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Radiocarbon trends in the Pampean region (Argentina). Biases and demographic patterns during the final Late Pleistocene and Holocene

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ABSTRACT

This paper compiles a database of radiocarbon dates of archaeological sites that are currently available for the Pampean region. Based on the probability distribution of radiocarbon dates from this database, major temporal trends are defined, taphonomic and scientific biases are evaluated, and their implications for demography are suggested. Results indicate a continuous archaeological signal between ca. 14,500 and 100 cal BP. During the final Late Pleistocene and the Early Holocene, the archaeological signal is low in ca. 14,500–12,800 cal BP, and increases to a moderate and continuous signal in ca. 12,800–7500 cal BP. The archaeological signal for the former lapse correspond to the early peopling of the region and is related to the inhabiting and exploitation of key landforms (e.g., rock shelters, river valleys) and critical resources (e.g., lithic raw material, water). The low amount of available dates for the Middle Holocene (ca. 7400–3700 cal BP), and the associated archaeological signal would be due to the combination of various factors such as taphonomic biases, organization of prehistoric populations, and even a possible low population density. The obtained low but continuous signal for this period are discussed in the framework of the proposed models for the human occupation of the region suggesting that a hypothesis about population extinctions and disruptions processes could not be sustained. Finally, during the Late Holocene (from 3700 to 100 cal BP) human occupations are recorded in all the micro-regions. Regardless of biases, this signal is interpreted as an increase in demographