al*., 1993
El Manantial 1/88, Sondeo 16	1360 ± 90	Beta 92642	Sanguinetti *et al*., 1999
	1310 ± 70	Beta 92641	
	1040 ± 70	Beta 92640	
	540 ± 60	LP 590	
CPO, Corralito subarea	2840 ± 80	n/d	Sanguinetti *et al*., 1999
(lower layers)	2710 ± 100	n/d	
Alero Cicuta			Silveira, 1999
Layer 3 lower level	1370 ± 55	LP 637	
Layer 3 top	1080 ± 50	LP 650	
Tapera Moreira – La Lomita	2960 ± 90	Beta 91934	Berón and Curtoni, 2002
Burial			Politis and Madrid, 2001
Tapera Moreira – Site 3	2630 ± 60	Beta 82558	Berón and Curtoni, 2002
Burial			Politis and Madrid, 2001
Tapera Moreira site 1			Berón and Curtoni, 2002
1st Occupation	3470 ± 80	Beta 91936	Politis and Madrid, 2001
	3010 ± 80	LP 264	
2nd Occupation	2320 ± 70	Beta 82557	
	2200 ± 40	Beta 91935	
	2110 ± 70	LP 275	
	1940 ± 90	LP 358	
	1870 ± 70	Beta 81695	
	1830 ± 100	LP 352	
	1800 ± 80	LP 343	
3rd Occupation	1190 ± 60	LP 265	
Tapera Moreira – Site 5 – 3rd	1710 ± 90	LP 340	Berón and Curtoni, 2002
Occupation	740 ± 50	Beta 81698	Politis and Madrid, 2001
	730 ± 40	Beta 91938	
La Petrona	770 ± 49	AA43125	Martínez, 2004
	481 ± 37	AA43124	
	462 ± 39	AA43123	
	411 ± 39	AA43112	
	352 ± 51	AA43126	
	314 ± 45	AA43127	
La Primavera	2800 ± 60	GX28772	Martínez, 2004
		Central Patagonia	
Campo Moncada 2	3350 ± 90	AC 670	Bellelli, 1988
	3210 ± 50	U.G 7621	Nacuzzi, 1987
	1750 ± 80	AC 669	Bellelli, 1998

Table 4. (Continued)

Localities/Sites	^{14}C years BP	Lab. Code #	References
Late Occupation	860 ± 80	AC 668	Pérez de Micou, 2002
	780 ± 80	AC 667	Carballido Calatayud, 2004
La Rural (Cerro Castillo)	3470 ± 70	LP 514	Stern *et al*., 2000
	2240 ± 90	LP 359	Belardi, 1996
	1740 ± 90	LP 371	
Cerro Pintado	1870 ± 80	LP 1313	Bellelli *et al*., 2003
	1120 ± 60	LP 1427	
	1100 ± 60	LP 1439	
	680 ± 60	LP 1333	
Los Alerces Alero Sendero	1670 ± 80	LP456	Arrigoni and Fernández, 2004>
Interpretación, Comp.II	1450 ± 70	LP556	
Aceramic, Comp. IIb	740 ± 70	LP1118	
Ceramic, Comp.	400 ± 40	LP1119	
El Riacho Level 2	3220 ± 70	n/d	Gómez Otero *et al*., 1999
Level 1	2640 ± 70	n/d	
Las Lisas Conchero 2	2600 ± 60	LP 868	Gómez Otero and Stern, 2005
Calle Tehuelches	2410 ± 50	LP 692	Gómez Otero and Dahinten, 1998
El Elsa (Rawson)	1990 ± 50	LP 712	Gómez Otero and Dahinten, 1998
Playa del Pozo	1540 ± 50	LP 651	Gómez Otero and Dahinten, 1998
Punta León (open sea coast)	1050 ± 50	LP 678	Gómez Otero and Dahinten, 1998
La Azucena I	880 ± 50	LP 633	Gómez Otero and Dahinten, 1998
El Golfito 2	770 ± 50	LP 685	Gómez Otero and Dahinten, 1998
Calle Villarino	550 ± 60	LP 839	Gómez Otero and Dahinten, 1998
La Armonía (2)	470 ± 45	LP 969	Gómez Otero *et al*., 2002
	460 ± 40	LP 1001	
Rawson	440 ± 50	LP 697	Gómez Otero *et al*., 1998
Los Abanicos 1	380	LP 889	Gómez Otero and Suárez, 1999
Gastre 1 (Central Plateau of Chubut)	350 ± 50		Gómez Otero *et al*., 2000
Bahía Solano 16	2954 ± 195	I-11-794	Caviglia *et al*., 1982
Bahía Solano 13	205 ± 95	n/d	Gómez Otero *et al*., 1998
		Deseado river basin	
Central Plateau			
Los Toldos, Cave 3 Industries 1,2,3	ca. 2500	n/d	Cardich *et al*., 1973
Los Toldos, Cave 13, layer 6	ca. 2500	n/d	Miotti 1998; A. Cardich, pers. comm. 1990
La Martita	2190 ± 115	AC 604	Aguerre,1987
	1620 ± 90	AC 603	
Cerro Tres Tetas layer 3b bed Strwa	2190 ± 70	LP-541	Paunero, 1994
Layer 3a, bottom	1740 ± 60	LP-1117	Paunero, 2003a
Layer 3a, top	1340 ± 50	LP-1180	
	830 ± 60	LP-770	
Cueva Maripe	3210 ± 60	LP-1497	Miotti *et al*., in press b AU11
	1078 ± 40	AA65176	
Cueva Moreno	3000 ± 110	OS-23754	Miotti *et al*., 2005
Las Cuevas 2	2940 ± 90	S/d	Mengoni Goñalons, 1987
	2510 ± 110		
Cueva de La Hacienda	2250 ± 70	OS-23753	Miotti *et al*., 2005
Chenque El Sargento	727 ± 48	AA65180	Miotti, 2006d

(Continued)

Table 4. (Continued)

Localities/Sites	^{14}C years BP	Lab. Code #	References
Atlantic Littoral			
Cabo Blanco 2	3310 ± 60	LP-992	Castro *et al*., 2005
	1700 ± 30	Beta 134598	Moreno, 2003
	960 ± 60	Beta 134599	Moreno, 2003
Sitio Moreno Comp.3	3290 ± 90	1063cSM	Moreno and Castro, 1995
Comp. 1	2720 ± 50	LP 206	
Médano 1, hearth 1	2390 ± 90	LP-1536	Zubimendi *et al*., 2005
Laguna del Telégrafo (M-259)	2380 ± 60	LP-1677	Castro *et al*., in press AU11
Punta Guanaco 91	2280 ± 60	LP-1694	Castro *et al*., in press AU11
Médanos DEL Canal 196	2280 ± 70	LP-1522	Zubimendi *et al*., 2005
Médano 3	2240 ± 80	LP-1532	Zubimendi *et al*., 2005
Punta Guanaco 97	1480 ± 70	LP-1648	Castro *et al*., in press AU11
Cabo Blanco 1	1420 ± 50	Beta 134597	Moreno, 2003
Cañadón del Puerto	1040 ± 40	LP-1298	Iantanos, 2003
Médano 4, bouy	920 ± 40	LP-1344	Zubimendi *et al*., 2005
	Piedmont, Eastern and Western Andean basins		
Río Ibáñez RI-50b	2290 ± 90	n/d	Lucero and Mena, 2000
Baño Nuevo 1	2830 ± 70	Beta 90894	Mena *et al*., 2000
CCP 5	2805 ± 105	AC-1107	Aschero *et al*., 1992; Aguerre, 2003
	2740 ± 105	AC-1104	
	2550 ± 50	Beta-27798	
CCP7	3480 ± 70	LP-294	Aschero *et al*., 1992
	3460 ± 70	LP-279	
Alero Cárdenas	3450 ± 110	AC-498	Alonso *et al*., 1984–1985
	1180 ± 85	AC-500	
De las Manos Cave	3380 ± 90	Nova-116	Gradín *et al*., 1976
	1610 ± 60	Nova-115	
	430 ± 50	CSIC-137	
Arroyo Feo	3330 ± 50	CISC-398	Gradín *et al*., 1979
	3260 ± 50	CISC-522	Alonso *et al*., 1984–1985
	1885 ± 36	CSIC-523	
	1660 ± 50	CSIC-399	
	1170 ± 50	CSIC-524	
Alero Rosamel	1590 ± 70	CSIC-799	Gradín and Aguerre, 1994
	1570 ± 50	CSIC-798	
Alero del Buho	1520 ± 50	CSIC-511	Alonso *et al*., 1984–1985
	1450 ± 50	CSIC-512	
	1170 ± 50	CSIC-513	
	960 ± 50	CSIC-584	
	900 ± 50	CSIC-545	
Alero Dirección	1510 ± 50	Beta-27800	Aschero *et al*., 1992
Obligatoria	1200 ± 70	LP-281	
	770 ± 60	LP-301	
	390 ± 110	LP-283	
	240 ± 50	LP-277	
Puesto El Rodeo	1380 ± 90	AC-943	Gradín and Aguerre, 1994
Alero Gorra de Vasco	1360 ± 60	LP-289	Aschero *et al*., 1992
	490 ± 60	LP-276	
	360 ± 60	LP-293	

Table 4. (Continued)

Localities/Sites	^{14}C years BP	Lab. Code #	References
Alero Destacamento		n/d	Rindel, 2004
Guardaparque layer 5 (5a)	3.440 ± 70	LP-290	Aschero *et al*., 1992
	2830 ± 60	LP-281	
	1200 ± 70	LP-288	
	890 ± 70	Beta-27799	
	200 ± 50		
Cerro de los Indios 1			Aschero *et al*., 1992; Aschero, 1996;
Layer 3-4	3400 ± 90	LP 480	Aschero *et al*., 1999; Figuerero Torres,
Layer 3c2	3350 ± 110	LP 378	2000; Aguerre, 2003
Layer 3e	3320 ± 50	CSIC 395	
Layer 2	3230 ± 120	LP 369	
Layer 3d	3150 ± 90	AC1098	
Area 3 layer 6	1790 ± 50	LP 493	
Area 2 layer 11	1420 ± 50	CSIC-394	
layer 7b3f	1630 ± 50	n/d	
layer 7bf	1170 ± 50	n/d	
layer 6a	1810 ± 50	LP 708	
layer 6a	1660 ± 60	LP 679	
layer 5b	1290 ± 50	LP 687	
layer 4	1250 ± 50	LP 689	
Area 1 layer 3b	1420 ± 50	CSIC 394	
layer 3b	990 ± 110	AC-1099	
CCP7	3480 ± 70	LP-294	Aschero *et al*., 1992
	3460 ± 70	LP-279	
SAC4N2 (niche)	2607 ± 41	AA38568	Goñi and Barrientos, 2004;
SAC4N1 (niche)	2520 ± 40	AA38567	Zangrando *et al*., 2004
SAC1-7-1 chenque	1147 ± 37	AA38559	
SAC1-7-2	1142 ± 42	AA385561	
SAC4-1-1 chenque	794 ± 63	AA38565	
SAC1-6-1 chenque	756 ± 32	AA38556	
SAC1-6-2	690 ± 40	AA38557	
SAC1-6-3	539 ± 46	AA38558	
SAC10-1-1 chenque	662 ± 43	AA38569	
SAC10-1-4	687 ± 43	AA38570	
SAC1-1-3	352 ± 40	AA38555	
SAC1-1-8	622 ± 57	AA38560	
SAC1-2-1	418 ± 40	AA38553	
SAC1-2-2	389 ± 40	AA38552	
SAC20-3-2	380 ± 40	UGA10623	
Chorrillo Malo 2	3790 ± 80	Beta 148743	Franco and Borrero, 2003
	1950 ± 60	LP 502	
Alero del Bosque 3 Bloque errático	3110 ± 50	Beta 91301	Franco, 2002
Alero 2 Punta Bonita	2540 ± 70	LP-402	Borrero and Franco, 2000
Campo del Lago 2	2940 ± 90	LP-235	Borrero and Franco, 2000
El Sosiego 2	1920 ± 40	GX-25278	Borrero and Franco, 2000
El Sosiego 4	1640 ± 90	LP-420	
Cerro Verlika 1	1685 ± 70	GX-25277-G	Borrero and Franco, 2000
Alice 1	1420 ± 70	Beta 112231	Borrero and Franco, 2000
	1480 ± 70	Beta 112232	
Charles Fuhr	1120 ± 110	LP-406	Borrero and Franco, 2000
Lago Roca 3	170 ± 30	Beta 91302	Borrero and Franco, 2000

(Continued)

Table 4. (Continued)

Localities/Sites	^{14}C years BP	Lab. Code #	References
		Magellan Basin	
Fell V layer 4	685 ± 90	I-5139	Bird, 1988
Cueva del Medio (unidentif.component)	2100 ± 60	Beta 52521	Nami and Nakamura, 1995
Alero Dos Herraduras, IV	2.870 ± 65	DIC-2622	Borrero *et al*., 1991.
Cerro Sota	3755 ± 65 3645 ± 65	n/d	Bird, 1988; Guichón *et al*., 2001
Cañadón Leona	2280 ± 60 2270 ± 50 2130 ± 80 1740 ± 70	GIF 10791 GIF 10790 GIF 10236 GIF 10789	Prieto *et al*., 1998
El Volcán Cave, layer 3	3600 ± 100	n/d	Massone, 1981
Lago Sofía 1, human cremation	3950 ± 60 3915 ± 60	PITT-0526 PITT-0527	Prieto, 1991
Pta. Bustamante			Mansur, 1988, Mansur, in press
RUD01BK	3690 ± 80	LP 533	
RUD01BK	3400 ± 60	LP 521	
RUD01BK	3200 ± 80	LP 160	
RUD01BK	3050 ± 60	LP 192	
RUD02FOI	2550 ± 50	LP 499	
CEM02LPM	1060 ± 50	LP 187	
HST01AM	890 ± 90	LP 454	
HST01AM	750 ± 70	LP 479	
CEM04CAN	710 ± 40	LP 201	
Cueva del Mylodon	2566 ± 45	BM-1202	Borrero *et al*., 1991
Camden 2-10	3030 ± 80	Beta 153514	Morello *et al*., 2001
KM44	2960 ± 60	Beta 153516	Morello *et al*., 2001
Puesto León 1	1570 ± 50	Beta 123470	San Román and Morello, 1999
Alero Los Chilcos 1	1100 ± 60	Beta 151873	Morello *et al*., 2001
Canal Maule	920 ± 55	Ua 17351	San Román and Morello, 2001
Angostura Titus o SK14	860 ± 30	n/d	San Román and Morello, 2001
Río Verde I	280 ± 60	Beta 152793	Morello *et al*., 2001
Caleta 2-14	110 ± 40	Beta 153515	Morello *et al*., 2001
		Tierra Del Fuego Archipelago	
Beagle Channel			
Seno Lauta	2780 ± 110 1080 ± 60 280 ± 90	n/d n/d n/d	Ortiz Troncoso, 1978
Caleta Segura, 170C	1895 ± 60	A10917	Ocampo and Rivas, 2000
Punta Baxa, 7	1820 ± 10	Beta 149813	In: Martín, 2004
Eugenia, 52	1590 ± 70	Beta 127304	Ocampo and Rivas, 1999
Caleta Segura, 169A	1540 ± 70	A10912	Ocampo and Rivas, 2000
Bahía Virginia, 282	1490 ± 60	Beta 127306	Ocampo and Rivas, 1999
Róbalo, 113	1275 ± 50	A10910	Ocampo and Rivas, 2000
Guerrico Alto, 138	945 ± 30 870 ± 60	RT-3214 Beta 127300	Ocampo and Rivas, 1999
Ens. Villarino, 296	880 ± 60	Beta 127301	Ocampo and Rivas, 1999
C. Segura/B. Honda 172B	920 ± 20 810 ± 60	TR-3215 Beta 127303	Ocampo and Rivas, 1999
Cal. Santa Rosa 390	590 ± 70	Beta 127308	Ocampo and Rivas, 1999

Table 4. (Continued)

Localities/Sites	^{14}C years BP	Lab. Code #	References
Puerto Eugenia 27B	630 ± 40	A10915	Ocampo and Rivas, 2000
Róbalo, 113 Bosque	365 ± 40	A10911	Ocampo and Rivas, 2000
Isla Martínez, 198	220 ± 90	A10916	Ocampo and Rivas, 2000
Túnel I	3530 ± 90	AC 702	Orquera and Piana, 1999
	2930 ± 100	AC 856	
	2880 ± 60	Beta 4387	
4th Comp.	2690 ± 80	Beta 2516	
	2660 ± 100	AC 1030	
	2520 ± 135	AC 854	
5th Comp.	2000 ± 110	AC 852	
	1990 ± 110	AC 851	
6th Comp.	1920 ± 80	AC 850	
	670 ± 80	AC 701	
	450 ± 60	Beta 4388	
Túnel II	1140 ± 90	AC 1031	Orquera and Piana, 1999
	1120 ± 90	AC 824	
Lancha Packewaia	1590 ± 50	CSIC 312	Orquera and Piana, 1999
Late Component	1120 ± 50	CSIC 311	
	1080 ± 100	MC 870	
	470 ± 50	CSIC 314	
	455 ± 85	MC 1063	
	410 ± 75	MC 1066	
	280 ± 85	MC 1062	
	280 ± 85	MC 1064	
Shamakush I	1927 ± 120	AC 1291	Orquera and Piana, 1999
	1020 ± 100	AC 1293	
	940 ± 110	AC 1047	
	890 ± 10	AC 1029	
Shamakush VIII	1490 ± 90	AC 1678	Piana and Vázquez, in press
	1380 ± 115	AC 1681	
	730 ± 55	AC 1679	
Shamakush X	1450 ± 100	AC 831	Orquera and Piana, 1999
	500 ± 100	AC 832	
Shamakush Enterratorio	620 ± 60	AC 1680	Piana *et al*., 2006
Mischiuen I layer D/E	1970 ± 190	AC 1625	Piana *et al*., 2004
layer C	1060 ± 85	AC 1624	
layer C	890 ± 90	AC 1623	
Mischiwen III	625 ± 25	KIA 19492	Piana *et al*., 2006
Ajej I	1400 ± 90	AC 1584	Piana *et al*. 2001
Isla El Salmón 5	1820 ± 120	AC 939	Figuerero Torres and Mengoni Goñalons, 1986; Figuerero Torres, 1988
	1765 ± 25	GrN 12430	
	1560 ± 90	AC 938	
Río Pipo 17	1080 ± 85	GX 14317	Figuerero Torres and Mengoni Goñalons, 1986
Tolkeyen	760 ± 80	GX 14315	Figuerero Torres and Mengoni Goñalons, 1986
	490 ± 80	GX 14316	
Mitre Peninsula			
Bahía Valentín S 11	1870 ± 50	Beta 23139	Vidal, 1988
	1350 ± 60	Beta 23140	
	550 ± 50	Beta 23141	
	modern	AC 0964	Vázquez *et al*., in press
Bahía Valentín S13	370 ± 120	AC 0966	Vidal, m.s. unpublished
Bahía Valentín S1	335 ± 85	AC 0965	Vidal m.s. unpublished

(Continued)

Table 4. (Continued)

Localities/Sites	^{14}C years BP	Lab. Code #	References
Bahía Valentín S1	modern	AC 0968	Vázquez *et al*., in press
Bahía Valentín S42	984 ± 36	AA 66715	Vázquez *et al*., in press
Fagnano Lake Area			
Marina 1	1800 ± 250	AC 1471	Mansur *et al*., 2000
	900 ± 170	AC 1470	
Northern Area			
Marazzi 2	910 ± 70	Beta 113690	Morello *et al*., 1998
Marazzi 38	795 ± 35	UA 21182	In: Martín, 2004
	785 ± 35	UA 21183	
Bloque Errático	785 ± 120	n/d	Borrero and Casiraghi, 1980; Borrero *et al*., 1985
Espíritu Santo 1	960 ± 80	LP 453	Horwitz, 1995, 2004
Cabeza de León 1	1100 ± 95	MC 1069	Saxon, 1979
	230 ± 60*	LP 604	Borrero, 2000
Cabeza de León 4	3780 ± 70*	LP 607	Favier Dubois, 1998; Borrero, 2000
	1600 ± 60*	LP 413	
Puesto Pescador	335 ± 35	AA69652	Salemme *et al*., in press b
San Genaro 1	1070 ± 80	Beta 51997	Horwitz, 1995; Isla and Selivanov, 1993; Favier Dubois and Borella, 1999
	1479 ± 90	INGEIS 1403	
	1620 ± 140	Moscow Ac.Sc.	
	1190 ± 90	Moscow Ac.Sc.	
	610 ± 45	LP 661	
San Genaro 2	1483 ± 80	AC 1404	Horwitz, 1995; Favier Dubois and Borella, 1999; Favier Dubois 2001; Martín 2004
	1420 90	AC 1484	
	520 ± 80		
	440 ± 70	LP 785	
	380 ± 70	Beta 82291	
	250 ± 80	LP 1291	
San Genaro 3	600 ± 90	AC 1600	
Avilés 1	1609 ± 38	AA69653	Santiago and Oría, in press
Las Vueltas 1	949 ± 41	AA69656	Salemme and Santiago, unpubl.
Chacra Pafoy 1	320 ± 60	LP 1069	Salemme and Bujalesky, 2000
Chacra Pafoy 3	804 ± 33	AA65162	Santiago *et al*., in press
	332 ± 39	AA65163	
Cantera Rhasa	1314 ± 36	AA69654	Salemme *et al*., in press b
Margen Sur 1	1295 ± 50	AA69657	Salemme *et al*., in press b
	897 ± 38	AA69655	
Cabo Peñas	620 ± 45	CSIR 7684	Salemme and Bujalesky, 2000
Punta María 2 (upper levels)	1230	n/d	Borrero, 1985
	300 ± 100	n/d	
	250	n/d	
San Pablo	290 ± 70	n/d	Borrero, 1985
María Luisa	1020 ± 80	n/d	Lanata, 1985; Borrero, 1985
	360 ± 50	n/d	Yesner *et al*., 1991

Note: Localities and sites listed by subareas.

Range or from the plateaus (or steppe areas). Based on pollen results, this disruption is also related to latitudinal effects; besides, the palynological sections usually come from sites along the Andean Range piedmont and fewer of them do so from the steppe (most of them from caves). Peat bogs, mires and caves are the best places for sampling pollen; while the first two are excellent, the arid conditions in extra-Andean caves are usually less appropriate (Páez *et al.*, 1999; Borromei, 2003; Chapter 17).

Table 5. Environmental conditions since Late Pleistocene, based on pollen analysis, faunal presence/absence, glacial and volcanic evidence.

^{14}C Yrs BP	Period	Vegetation	Fauna	Sea level	Temperature	Volcanic eruptions	Human occupation
100			Pampean fauna, *Rhea* sp.	Present sea level	Increasing temperatures		
200	**Late**	Grassy steppe advance					
500			*Lama guanicoe*		Little Ice Age		
1000			*Pterocnemia pennata*		Medieval Optimum		North, central and
2000		Present	*Rhea* sp.		Second cooling pulse		Southern Plateau
3000			*Lama guanicoe*		Arid and colder	Aguilera volcano	coast, Andean basins
3500	**Holocene**	configuration	*Pterocnemia pennata*		First cooling pulse		Magellan Basin and
4000			*Canis familiaris*				Tierra del Fuego
5000	**Middle**	Forest and grass steppe				Hudson volcano	
6000		advance	*Mytilus* sp.	Flandrian transgression	Optimum climaticum		North, South Plateau
7000	**Holocene**	Schrubby steppe			Wetter and warmer	Hudson volcano	Magellan, east and
7500		increase	*Fisurella patagonica*		Increased		West Andean basins
8000	**Early**			Opening of the Straits of Magellan	aridity and gradual warming	Burney Mt. volcano	
9000	**Holocene**	Forest retreat – steppe	*Lutra* sp.				Northern Chilean Basin Northern Patagonia
9500	----------	advance	*Lama guanicoe*	Lower global sea levels	Mored arid and colder		Deseado Plateau
10,000	**Pleistocene/**	Shrubby steppe advance	*Pterocnemia pennata*		Llanquihue 3		Magellan Basin
10,500	**Holocene**				readvance	Reclus volcano	
11,000		Grassy steppe	*Lama gracilis*		Colder and		
12,000	**Transition**		*Hippidion saldiasi*		wetter	Reclus volcano	
13,000		Forest advance	*Rhea americana*		Glacier readvance		
14,000	**Late**	Higher moisture	*Hemiauchenia paradoxa*			Reclus volcano	No evidence of
15,000	**Pleistocene**		Xenarthra, Glyptodontidae, Mylodontidae		Varas interstadial		human occupation
					End of LGM		

Source: Modified after Miotti (2006d).

Based on the archeological information provided in Tables 2–4 and the paleoenvironmental data in Table 5, we may infer the following:

1. During the Late Pleistocene and Late Pleistocene–Holocene transition, dramatic changes in the environment occurred that, in a sense, reduced the landscape availability to the human groups who were then colonizing Patagonia. Last major readvance and retreat of glaciers (ca. 15.0 ka BP), tundra environment close to the foothills, shrubby to grassy steppes where Pleistocene megamammals were plentiful resources for people, frequent lakes providing continuous water availability and a very cold climate were the existing conditions for the earliest inhabitants. They mainly occupied, at the beginning, the Río Deseado Basin (ca. 12.0 ka BP) on the eastern side of the Andes and the Magellan Basin further south (ca. 11.0–10.0 ka BP). In northern Patagonia, the ecotone and the steppes close to the Andean foothills were probably under a more unfriendly climate by the end of the Late Pleistocene; thus, the area was probably still uninhabited until ca. 9.0 ka BP (see Table 2 and references cited there). On the western side of the Andes – the Pacific façade – the Chinchihuapi valley was peopled ca. 13.0 ka BP, the Valdivia Basin ca. 10.0 ka BP and the Aysen region was occupied ca. 9.0 ka BP or maybe even earlier (see Mena and Stafford, 2006).
2. Between 15.0 and 8.5 ka BP, the Pleistocene megafauna (like American horse, *Mylodon*, *Lama gracilis*, *Hemiauchenia paradoxa*, among others) was slowly becoming extinguished, depending on the adaptive strategies of the different species to those changing environmental conditions. During the Late Pleistocene–Holocene transition, the Atlantic coast was located up to 200 km eastward from today; thus, as the coastal sites of those times are submerged today, the use of resources and space in those environments is still unknown.
3. The Middle Holocene (8.5–3.5 ka BP) was also a critical time, with a tendency toward aridization that lasted throughout the Holocene. Sea level rise was the main consequence as climate became warmer; the maximum transgression took place then and several remains coming from marine environments were found in archeological contexts of the steppe, indicating certain knowledge of such resources either by exchange or by taking advantage of new environments. Several volcanic eruptions during the Holocene that accumulated tephra layers in caves (Stern, 1992, 2007) and seismic events that may have forced the collapse of rockshelter roofs were probably the cause of the abandonment of caves, as well as the reorganization and distribution of human groups in other landscapes (neighboring areas) but returning later to the abandoned places.
4. Around 3.5 ka BP, Patagonia achieved its present environmental configuration (climate, fauna and vegetation); smaller glacier readvances, confined only to the higher mountain valleys, triggered short colder and drier episodes, which probably had no strong influence upon human life conditions; in fact, the high archeological variability all over Patagonia during the Late Holocene indicates a very accurate knowledge of the environment plus very well-established social networks.

The dispersal of human population, especially during the Middle Holocene, can be analyzed from the distribution of the available radiocarbon dates. Sometimes, microenvironmental discontinuities identified based on the lack of archeological record may have been coincident with chronological discontinuities in human occupation and/or changes in mobility patterns, but the cultural knowledge and communication networks allowed the hunter-gatherer societies to spread and occupy different landscapes and environments following diverse routes, until a wider proliferation all over Patagonia by the Late Holocene.

3. The Archeological Data

3.1. The Beginnings of Human Colonization in Patagonia: Late Glacial and Late Pleistocene–Early Holocene Transition Times

Several papers published during the last 10 yrs synthesize our knowledge on human colonization of Patagonia (Borrero *et al.*, 1998; Borrero, 2001b, 2004; Miotti, 2003a, 2006b; Miotti and Salemme, 2003, 2004; among others). All of these papers claim that this process was very slow, lacking a linear evolution. This history shows continuities and discontinuities in the occupation, sometimes under fast displacement of people with widespread occupation followed by long periods of stasis. What were the reasons for this? Probably environmental conditions – frozen soils, deserts, adverse climatic conditions – combined with human attitudes – fission and fusion of bands, social stress, decision making. But it has been recognized in all cases that at least three main subareas (Table 1: 3, 4 and 5) have provided abundant data about the earliest human occupations of Patagonia, as it is shown by the cited references in Table 2 (see also Miotti and Salemme, 1999, 2003, 2004; Borrero, 2001a; Miotti, 2003a, b, 2006b, c; Miotti *et al*., 2004; Carden *et al*., in press). AU6

In fact, the Deseado central Plateau and the Magellan Basin area, including Tierra del Fuego before it became isolated from the continent (Clapperton, 1992; Clapperton *et al.*, 1995; Rabassa *et al.*, 2000), show the highest density of sites chronologically allocated to the first interval (Fig. 2a, b; see also Fig. 1 in Miotti and Salemme, 2003).

In this sense, several ways of space and resources exploitation indicate an ample microenvironmental diversity, with the exception of the coastal area: natural refugia like caves, rockshelters, boulders, sheltered wetland dells and deep canyons, as well as quarries of lithic raw material and pigments, campsites (residential and logistic task bases), walls and caves for rock art representation, sites for gathering roots and fruits, or mussels along the marine coast, use of wood for heating, etc.

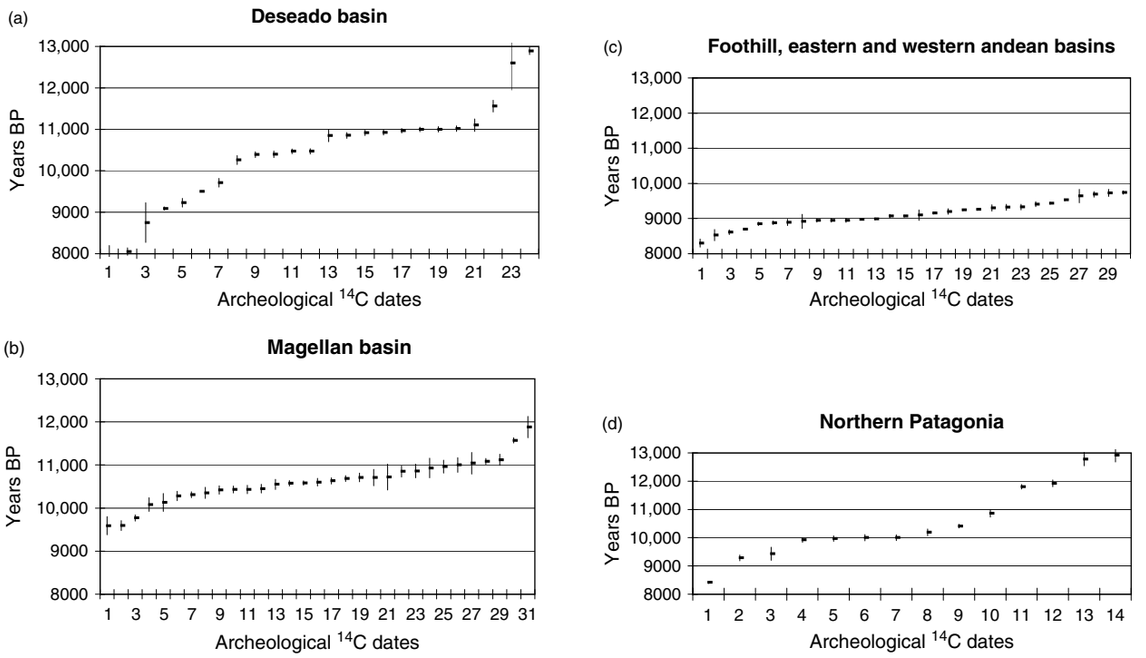

Fig. 2. Span and density of radiocarbon dates in each subarea during the Pleistocene–Holocene transition and Early Holocene: (a) Deseado Basin; (b) Magellan Basin; (c) Foothill and Andean basins and (d) northern Patagonia. These figures intend to show the chronological distribution of available uncallibrated radiocarbon dates, revealing their continuity and/or existing gaps for each subarea. The numbers on the x-axis corresponds to each one of the total number of available radiocarbon dates for the indicated subarea, which are depicted in growing order of age. The vertical lines for each radiocarbon date illustrate the statistical error of every date, but only in those cases when it is larger than 200 yrs.

Plateaus, valleys or basins, rockshelters and caves with rock art (paintings and/or engravings) clearly show evidence of human activities or occupation both in stratified and in superficial material deposits. Several sites have been assigned to the latest Pleistocene and Early Holocene in the central Deseado Plateau through three main chronological clusters (using AEP-1 and Maripe sites as markers: 12.9–10.5 ka BP, 10.45–9.0 ka BP and 9.0–8.0 ka BP; Figs 2a, 3–5; see Miotti *et al.*, 2003); that is also the case of Cerro Tres Tetas, Casa del Minero and La Mesada Cave sites (Paunero, 2003a, b; Paunero *et al.*, 2005). In the western piedmont, the Monte Verde site (Dillehay, 1997) shows recurrent occupation at least since 12.5 ka BP and probably even earlier, and the Marifilo 1 site since 10.5 ka BP (Fig. 2c; Mera and García, 2004). The Magellan Basin seems to have been inhabited around 11.5 ka BP (Fig. 2b; Borrero, 1999; Morello, 2000; Massone, 2003). On the contrary, along the eastern Andean foothill, the earliest sites are not older than 9.7 ka BP (Civalero and Aschero, 2003; Civalero and Franco, 2003; Franco and Borrero, 2003), showing a higher concentration between 9.4 and 7.0 ka BP (Fig. 2c; Gradín and Aguerre, 2004; Miotti and Salemme, 2004, and references cited therein).

On the western Andean slope, the Baño Nuevo 1 site is very interesting because of the finding of several human burials in the cave, with differential conservation but within a reliable and well-documented archeological context dated ca. 9.5–8.0 ka BP (Table 2; Mena and Stafford Jr., 2006: 148). Some earliest dates show the evolution of the cave after the retreat of a proglacial lake, but the association of the earliest layers containing megafaunal bones with cultural remains is still doubtful (Mena and Stafford Jr., 2006: 150). The authors argue that the area of Baño Nuevo, as a marginal territory, could have been explored from the extra-Andean steppe during the effective colonization stage.

Regarding the rock art on both sides of the Andean ranges, great differences are observed. But, although paintings and engravings in eastern rockshelters and caves are abundant (Figs 3b, d, 4a, b, 5c, d), rock art has not been reported yet from the western basins (Carden, 2004; Carden *et al*., in press; Fiore, 2006; Miotti *et al*., in press a).

The Andean foothills, in the Río Pinturas (Fig. 6a, b) and the Río Belgrano–Lago Posadas basins, contain early colonization sites, but of a later age than those of the Deseado Plateau. Evidently, as the first occupation took place in the Deseado Basin toward the end of the Pleistocene (Table 2; Fig. 2a), and this Andean region has no signs of human occupation by that time, the expansion of human population seems to be addressed from plateau to Andean basins in the Early Holocene. Probably the foothills would have been still under the influence of glacial climate within the valleys; therefore, the first effective exploration and occupation would have started ca. 9.3 ka BP (Gradín and Aguerre, 1994; Civalero and Franco, 2003), being concurrent to the second pulse of

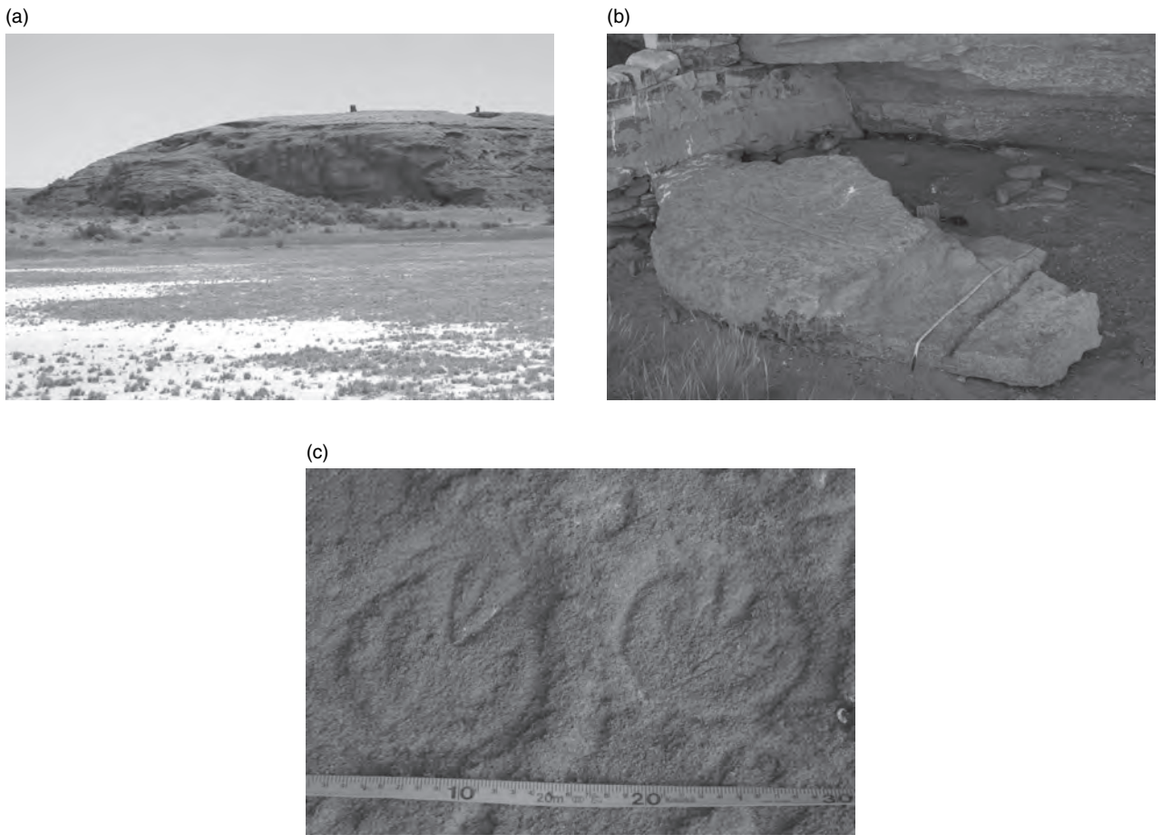

Fig. 3. Piedra Museo locality: (a) AEP-1 site, view of the rockshelter; (b) boulder below the roof, showing petroglyphs and (c) details of the engravings on the boulder shown in 3b, depicting American horse footprints (Photos by Laura Miotti, 2005).

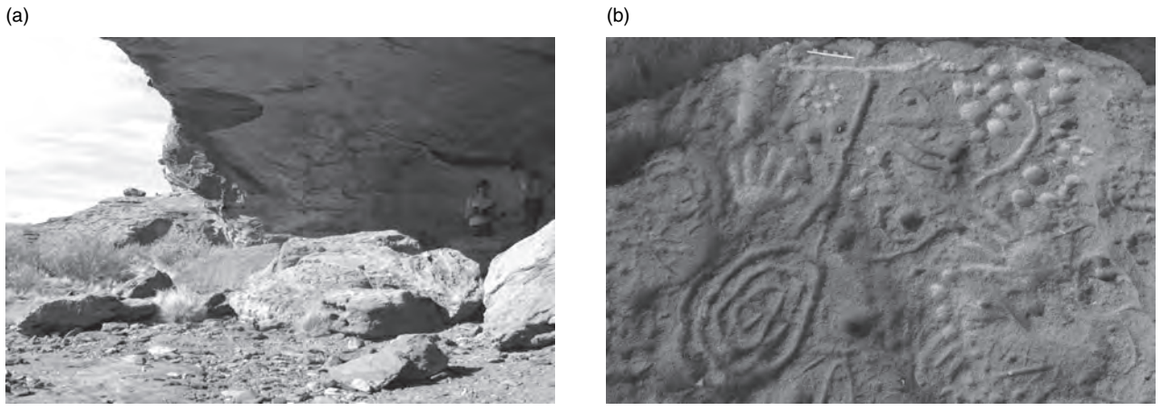

Fig. 4. Piedra Museo locality: (a) Cueva Grande and (b) details of petroglyphs on boulders (Photos by Laura Miotti, 2005).

colonization and territorial consolidation of the Río Deseado Basin. This fact may likely be indicating the expansion of this sociocultural system toward western habitats at a higher altitude, closer to the Andean ice fields (Fig. 2c). The raw materials from this region also reveal management of local resources. Thus, it is possible to support the hypothesis that this first occupation is the result of the expansion and consolidation of groups coming from the central Plateau; they shared the same technologies, unifacial and bifacial techniques for different purposes, and the choice of best quality raw materials for highly conservative tools (Fig. 7; Miotti, 1995; Cattáneo, 2002). But the intersite variability seems to be higher here than in the other region, which turns

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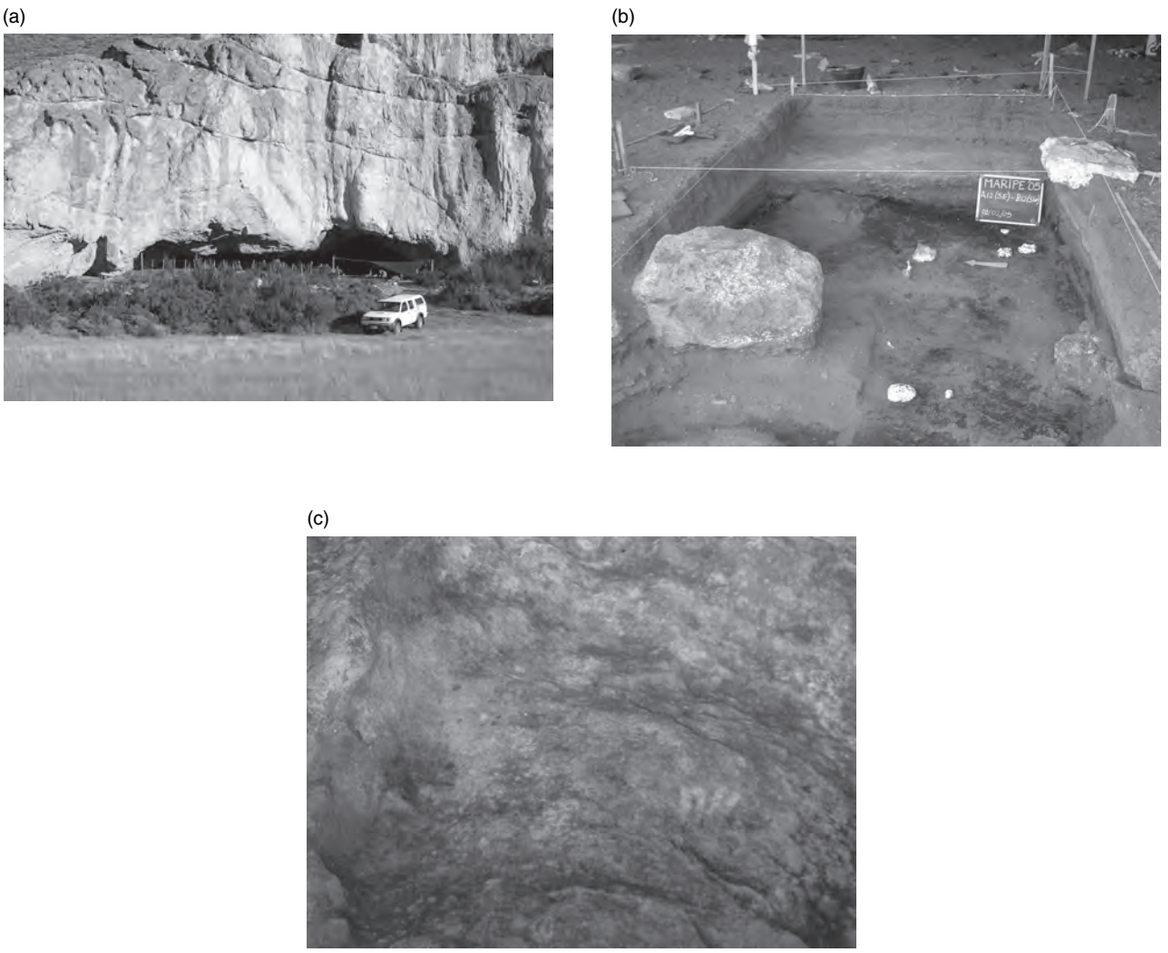

Fig. 5. La Primavera locality: (a) view of Maripe Cave and the mire environment in the valley; (b) excavation in the southern chamber of Maripe Cave and (c) rock paintings on the walls of the southern chamber (Photos by Bruno Pianzola, 2006).

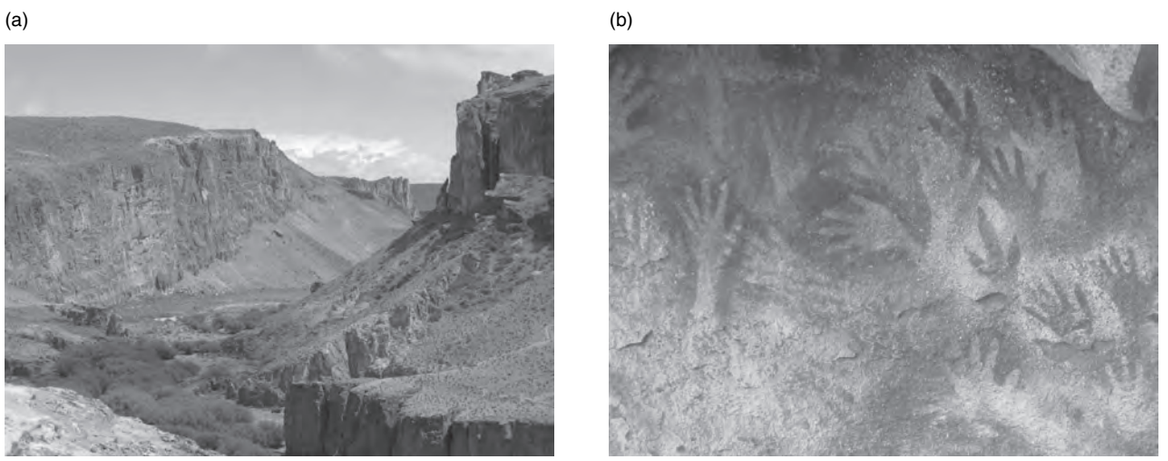

Fig. 6. (a) Río Pinturas environment and (b) caves with paintings (Photos by Jorge Rabassa, 2007).

more reliable the assumption that the trend of the settlement system goes toward the logistic forager strategy, with multiple activity and aggregation sites, linked to locus of special activities. Good examples of special activities are AEP-1 at Piedra Museo locality (Fig. 3; Miotti, 1995; Miotti and Cattáneo, 1997, 2003; Miotti *et al.*, 1999; Miotti and Salemme, 2005) and El Ceibo Cave 6 (Mansur, 1983; Cardich, 1987; Miotti, 1998).

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Fig. 7. Fishtail projectile point and unifacial artifacts from AEP-1 lower units (Photo by Laura Miotti, 2003).

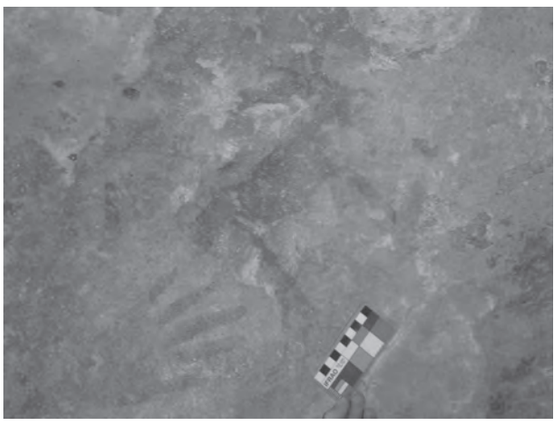
Examples of multiple activities are Los Toldos Cave 3 (Fig. 8; Cardich and Miotti, 1983; Miotti, 1998), Maripe Cave (Fig. 5; Miotti *et al.*, 2004; in press b), Cerro 3 Tetas Cave 1 (Paunero, 2003a) and various sites at La María Locality (Paunero *et al.*, 2005).

However, in some cases the archeological resolution of intrasite activity areas is low, due to a coarse-grained taphonomical integrity. This hypothesis can be tested in the La Mesada, Túnel, Casa del Minero and Cerro Tres Tetas caves (Paunero *et al.*, 2005), and in Los Toldos Cave 3 (Cardich *et al*., 1973). All of them need to intensify taphonomical analysis to reduce the grain and the kinds of agents and processes that contributed to the accumulation. In the latter caves, inner spaces were interpreted as multiple activity areas. Records from these contexts indicate that the structure of the inner space was lower at the earliest human occupation, or the archeological integrity is coarse-grained and an enhanced reading is difficult or even impossible. Zooarcheological studies were carried out only for Los Toldos Cave 3 (Miotti, 1998) and AEP-1 (Miotti, 1996; Miotti *et al.*, 1999; Miotti and Salemme, 2005); zooarcheological and taphonomical analyses were performed on the Cueva Maripe bone record (Miotti *et al*., in press b; Salemme *et al*., 2006), and in Tres Arroyos (Borrero, 2003) and Lago Sofía (Prieto, 1991), as well. Nonetheless, faunal and taphonomical analyses are still absent in other key sites for the peopling of Patagonia. A deeper study of

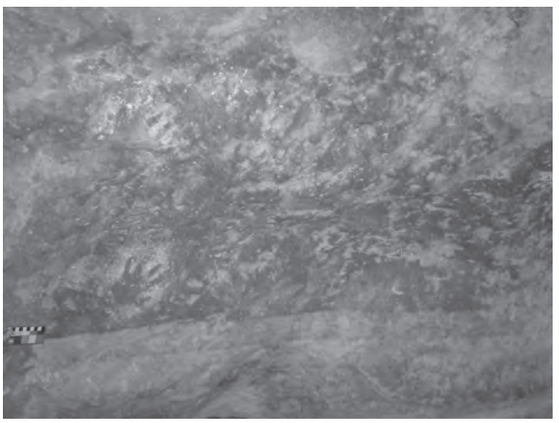
(a)

(b)

(c)



(d)



these aspects is needed shortly, just to be able to improve the grain analysis and to produce more and better-adjusted hypotheses about the use of space by the first inhabitants.

The main point is that all of these sites (special and multiple activity places) were recurrently occupied during shorter or longer terms; in each different time of occupation the use could or could not have been the same (Miotti, 2006b, d; Salemme *et al*., 2006). This evidence is coherent with a peopling exploration and dispersion strategy from a region where effective colonization had already started. It must also be noticed that in the piedmont area (the Andean foothills), neither fishtail projectile points (FTPP) nor associations with extinct fauna exist, which strengthens the idea of an area that is explored and selected later than the central Plateau, once the Pleistocene megamammal fauna had already vanished. Although the resources from this region are good and varied by the time of the first occupations, altitude and mountain effect could have generated in these places a more noticeable seasonal occupation than in the eastern lowlands. Probably, something similar occurred in northern Patagonia (Cuyín Manzano, Traful Cave, Epullán Cave; Table 1, Fig. 2a, b, c, d).

3.2. Territorial Consolidation as a Continuous Process: Disruptions and Discontinuities into a Mobile World of Hunter-Gatherers During the Middle Holocene

The time boundaries of the Middle Holocene may be variable according to the region analyzed, but essentially most authors accept that it was a warmer period with a variable effective humidity depending on the area considered (Tonni *et al.*, 1999). In this sense, Barrientos and Pérez (2005: 96) acknowledged that "... from a global perspective, it can be said that data from several sources suggest an increased regionalization of climate from the early to the late Holocene". However, and in terms of regional peopling, many examples of southern South America illustrate a contradictory picture about human occupation during the Middle Holocene: archeological "silence" in Atacama (Núñez *et al.*, 1996), in the higher Andes at 35°–36° S (Gil *et al.*, 2005) or in the Puna, where "the aridity increase and perhaps higher temperatures promoted people change mobility patterns and social strategies" (Yacobaccio and Morales, 2005: 12), whereas in other sectors of the Andean Range, at 32°–34° S, an increase in human occupation has been recorded (García, 2005).

From an archeological viewpoint, the analysis of proxy data for paleoenvironmental reconstruction is more or less coincident with studies on the Pampean and Patagonian sites by different authors (see Politis and Madrid, 2001; Barrientos and Pérez, 2005: Fig. 2; Miotti, 2006c). Table 5 lists some disparity regarding proxy information, but in all cases the paleoenvironmental conditions during the Middle Holocene could be interpreted as the consequence of events indicating regional asynchronicity.

The most relevant differences are found between the Andean Range zones and extra-Andean Patagonia at middle and high latitudes. However, beyond the latitudinal stripes, two main climatic "pulses" were detected in the southern extra-Andean region (see Table 5). During the first period (8.0–6.5 ka BP) the climatic conditions show characteristics similar to those of the previous period: cooler temperatures but increase in effective moisture considering that, during the transition from glacial to postglacial periods, environmental conditions went from drier to wetter. As in the mountainous areas temperature was decreasing (probably as snow precipitation increased), these regions became hostile for human settlement. This fact should at least partly explain the depopulation process detected at those times in nearby areas like the southern ecotone in the Cuyo Region (southern Mendoza Province) and in northern Patagonia (Gil and Neme, 2001). On the other side, while population was diminishing in this Cordilleran area, the occupation of several environments by hunter-gatherers expanded in some subareas of the Patagonian and Pampean Regions (Table 3, Fig. 9a, b, c, d, e, f, g; Politis and Madrid, 2001; Barrientos and Pérez, 2005). At the local level, the exploitation strategies changed, showing higher occupation variability.

In Patagonia, three sites that developed at the very beginning of the Middle Holocene (or the latest Early Holocene) indicate that climate amelioration allowed human settlement in the southern portion of the Deseado Plateau (El Verano Cave, ca. 8.9 ka BP; Durán, 1986/1987) and closer to the Andean foothills, in the northwestern sector of the Deseado Basin (CCP 7, ca. 8.3 ka BP; Aschero, 1996). Immediately after that, the more easily achieved occupation of La Martita at 8.0 ka BP (Aguerre, 1987) demonstrates again the excellent conditions for people and goods circulation (probably a warmer and wetter climate) in this subarea (see Tables 2 and 3, Fig. 9a, b).

A second pulse during the Middle Holocene (between 6.0 and 3.5/3.0 ka BP) is characterized by a decrease in effective humidity. Mean temperature had remained stable (Table 5), but it also started to decrease. At a regional scale, the lowest mean annual temperatures occurred between 3.3 and 3.0 ka BP and diminished to –1°C, returning later to temperatures closer to those achieved at 8.0 ka BP, but under moisture conditions effectively lower, with accordingly higher evaporation (Bonadonna *et al.*, 1995; Carlini and Tonni, 2000).

The most dramatic event recorded in southern Patagonia by 8.0 ka BP is the flood of the Magellan glacial valley, turning into the present Strait of Magellan and separating the Fuegian Archipelago from the continent. This transgression probably played a special role among the Indian populations of the southern Cone tip. Mobility and communications must have changed because the groups of pedestrian people that had colonized this area became isolated. Since then and up to reorganization in social communication the archeological record is very scarce or even zero. Perhaps the definitive settlement and development of canoeing people would have linked people from both sides of the straits.

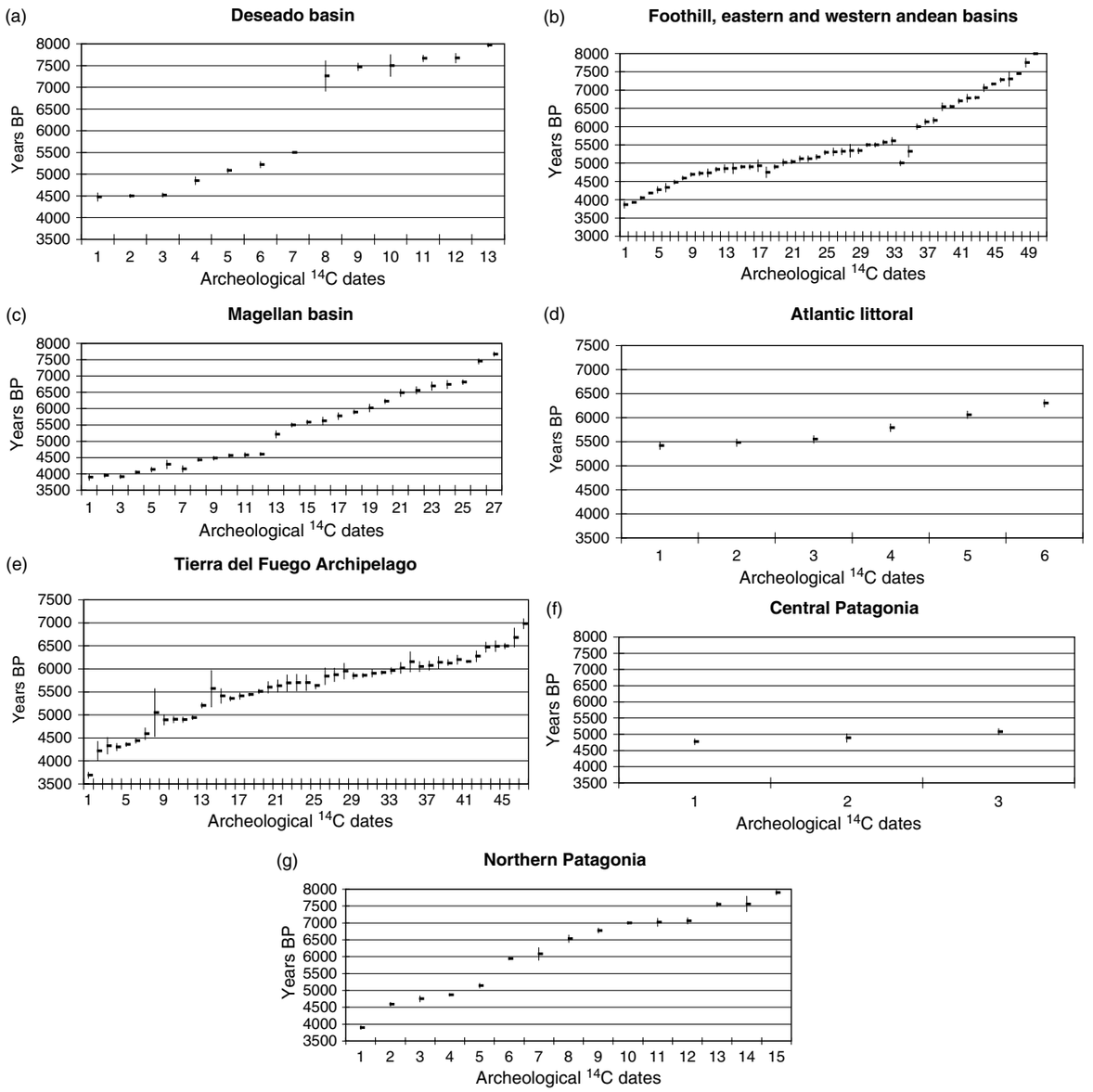


Fig. 9. Span and density of radiocarbon dates in the different subareas of Patagonia during the Middle Holocene: (a) Deseado Basin; (b) Foothill, eastern and western Andean basins; (c) Magellan Basin; (d) Atlantic Littoral; (e) Tierra del Fuego; (f) central Patagonia and (g) northern Patagonia. For explanation, see caption for Fig. 2.

At a regional scale, the environmental conditions might be different during the Middle Holocene in higher latitudes, when compared to middle or lower latitudes. At least, for the Deseado Plateau (Miotti, 2006b) and the Beagle Channel (Orquera, 2005) reliable evidence allows to give a different interpretation to what has been verbalized in several papers of the volume edited by Zárate *et al.* (2005), about dispersal and mobility of human bands during the Middle Holocene. The strong littoral maritime adaptation is supported by uninterrupted occupation since 6.0 ka BP with a specific technology and special use of such macroenvironment (channel, coast, forest and open prairies beside the coast) along the Beagle Channel (Fig. 10) but also in the western channels (Table 3; Fig. 9d, e).

The conditions would have been favorable for a different use of the space among hunter-gatherers, particularly geomorphological landscapes, like the Deseado Plateau, where microenvironments with higher water concentration and a larger variability in the frequency of wind, rainfall, moisture and temperature could be found.

In the Deseado Basin, human occupation would have reached a major differentiation in the use of microenvironments during the Middle Holocene, compared to those of the Colonization Phase, during the Pleistocene–Holocene

transition and the Early Holocene. This is shown by the increase and/or redundancy in occupations in the same sites (Miotti, 2006b).

It is possible that this sector of extra-Andean Patagonia would have been a preferential area for human occupation, even better than the Patagonian coast (Fig. 9a, d). Or, effectively, an unequal distribution in the human occupation occurred in other regions of midlatitudes, like the Pampa or Cuyo regions (see Politis and Madrid, 2001; Barrientos and Pérez, 2005; Gil *et al*., 2005).

Going back to the hypothesis of the Andean Range as a geographical barrier for peopling (Miotti, 2003a, b; Miotti and Salemme, 2003, 2004; Borrero, 2004), toward the Middle Holocene the southern Patagonian Cordillera became partly permeable to human communication through certain paths near the ice fields. There, the fluvial and lacustrine basins considered as "dead ends" (*sensu* Borrero, 2004) were related to both still existing ice fields, the Northern Patagonian Ice Cap (Aysén Region, Chile) and the Southern Patagonian Ice Cap (from Perito Moreno National Park to southern Lago Argentino, Argentina); they were occupied in a discontinued and marginal manner, sometimes as satellite groups from those located in the steppe (Miotti and Salemme, 2003, 2004; Borrero, 2004). The peripheral occupation of Río Ibáñez, like Las Guanacas on the western slope of the Andes (Table 3; Mena, 1999) and eastern occupations in the Perito Moreno National Park (Table 3, Fig. 9b; Aschero *et al*., 1992;Espinosa and Goñi, 1999; Borrero, 2004) can be considered as adequate examples of these conditions.

If deep climatic changes occurred in other subareas, the Deseado Plateau could have been alternatively a better place for concentration of resources that gathered human groups from those regions. The Atlantic coast seems to have been an environment that was occupied sporadically or at least for shorter periods, both on the continent and in Tierra del Fuego (Fig. 9c, d, e) unless a sampling bias may be masking the evidence.

Likewise, the archeological results from the Magellan Basin and the fluvial and lacustrine Andean basins show a significant increase for the sites occupied since the Middle Holocene, especially close to the heads of Río Santa Cruz (Fig. 9a, b; Borrero, 2005; Carballo Marina, 2007). The archeological contexts and radiocarbon dates are clear evidence of occupation in northern and central Patagonia areas. A few scarce records are found in the Curacó and Colorado basins (Casa de Piedra, Tapera Moreira; Table 3) and Chubut Basin (Campo Moncada), respectively. The Somuncurá Plateau is another sector of central Patagonia that shows occupation during this time, as well as the effective colonization along the foothills of the Andes (Aysén sector, Traful caves, etc). Some of the sites had been previously known by the human groups, but others were occupied for the first time (Tables 2 and 3).

Under these conditions, during Middle Holocene times, Patagonian hunter-gatherers seem to have consolidated and extended their territories to neighboring regions, such as the southern Pampas. The archeological evidence from some lake basins located in zones defined as "dead ends" in the vicinity of the Andean Cordillera (Borrero, 2004), between 46° and 47°55′ S, indicates that the definitive initial colonization of this area took place during the Middle Holocene. Earlier occupations such as Baño Nuevo 1, Río Ibáñez (46° S) and CCP 7 (on the eastern side of the mountains) were interrupted and discontinuous (see Tables 2 and 3, Figs 2b and 9b). "Dead ends" are considered here as biogeographical marginal areas, influenced by high altitudes and in the case of the main Patagonian Cordillera, by extensive ice fields (Borrero, 2004). East of the Andes, at the headwaters and near the highest peaks, the piedmont basins and in the lowlands (like the La Payunia region) around 35–36° S, local population history shows a significant gap between 5960 and 5060 ^{14}C yr BP (Gil *et al.*, 2005), whereas Barrientos and Pérez (2005) have argued that the new population that occupied the southeastern Pampas could have arrived from Patagonia by the Middle Holocene as well. This model is in agreement with the replacement theory; morphometric evidence supports such hypothesis (Barrientos and Pérez, 2005). However, the multiproxy data (Table 5), the archeological record and radiocarbon dates (Table 3 and Fig. 9a, b, c, d) indicate noteworthy paleoenvironmental fluctuations at supraregional and subregional scales. Sea level achieved then its maximum elevation along the Atlantic coastline, woodlands advanced toward the steppe on the eastern slope of the Andean Range, available records indicate dry conditions from 7700 to 4000 cal yr BP along the Pacific coastal zone (Zárate *et al.*, 2005) and temperature and aridity became higher over the Patagonian plateaus. All these dramatic changes should be reliable causes to assume a trend toward resource specialization in different areas. For instance, and for the first time the most noticeable, intense and long-lasting human adaptive explorations during the Middle Holocene became visible. This happened in the archipelagos of southern Chile and the Beagle Channel, due to specialization in marine resources exploitation. There, rainy and cool forest environments were available for strengthening in the use of marine littoral resources, which was noticeably different from what happened along the Atlantic coast of extra-Andean Patagonia (Fig. 9c; Orquera, 2005) and northern Tierra del Fuego (Figs 9e and 11; Salemme *et al*., in press a). Nonetheless, in these latter areas, the increasingly intense

Fig. 11. View of the northern plains in Tierra del Fuego – Río Chico (Photo by Mónica Salemme, 2005).

use of plateaus and basins triggered a specialization in "guanaco" (*Lama guanicoe*) hunting. Radiocarbon dating shows substantial occupation continuity in all the studied subareas in Patagonia, including those which were considered marginal areas such as the higher basins of the Andes (Borrero, 2004), very close to the large ice fields (see Fig. 9b).

The expansion and diversification of resources and land use were possible by alliances among logistics and/or family groups, which would have stimulated geographical mobility. Cultural items like beads made of marine shells and sizable increase of obsidian artifacts in archeological contexts of the central plateaus (Los Toldos, Piedra Museo, La Primavera, La Martita and La María localities) allow us to suggest that goods and raw material circulation reached long distances. In this sense, different bands of hunter-gatherers would have been moving across Patagonia, probably with higher mobility than during the Late Pleistocene. Thus, the hypothesis of fission and fusion of bands is trustworthy to reassess peopling dynamics, taking advantage of new spaces with better habitability conditions, at least seasonally – during spring and summer – both closer to Cordillera and the marine coastline (Fig. 9b, c, d).

Treatment of death became an important marker by the Middle Holocene. There is a record of burials in the eastern foothills like Puesto El Rodeo (Table 3: 4860 yrs BP, Gradín and Aguerre, 1994), as well as cremation evidence in Lago Sofía 1 by 3950 yrs BP (Prieto, 1991) and in Cerro Sota by 3900 yrs BP (Borrero, 1993), or a burial at La Arcillosa 2 (Atlantic coast of northern Tierra del Fuego, 5200 yrs BP; Fig. 12; Salemme *et al*., in press a, b), in this case using an open air site between a lagoon and the ancient coastline. This latter burial shows reddish sediments surrounding the pelvic area of a woman (Salemme *et al.*, in press a).

Another important topic that confirms the intense occupation of Patagonia, at least in the plateaus and the Cordillera basins, is the increase of sites with rock art (Carden, 2004; Carden *et al*., in press; Miotti *et al.,* in press a, and references cited there). Rock art increases not only in spatial distribution, but also in the variability of motives and production techniques.

Considering the chronological span of human occupation in different subareas of Patagonia, a main hiatus between 6.0 and 5.0 ka BP has been noticed in the Deseado Massif and the Magellan Basin (Fig. 9a, c), but it appears that movements of the hunter-gatherers toward the Atlantic coast and Cordillera took place. Table 5 summarizes at least a catastrophic event by this time: intensive and frequent volcanic eruptions. The evidence found in several caves is a record of tephra layers that translates into archeological silence or a mirror of site abandonment. In the Fuegian Archipelago, a brief occupation lapse took place between 5.5 and 5.0 and between 4.9 and 4.7 ka BP (Fig. 9e). On the other side, the Atlantic coast and central and northern Patagonia show a stable occupation during this period (Fig. 9d, f, g). Two particular occupation disruptions have been identified in the Andean foothills and lacustrine basins, the first one at 6.0–5.5 ka BP and the second between 4.9 and 4.7 ka BP (Fig. 9b).

How these human occupation continuities and discontinuities (or spatial movements) can be interpreted for the different subareas in southern Patagonia? A correlation of these discontinuities with volcanic events along the Andean Range is observed, if the archeological radiocarbon dates are compared to environmental data (Table 5). Those events are coincident both with the collapse of rockshelter roofs as well and cave depopulation, suggesting that the following:

(a) This fact could be indicative of human mobilization to other inhabitable places, abandoning those more risky areas affected by such catastrophic events.
(b) It could also be due to strategic fission of bands that probably spread over already known neighboring areas.
(c) This last strategy may or may not be concurrent with environmental effects; instead, it could probably be an answer to social necessities, but available data point out that this relationship is sealed by volcanic and other environmental events.

In the case of the Fuegian Archipelago, the isolation of the area by the end of the Early Holocene and the beginning of the Middle Holocene is documented in the islands (Orquera and Piana, 1999, 2000, 2005; Ocampo and Rivas, 2000; Salemme and Bujalesky, 2000; Favier Dubois and Borrero, 2005; Salemme *et al*., in press a)

but also in the northern margin of the Strait of Magellan (Bahía Buena, Punta Santa Ana, Ponsonby; Legoupil and Fontugne, 1997). The presence along the Beagle Channel and other waterways seems to portray the beginning of a maritime littoral adaptation, whereas in the steppes it appears to keep supporting a terrestrial way of life, though taking profit of marine environments as well.

This information demonstrates the occurrence of certain mobility and territoriality patterns that, together with the presence of extraregional objects, should be indicative of an increase in social identity, which should denote a certain complexity of these societies.

3.3. Late Holocene: Daily and Sacred Landscapes

The first absolute dates from open air sites in continental Patagonia are known only for the Late Holocene. Before that, dates come usually from contexts located in caves or rockshelters, at least in the Deseado and Magellan Basin subareas. In Tierra del Fuego, on the contrary, there are just a few sites located in rockshelters or next to glacial erratic boulders. In addition to the Tres Arroyos site (which was occupied recurrently since the Late Pleistocene–Holocene transition), the Marazzi site was also settled during the Early Holocene and then later in the Middle Holocene, but this locality is a huge erratic boulder. Bloque Errático (another erratic boulder) and Cabeza de León are both localities close to Bahía San Sebastián; this last one, together with San Julio 1 and 2 (Saxon, 1979) in the northwestern area of Argentine Tierra del Fuego, are examples of Late Holocene or postcontact archeological sites located under rockshelters.

Some restricted sectors acted like territorial markers; they could have been natural pigment exposures for painting (Aguerre, 2000; Miotti, 2006d and references cited there), burial areas (locally named as "chenques"), places with high concentration of rock art but few tools, and also other peculiar topographic features of the landscape which in general would coincide with the presence of specific mineral resources that could be added to human burials. Forests could also be used for certain social practices, what is shown in the archeological record. Other areas could be used by logistic groups in a discontinuous manner, like coastal sectors, foothills or the central plateaus themselves, where human burials are recorded for the first time separated from daily life.

During the Late Holocene (Table 4), the spread of human population seems to have saturated all habitats. However, "dead ends", i.e. nearly the ice fields in the Andean ranges and their foothills, were used always as special *loci* of activities and, in this sense, they have been considered as seasonal hunting sites and/or collecting logistical stations, i.e. the area of the Perito Moreno National Park (Aschero *et al.*, 1992; Espinosa, 2002; Aschero *et al.*, 2005), Casa de Piedra (CCP 5 and 7; Aschero, 1983) and, farther south, Chorrillo Malo (Franco, 2002; Franco and Borrero, 2003) (Table 4, Fig. 13a).

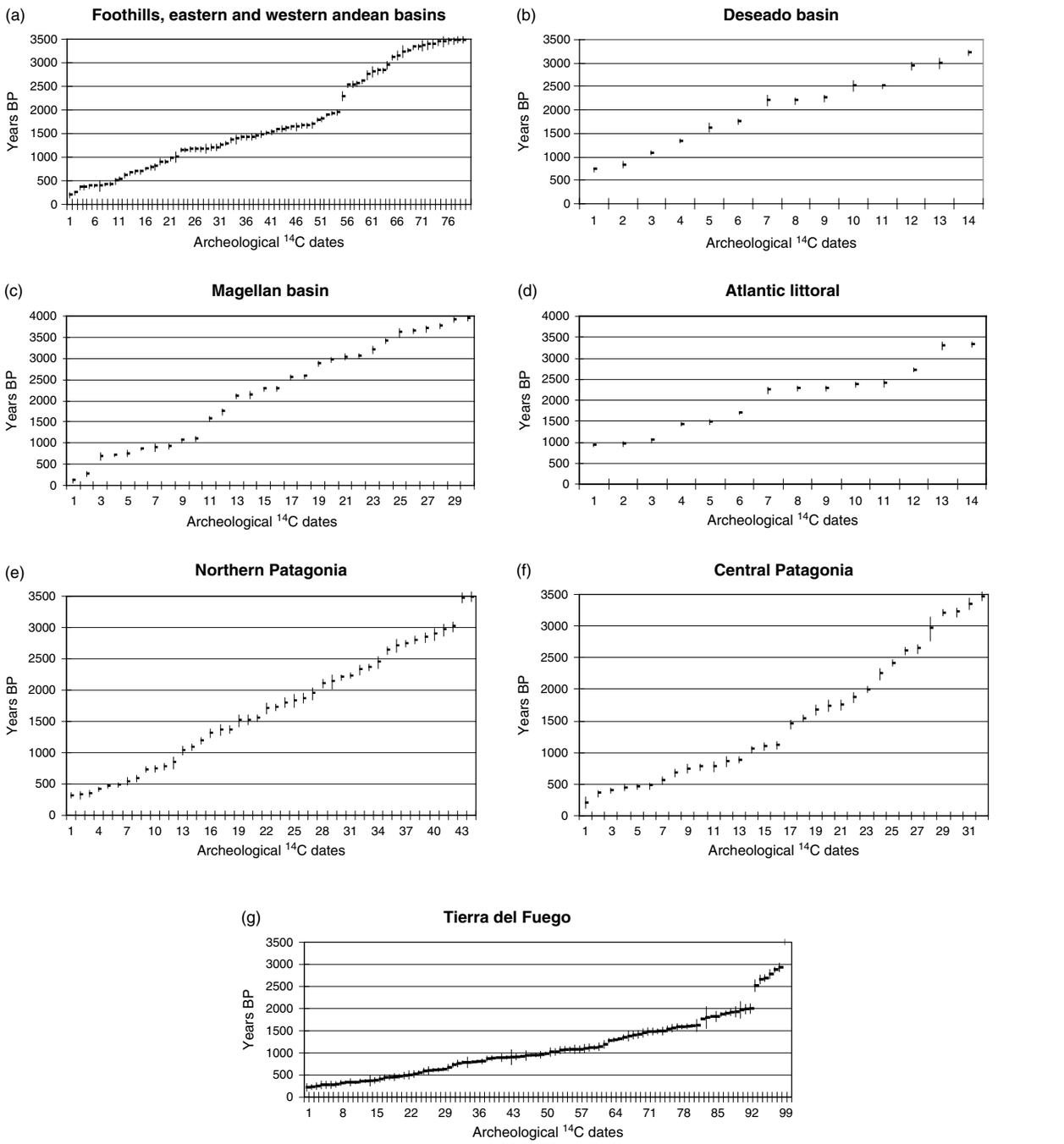
Toward the Late Holocene most of the areas would have been occupied (Table 4) for settlement in new spaces not only due to environmental changes that pushed human displacement but also due to demographic pressure. This fact probably provoked fission and/or fusion of bands as well as other intrasite and intersite structures, maybe at a territorial scale. The regional archeological evidence indicates a higher recurrence in the occupation of the same places or of new sites that were unexplored before or marginally located from a biogeographical view point. Sometimes, these new areas could be assigned to rarely visited, sacred or taboo sites, or perhaps accessible only to special people (elite). These are special places, probably sacred sites where the archeological record is different from those in areas dedicated to domestic or daily activities (Miotti, 2006c).

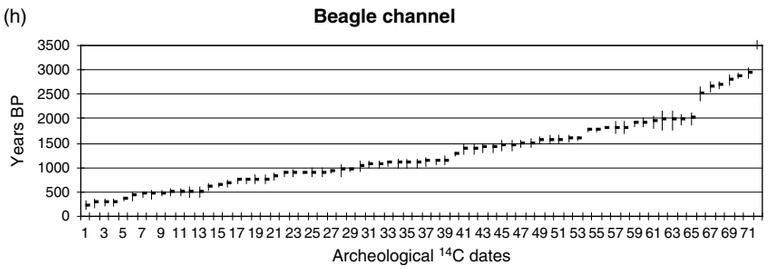
Around 3.5 ka BP, Patagonia achieved its present environmental configuration, in terms of climate, fauna and vegetation; smaller glacier readvances, only confined to the higher valleys, forced short colder and drier episodes in the lowlands (Table 5), although they probably had little influence on human life. In fact, the high archeological variability all over Patagonia during the Late Holocene indicates a very accurate knowledge of the environment plus very well-established social networks.

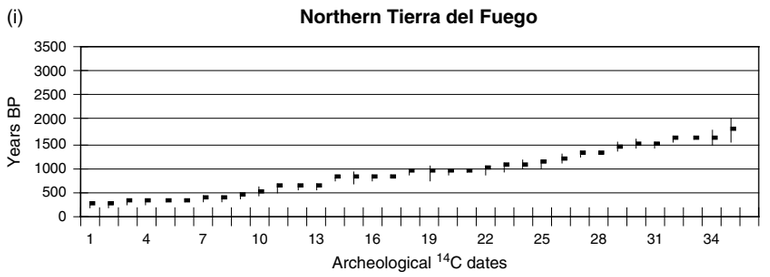
By this time, the record of human burial fields ("chenques") becomes frequent in extra-Andean Patagonia, like the area of Lago Salitroso (Goñi and Barrientos, 2000; Table 4) and other places along the plateaus. On the Deseado Plateau, data come mainly from unicomponent sites; they are dated between 3.2 and 0.7 ka BP (Fig. 13b), as in Aguada del Cuero, La Huella, Moyano, Bajo Pantano, El Sargento and the Monumento Natural Bosques Petrificados (MNBP; Hermo and Vázquez, 1999; Miotti *et al.*, 2002, 2005; Hermo and Miotti, 2003). In the headwaters of the Río Deseado and in higher latitudes it is important to note microenvironmental discontinuities that seem to indicate a chronological interruption in the occupation regarding the colonization of the area, such as it was demonstrated above for the Late Pleistocene–Holocene transition. A paradigmatic example is the Aguada del Cuero Locality, only 30 km south from Los Toldos canyon, 65 km west of Piedra Museo and 57 km north-northwest of Cueva Maripe, at La Primavera locality. In these three latter localities, the earliest occupations were assigned to the Late Pleistocene–Early Holocene transition. However, the earliest occupation in Aguada del Cuero came from two caves situated at higher altitude and dating from the Late Holocene (Cueva Moreno and Cueva de La Hacienda, see Table 4). The question is why this sector of the Deseado Plateau – similar to others in quality and quantity of resources – seems to have been occupied so lately. Moreover, in this locality, in addition to the open air sites and caves, other sites were recorded at the base of basaltic exposures nearby lagoons and springs, like in Laguna Cerro Bonete and La Leonera, both of them with a great number of petroglyphs, engravings (Fig. 14; Miotti *et al.*, 1999, 2002; Carden, 2004; Carden *et al.*, in press) and lithic tools indicating a later chronology.

Regarding different ways of burial, which may be used as direct evidence to interpret certain spaces as sacred in the subareas of the Andean foothills – like Salitroso and Cardiel lakes – and the Atlantic coast, the abundance of burials in "niches" and "chenques" (Fig. 13a; Goñi and Barrientos, 2000; Goñi *et al.,*

2004) is directly related to the available data up to this time. On the contrary, in the Deseado Plateau area there is still not much relevant information; the only dated "chenque" is El Sargento site (ca. 0.7 ka BP, Table 4 and Fig. 15), in the area of Piedra Museo locality. Lately, more than 30 structures built with stones and considered as "chenques" have been located in several basins that drain into the upper/middle Río Deseado Basin. The radiocarbon date available at El Sargento is the first one from a burial of this area; it is very significant since until today it was thought that during the Late Holocene, hunter-gatherers buried their dead only in the Andean foothills or along the Atlantic coast (see Boschín and Nacuzzi, 1979). Here, we claim that AU9







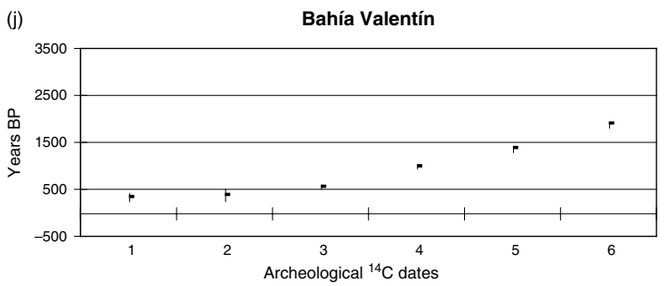


Fig. 13. Continued

the Deseado Plateau was also used for burial purposes, without considering seasonal displacements of groups for such immense long distances with the only goal of burying their dead.

Other "chenques" discovered in Cerro Madre Hija (also known as Cerro Horqueta) show two different kinds of structures: (1) five "chenques" grouped on the southern slope of the hill, one of them with the floor and walls covered by flat stones to arrange the dead bodies; this previous conditioning in a certain sector of the space points toward a major definition of these places for special practices; and (2) a secondary burial was found in a small structure, covered with a pile of stones on top of columnar basalts, at the ancient crater of the Cerro Madre e Hija, an inactive volcano. At least one individual and some long bones of other humans were buried there. The

burial was already open by the time of discovery and most of the bones were spread in the surroundings and among the columnar basalts. Neither the skull nor the vertebrae were found, only highly weathered folded bones were still inside the structure. Besides the "chenque" and close to the top of the hill, two ochre lenses (yellow and red) were found; some long bones and the basement of the structure were impregnated with such pigments. Other "chenques" were found at the border of El Cuadro Plateau and in a low hill at its base, in this lower sector of the basin.

Some materials usually distributed nearby the burial structures suggest activities of stone chipping in those places. Usually, this activity coincides with the manufacturing of projectile points probably used as offerings, as well as beads. The technology used in the manufacture of points and other artifacts found in several "chenques" from Aguada del Cuero (Miotti *et al*., 2002) and La Suerte localities (Miotti, 1998, 2006d) is assignable to the Middle and Late Holocene. In some cases, European objects have been found that are taken as evidence of a burial style practiced up to very late hunter-gatherer occupation.

In those caves and places defined as campsites for limited activities (logistics) or for multiple activities (residential base camps), none of the burial styles from the foothills or the marine coast have been found yet. In all cases, its presence is associated with the margins of basaltic plateaus or low hills from where the panoramic view of valleys and basins could be managed, whereas spaces for domestic activities are restricted to areas where shelter, resources and especially drinking water were available. Places for burials could be coincident or not with sectors where special raw materials, such as pigments, were available. This discontinuous spatial relationship between such sites that are very different according to their function is relevant, since the extractive activity of ochre and its social circulation should be related to sacred activities directed to special groups, as Aguerre (2000) has documented for ethnographical cases. In archeological contexts, the use of ochre has been recorded by Miotti (2006d) for the Deseado Basin, Martínez (2004), Berón and Baffi (2004) and Prates (2006) for northern Patagonia, and Messineo and Politis (2005) for the Interserrana Area in the Pampean region.

Finds of ochre exposures are other examples of territoriality markers. Between the "chenque" at the top of Cerro Madre e Hija and others on the slopes, an exposure of yellow ochre is highly visible; it has a thickness of 2.5 m and a width of 15.0 m. At Piedra Museo, the El Sargento "chenque" was covered by red ignimbrite boulders from the same hill and nodules, cores and waste debris of an allochthonous greenish silex.

The emplacement of this burial in the landscape is very interesting. From the top of the ignimbrites and basalts covering the tuff hill and from the burial itself, the Cerro Madre e Hija (20 km to the north) is highly visible; the exposures where the rockshelters with petroglyphs were excavated are located to the east and the red silex quarry on the slope of El Sargento Plateau. At the bottom, the Los Algarrobitos open air campsite is easy to identify. Southward, the southern margin of the paleolake at Piedra Museo is observed (Fig. 4a).

Although GPS positioning, taphonomic observations, topography and landforms of emplacement have been studied over the last 20 yrs, available information is still unsatisfactory (Miotti, 1998; Miotti *et al.,* 2002).

Rock art confirms, on the continent, the complexity of this picture and the increase of stylistic regionalization of images represented on rocks and mobile artifacts (see Carden *et al*., in press; Belardi and Goñi, 2006; Miotti *et al*., in press a; Fiore and Podestá, 2006, and references cited there).

In summary, during the Late Holocene people were well organized, with strong communication networks, living under a changing climate but then with less environmental stress and changes, occupying all of Patagonia on both sides of the Andean Range, which had been previously thought of as a topographic filter. Likewise, the archeological results from the Magellan Basin (Fig. 13b) and the fluvial and lacustrine Andean basins show a strong increase for those sites occupied during the Middle and Late Holocene (Fig. 13a), especially close to the heads of Río Santa Cruz, and for the Late Holocene in the mouth of the Chico and Gallegos rivers (Table 4; Fig. 13c; Gradín *et al.*, 1979; Goñi, 2000–2002; Goñi and Barrientos, 2004; Goñi *et al.*, 2004; Borrero, 2005; Carballo Marina, 2007, among many others).

The Atlantic coast seems to have been occupied recurrently during this interval, as verified in the record of materials in open air sites, but the number of radiocarbon dates is still very low (Fig. 13d); instead, the large chronological information existing for northern and central Patagonia (Fig. 13e, f) demonstrates more stable occupation by this time and/or higher demography than in previous periods. The record along the central coast in Patagonia is very interesting, as is the increase of radiocarbon data coming from Tierra del Fuego (Fig. 13g), particularly in the Beagle Channel (Fig. 13h), but there may be a sampling bias (E. Piana, personal communication). In the northern plains of Tierra del Fuego, the archeological record is particularly concentrated close or very close to the Atlantic coast and the radiocarbon dates indicate a large population in this area since 2000 yrs ago (Fig. 13i). For the time being, the low frequency of radiocarbon dated sites in Bahía Valentín at Península Mitre is still related to the few investigations done there, although

research activities have recently been reactivated in this remote area (M. Vázquez, personal communication.).

3.4. The Breakdown of the Aboriginal Society After the European Contact

The end of the expansion of the aboriginal society (considering it as a whole) has been considered herein partly as the end of the Holocene, but in this case not as a consequence of climatic or environmental changes. Moreover, another kind of impact took place upon the Patagonian populations with the entrance of the "white" people, the Europeans who started their expansion toward the Patagonian territories southward from the Pampas. Such expansion took place since the last part of the seventeenth century.

This event very strongly changed the aboriginal habits and resources, with the introduction of a new large mammal species such as the European horse, which created a whole complex of tools and life strategies, known as the "horse complex".

The crash between these two societies with very different behavior, tools, economy and social organization was too strong to allow the preservation of the aboriginal lifestyle much longer. Natives were unable to replace or accommodate their social organizations when these changes became effective. Thus, less than 200 yrs were enough for the Europeans to weaken and destroy these aboriginal societies (even when considering different ethnographic groups) and to dominate the entire extension of Patagonia.

Many archeological sites belonging to the so called "postcontact period" have been studied all over Patagonia from different points of view. The extremely long list of these sites makes it impossible to include them in this brief study, but they are proving the very high population density distributed all over Patagonia during the latest part of the Late Holocene.

4. Discussion: Stability, Discontinuities and Radiocarbon Chronology

No radiocarbon chronology has yet been established for the Pleistocene–Holocene transition along the Atlantic coast and the extra-Andean area of central and northern Patagonia. Human occupation has been recorded only along the piedmont of the northern Patagonian Andes (Table 2, Fig. 2). The earliest and more concentrated human occupation known so far occurred in the Deseado Massif and in the Magellan Basin area.

The region of the Pali Aike volcanic field and Seno Última Esperanza extended by that time into the present Isla Grande de Tierra del Fuego (Fig. 1, Table 2 and Fig. 2c); the Strait of Magellan was then occupied by a land bridge composed of moraines and glaciofluvial plains and a large proglacial lake. Tierra del Fuego was still the continental southern tip of Patagonia by the end of the Pleistocene. In the area of the Deseado Massif, the earliest known occupations are at least 500 yrs earlier than in the southern margin of this Magellan paleolake. The oldest records are concentrated in sites within the Deseado Massif and the age of the surrounding localities decreases southward and westward.

Northern Patagonia shows a few records for the earliest occupations, which are located in the eastern Andean foothills or in the ecotone area (see Fig. 1, Tables 1 and 2). Along the Pacific façade, the site of Monte Verde is the only one known with human occupation during the Pleistocene–Holocene transition. This site was occupied ca. 1.5 kyr before the sites in Seno Última Esperanza and the Pali Aike volcanic field (Fig. 1, Table 2). The Marifilo-1 site displays the human settlement at a rockshelter in the Río Valdivia basin, ca. 10.0 ka BP; in the Aysén area, the earliest occupation at Baño Nuevo occurred during the Early Holocene, but only around 3000 yrs later. However, this occupation seems to be the result of an effective colonization phase, not just an exploration event (Mena and Stafford Jr., 2006). New research in this site could perhaps solve the question of an earlier occupational event within the cave, according to the available radiocarbon dates and contexts (Table 2).

During the last period of the transition and the Early Holocene (ca 9.7 and 8.0 ka BP), population seems to have spanned and colonized other zones such as basins in the Eastern Andean foothills of northern and outhern Patagonia, as well as occupying new localities in the already known and colonized regions. The earliest occupations in Tierra del Fuego seem to have been interrupted during these times (Tres Arroyos and Marazzi sites, see Table 2, Fig. 2). Is it possible to believe that the exploration of the southern edge of the Magellan Basin had failed or, instead, that the population had moved back northward of the proglacial lake? Whatsoever the answer is, any theory should explain the causes of site abandonment. However, if the paleoenvironmental conditions are analyzed (Table 5), a few answers may be found. About ca. 9.0 ka BP, volcanic activity started in the area with several eruptions; within the caves, roofs frequently collapsed and several caverns and rockshelters were abandoned perhaps due to a dramatic reduction of the available space for human occupation, i.e. CCP 7, AEP-1, Chorrillo Malo, Las Buitreras and Tres Arroyos (Table 1, Fig. 2). Probably, tectonic and/or volcanic events had an influence upon the discontinuity of peopling in certain areas as well as on the beginning of colonization of new places.

A second and great event that took place at ca. 8.0 ka BP, which could have had effect upon human mobility and certainly increased the isolation of the Fuegian population, was the opening of the Strait of Magellan that firstly connected the Atlantic and the Pacific oceans since the arrival of humans at this latitude. The occupation recorded in the Aysén zone, on the western side of the Andes, would be a result of different populations arriving along the Pacific façade from the north or, alternatively, of human groups (maybe mongoloid people *sensu* Mena *et al*., 2003) from the east of the Andes who found a cordilleran path and colonized the Río Ibáñez Basin. Likewise, the archeological contexts of the western side of the Andean Range show several differences in the use of the space and resources. Human burials recorded in Baño Nuevo 1 indicate some aspects of social complexity for this time that are

reproduced in those entombments specially prepared (probably wrapped in a sort of skin, see Mena *et al*., 2003) or arranged in singular places that became common practice in the Andean area ca. 9.0 ka BP.

During the Early Holocene, human occupation has not been recorded neither in central Patagonia nor along the Atlantic coast, as it can be observed in Table 2 and Fig. 2; clearly, the earliest records as well as their highest frequency came from the Deseado Plateau; younger and less frequent sites are recorded in the Magellan Basin and the foothill and lacustrine Andean basins. Only one record for the earliest colonization times is known so far for Tierra del Fuego (the Tres Arroyos site, Table 2). At present, this site is located 20 km away from the Atlantic coast; coastal areas were probably as far as 100 km eastward by the time of human peopling. This site is found within the Río San Martín Basin, which drains to Bahía San Sebastián at the Atlantic coast. This fact could be reliable evidence to support that this first peopling wave into the Fuegian lands came from the eastern or northeastern steppes, instead of coming from the west, where the receding ice front was still occupying the bottom of the valley and blocking the proglacial lake (McCulloch *et al.*, 2005). The other very early site, Marazzi, is a rockshelter probably occupied by humans just before the opening of the strait (Table 2).

In this sense, it can be suggested that the southward exploration in the western side of the Andes, alongside the glaciated area with extant glaciers, deep fjords, abrupt channels and bare rocky islands, was slower and more limited than on the eastern side of the mountain ranges and extra-Andean Patagonia, mostly due to severe spatial and environmental constraints.

Archeological, environmental and radiocarbon data indicate that population west and east of the Andes would not have been in contact until 9.0 ka BP (Tables 2 and 5). Then, it can be concluded that toward the end of the Pleistocene, a slow but continued peopling expanded from east to west coming from the Atlantic façade, reaching the eastern Andean foothills by the Early Holocene.

Another arrival event would have happened along the Pacific façade, but this migration would have been discontinuous and probably with failing exploration expeditions other than the one aforementioned or, sometimes, short trips intentionally organized with very precise, logistic goals like searching for new resources or as elite excursions. But also the special conditions of the area (glaciated landscape, ice fields) may have required special technologies for littoral adaptation that were even not sufficiently developed in those exploration times.

On the eastern side, though with more evidence of occupation, human dispersal was discontinuous, probably due to hostile environmental conditions when getting closer to the Andean Range. There should be places used by eastward incoming people during times of climatic amelioration, but this must have occurred briefly and/or seasonally due to the higher latitudes where they are located.

Then, it is suggested that groups from both sides of the Cordillera would have gotten in touch only 2 kyr after the earliest exploration west of the Cordillera, while the process of expansive colonization was taking place in the Río Deseado Basin. Within the Magellan Basin, instead, more intensive contact probably increased during the Middle Holocene between people from both sides of the Andean Range, though there was probably still only a small population in both the Aysén and Puerto Montt areas.

As the Tierra del Fuego Archipelago became isolated, people adapted to two very different environments became established there, i.e. the maritime littoral of the Beagle Channel and western waterways and isles and the steppe plains north of the Fuegian Andes. The appropriation of the landscape was different for these two groups, but the pedestrian people also used the coastal landscape, not only for economic purposes but also as burial places (Salemme *et al.*, in press b).

The fission and fusion mechanisms of human bands were probably effective since the exploration times, but it intensified throughout the Holocene as shown by increasing colonized spaces all over Patagonia. The evidence of allochthonous raw materials in different areas (rocks, marine shells, pigments, etc), the chronological gaps of certain settlements in some subareas, whereas complete sequences are found in others, the paleoenvironmental data based on changes in fauna and vegetation, and the transition from generalist to specialist economy are some of the topics that allow to sustain that the initial peopling of Patagonia took place alongside the main fluvial basins, from the Atlantic coast toward the central mainland.

5. Final Remarks

The southernmost end of South America was one of the last territories to become populated on the Earth. The Andean Range and its ice caps were the cause for the asymmetrical pattern of human distribution: almost all of the archeological sites are concentrated on the eastern side of the cordillera (Miotti and Salemme, 2003, 2004; Borrero, 2004), as there was a glacier barrier that would have been explored at different times until several paths were found, opening the communication between both sides. It seems clear so far that the earliest arrivals occurred independently on both sides.

Six main issues have been considered in the analysis of the peopling of Patagonia's landscapes:

(a) the most important environmental conditions that could have affected human occupation during each interval;
(b) the chronological gaps, clearly visible through the analysis of radiocarbon data;
(c) the generalist or specialist adaptations in the use of faunal resources;
(d) the rock art;
(e) the human burials; and
(f) the allochthonous raw materials.

Extreme environmental conditions during the latest Pleistocene would have been the scenario under which the first human groups entered the continent. But these harsh circumstances did not threaten them to begin the exploration and colonization of the new available lands.

Several of the best and earliest known archeological localities are today under desert climate conditions, with

very scarce water sources, most of them salty areas today, like Piedra Museo. However, between 13.0 and 10.0 ka BP, there were basins partially related to ancient snow and permafrost melting into the Río Deseado Basin, special environments for grassy plains hosting the then existing fauna. In fact, the Río Deseado would have flown toward the Atlantic Ocean during the Late Pleistocene, with as much discharge as the present Río Santa Cruz, with glaciers still occupying the Lago Buenos Aires Basin. But when its drainage was interrupted at its heads and deglaciation opened westward routes into the Pacific Ocean, desertification processes were intensified on the central Deseado Plateau. The colonizers of the Piedra Museo area lived through an environmental impoverishment, with changes and degradation of faunal and vegetation resources, as shown by palynological and faunal records. Similar conditions are found at Cueva del Minero Cave 1 in La María Locality and Los Toldos Cave 3. In this latter locality, caves would have been located along the margins of an old tributary of Río Deseado and close to two paleolakes.

Piedra Museo, a locality with a high archeological integrity and good radiocarbon chronology and paleoenvironmental resolution shares these characteristics with other localities during the Colonization Phase, such as Cueva del Medio, Cueva Lago Sofía, Cueva Fell and Tres Arroyos Rockshelter, all of them within the Magellan Basin, though environments were different. All of them had direct relationship with water: the two first are located close to the Skyring and Otway fjords, which were at least temporarily occupied by proglacial, freshwater lakes during the latest Pleistocene, in an open forest environment, and the other two were related to the Chico and San Martín fluvial basins. Note that the Pleistocene megafauna was equally exploited in all these sites.

The case of Monte Verde site is an example of ecological and adaptive variability; its economy seems to have been related to forest resources and, less likely, with megamammals; though remains of *Cuvieronius* are associated to this site, its synchronicity with the occupational context is still doubtful. Monte Verde has been considered a site of human interaction with the valdivian forest, where the main attractor for this residential camp was the basin of Arroyo Chinchihuapi, which was relatively close to the Pacific Ocean (approximately 50 km westward) by 13.0 ka BP.

In the Aysén Region, Baño Nuevo 1 site provided an interesting record of eight human skeletons dated ca. 9.0 ka BP, especially taking into account the type of burial. However, earlier occupations (related to extinct fauna like *Mylodon* sp.) are still doubtful since the disturbance provoked by the burials may have masked or blended them.

During the 15.0–8.5 ka BP interval, the extinction of Pleistocene megafauna occurred stepwise, considering not only space pattern but also species type, depending on their degree of adaptability and/or resistance to the changing environmental conditions. The Atlantic coast was as much as 200 km further east than today in some places; thus, if this centripetal model of peopling following large fluvial basins along the Atlantic slope is accepted, the existing oldest archeological sites should be found at least several tens of meters below present sea level on the present submarine platform. The change in the faunal component triggered by the extinction of megamammals forced people to turn from generalists into specialists. Since the end of the Early Holocene, camelids such as "guanaco" (*L. guanicoe*) became the most frequent and well-represented mammal in the hunter-gatherer's economy.

The Atlantic Ocean façade seems to indicate not only the highest antiquity but also the highest archeological variability, with more varied cultural development and segregation: the Piedra Museo, Cerro Tres Tetas Cave, Cueva del Minero, Cueva Maripe, Arroyo Feo, CCP 7, Río Robles, Chorrillo Malo and Fell sites, among others, should be considered in this sense.

Nonetheless, the Pacific Ocean façade shows different geographical and topographical scenery in those high latitudes: shorter valleys that reach the marine coast and less availability of settling places were probably unstable circumstances for human occupation. Anyway, sites like Monte Verde, Baño Nuevo, Marifilo in northern Patagonia and Cueva Sofía and Cueva del Medio in the south are showing that by the latest Pleistocene and the Early Holocene human groups were exploring and colonizing the western side of the Andes, maybe with little or without contact with the eastern side of the mountain ranges.

The case of the Tres Arroyos site, in the Magellan Basin, shows a privileged place because it dominates both façades. It is close to the main basin of Río San Martín – which flows into the Atlantic Ocean – but it was in the neighborhood of the Magellan proglacial lake before the opening of the straits. Thus, access to this area would have been possible also from the Pacific Ocean side; however, the still receding glacial front was likely blocking the passage. Therefore, it is more likely that people would have been moving southward from the northern steppe areas.

In summary, the exploration stage was lengthy, gradual and discontinuous, with advance and retreat related to the environmental availability, leaving some areas and recolonizing others, with culturally defined territorialities, as well as to those communication and mobility strategies accumulated through time and known as landscape appropriation. Certainly, ca. 12.0 ka BP was the time when both sides of the Andes would have been explored using different strategies: this moment has been defined as the Initial Colonization stage, *sensu* Miotti and Salemme (1999), or Exploration Stage, *sensu* Borrero (1990) and Franco and Borrero (2003). Between 10.5 and 9.0 ka BP, the bonds of human groups in landscape knowledge and communicational networks are widely demonstrated up to the eastern Andean piedmont. With the available evidence, the Río Deseado Basin becomes the most likely way of entering the continent at the earliest times; it is also possible that the Río Santa Cruz Basin was another equivalent route at somewhat later times. Unfortunately, the lack of information for the other subareas, which could be due to sampling bias, obscures the interpretation.

In fact, the record of allochthonous raw materials such as obsidian flakes (coming from the central–northwestern area) and shells of *Fisurella* and *Aulacomya*

(coming from the Atlantic Ocean) in the middle Deseado Basin sites are excellent examples that communication networks worked intensively during the Early Holocene. Those gaps detected in the occupation for a certain area but the available record in others show the mobility of hunter-gatherer societies that were searching for better living conditions, at least temporally and/or seasonally. Between 12.8 and 11.5 ka BP, the central Plateau was populated, though it seems that people moved to the eastern piedmont (Chorrillo Malo, CCP 7, Cuyin Manzano, Epullán sites), returning to the area around 8.0 ka BP (El Verano Cave, La Martita Cave and the AEP-1 upper component).

Idiosyncratic communication between human groups has been through rock art. This cultural expression is very common along the eastern side of the Andes, particularly represented in the central Plateau for the beginning of colonization and very frequent in different scenarios such as the Río Pinturas area and La María locality since the end of the Early Holocene. On the western side, the Aysén area is the only known area where this representation is available for the Late Holocene.

Death practices are still uncertain for this period, except for those burials found in Baño Nuevo Cave 1, which offered not only physical information due to their excellent degree of preservation, but also about treatment of the death. The record of human skeletons for the Middle Holocene is very scarce; only a few examples are known for the Magellan Basin and northern Tierra del Fuego (Table 3). But this indicator provides exciting information for the Late Holocene, when special attention was devoted to death rituals, not only considering the body treatment but also bearing in mind the special places used for burial (selectivity of space, grave building, body preparation, etc).

On the eastern Andean slopes, pulses of human occupation were more frequent during the Late Holocene. Sites CCP 7 and 5 are examples of occupation and abandonment, with subsequent repopulation again during the Late Holocene, but sites closer to the Cordillera like those from the Perito Moreno National Park could be interpreted as a model of marginal use, probably in response to seasonal environmental variations (*sensu* Miotti and Salemme, 2003, 2004; Borrero, 2004). Similar conditions would have taken place farther south, within the Magellan Basin, in intermittently occupied sites like Chorrillo Malo 2, or in the area of Seno Última Esperanza, where low-altitude paths and ice-free corridors were practicable and the connection between the Pacific and Atlantic basins was feasible. The Andean foothills were intensively used during the Late Holocene since the hunter-gatherer bands settled there, using the area under logistic or residential camps. Communication networks with the central areas were operational as regional demography was increasing.

Very likely, the differential use of space in central Patagonia, the Deseado Basin, the Magellan Basin and the Andean piedmont would have began during the Middle Holocene (Miotti, 2006c), an episode named the "Territorial Consolidation Interval" by Miotti and Salemme (1999, 2003, 2004), and later greatly increased during the Late Holocene. This could be perhaps a cause for the "depopulation" of southern Patagonia between 7.5 and 4.0 ka BP (Miotti, 2006c). Changes in spatial structures are visible in increase in sites and variability, as well as the regular and recurring occupations in certain types of landscapes. In the case of the Fuegian Archipelago, shell middens along the channels show a systematic reoccupation of the same sites, particularly during the Late Holocene, but this is much less frequent in the shell middens along the open plains of northern Tierra del Fuego, besides the higher variability observed there. Microenvironmental discontinuities are sometimes coincident with chronological colonization discontinuities, which may be related to catastrophic events or more local environmental modifications.

From an environmental and chronological point of view (at the regional scale), different, complementary movements among the defined stripes are observed. While the Initial Colonization Phase occurred on the plateaus (very well represented in caves), the Consolidation Phase took place along the piedmont of the Andes, northern Patagonia or along the coast, which had been bypassed until then. Later on, in the "dead ends" of the foothills, Holocene Glacier fluctuations (neoglaciations) and volcanic events probably displaced people to other places, thus forcing the exploitation of new landscapes in other regions, which we suggest to call the Definitive Settlement Phase, during the Late Holocene.

Some open air campsites from the Consolidation Phase show the occupation of northern Patagonia (see Table 3, Fig. 10), but the main bias is the scarcity of properly radiocarbon dated open air sites until the Late Holocene, with the exception of the Atlantic coast, where the most common open air sites correspond to burials ("chenques").

In the isolated Fuegian Archipelago, after the opening of the Strait of Magellan, the main island is the area best known archeologically. Two main adaptive strategies developed then, evolving in different ways of appropriation of the landscape. A long sequence of occupation has been recognized along the Beagle Channel since 6.0 ka BP (Orquera, 2005; Orquera and Piana, 2006), while just a few sites in the steppes reach this antiquity (Salemme *et al*., in press a; Favier Dubois and Borrero, 2005). Nonetheless, the expansion of hunter-gatherer groups in both areas is very well documented for the Late Holocene (Orquera and Piana, 1999; Borrero and Barberena, 2004).

The cultural divergence between the present continental area and the Archipelago area occurred after 8.0 ka BP. Such discrepancy is clear in the archeological record by means of three topics:

(a) Rock art increased in variability and expanded over the continental territories, but it is absolutely absent in the Tierra del Fuego Archipelago.
(b) Burials were performed as rocky monuments, particularly during the Late Holocene, in the three longitudinal environmental stripes of the continent, but they are absent in the archipelago, where the open air sites in the steppe or some rockshelters along the channels were used for burials.

(c) Circulation of exotic raw materials – Obsidian was used in places very far away from the Cordilleran source, like in the plateaus and Atlantic coast. Marine shells have been found in archeological contexts from the plateaus and the foothill Andean basins; however, they were not commonly used by people of the northern Tierra del Fuego inland steppe.

These differences are clear evidence for latest occupation by hunter-gatherers of Fuego-Patagonia. They might be the representation of only one ethnic materiality or territoriality patterns, which could have began after 8.0 ka BP.

But the main distinctive feature was given by the introduction of European horse (ca. AD 1725 in Punta Arenas, Chile, *sensu* Bulkeley and Cummins, 1744), bringing in further divergence between the Fuegian Archipelago and the continental populations. Up to extinction, natives from Tierra del Fuego never adopted the horse, whereas those from the continent fully did so. Thus, the continental aborigines expanded their mobility tracks though with unexpected additional consequences. In both areas, the European takeover drove them to extinction. It was a slow but constant and brutally aggressive process that in 200–300 yrs on the continent and in less than hundred years on the islands destroyed a hunter-gatherer life way more than 12,000 yrs old.

6. Agenda

Both the list of references and the exhaustive (but probably incomplete) inventory of radiocarbon dated sites are intended to give the reader a global idea of the state of archeological knowledge of Patagonia and Tierra del Fuego. Likewise, the information of nonradiocarbon dated archeological and historical sites (which have not been included in this study) is colossal. Nonetheless, we are aware of the gaps we still have to achieve for a comprehensive interpretation of the native cultures before the European arrival.

Particularly, northern and central Patagonia and the Atlantic coast (with the exception of the areas actually mentioned in this chapter) show a true paucity of reliable radiocarbon dates. Areas like the Somuncurá Plateau and the Río Colorado, Río Negro and Río Chubut basins appear as exciting places where to look for different stages of human peopling.

In Tierra del Fuego there are three main gaps in knowledge to be investigated:

(a) that one of about 2000 yrs between the only two sites related to the earliest population (Tres Arroyos and Marazzi sites);
(b) the absence of any archeological record between those early dates and the Middle Holocene record; and
(c) the archeological record of the ecotonal area of Lago Fagnano, in central Tierra del Fuego.

Some new interdisciplinary projects that are just starting will undoubtedly bring enlightenment on those open questions and also to many others still to be formulated.

Acknowledgments

This chapter is the result of many years of work on the Archeology of Patagonia, especially in Santa Cruz Province and northern Tierra del Fuego. CADIC (Ushuaia) and Departamento de Arqueología at the Museo de La Plata hosted our research projects during more than 20 yrs. Several grants helped the development of these research projects, coming from CONICET (the National Research Council of Argentina), ANPCyT (the Argentine National Promoting Agency for Science and Technology), National Geographic Society and the SECYT–ECOS Program (between the Science Secretariats of Argentina and France). Many pre- and postgraduate students have participated in fieldwork and their assistance in the laboratory has been very helpful. Fernando Santiago helped us with the drawing of Fig. 1. Radiocarbon dating of our projects was performed in the laboratories of Arizona University (USA) and LATYR (Universidad de La Plata, Argentina).

The authors are very grateful to all of them, as well as to the reviewers that helped to improve a first version of this manuscript. However, we would like to emphasize that we are solely responsible for the concepts and ideas as well as the errors and inaccuracies included in this contribution.

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Chapter 22

AU1 “Hrdlika 1912” has been changed to “Hrdlicka 1912 ” in order to match with the Reference list. Is this Ok?

AU2 Please provide the explantions for part figures 1a, 1b and 1c.

AU3 “see Rabassa, this volume” has been changed to “Chapter 8”. Please confirm if this change is OK.

AU4 “Salemme et al., in press a”. Please update.

AU5 “Mancini et al., this volume” has been changed to “Chapter 17”. Please confirm whether this change is oK.

AU6 “#” What does it specify.

AU7 Please clarify whether “central Deseado Pleateau” could be changed to “Deseado central Pleateau”.

AU8 “Gradín and Aguerre, 2004” has not been listed in References. Please provide.

AU9 “Boschín and Nacuzi, 1979” has been changed to “Boschín and Nacuzzi, 1979” in order to match the Reference list. Is this Ok?

AU10 Please provide editor names for this Reference entry.

AU11 Please update this Reference entry.

AU12 Please provide the significance of the grouped values using the line. (Table 2: Baño Nuevo 1).

AU13 Please provide the significance of “*” in Table 3 and Table 4.

AU14 The following entries are inconsistent. Please advice which style is to be followed.

Beta-164476	Beta 2517
LP-300	LP384, LP 352
AC-1102	AC 674
MC-1068	MC 1062
CSIR-7682	CSIR 7684
Gif-8851	GIF 10791
AA65165	AA 66713

AU15 Please provide the complete details of “Martin, 2004”.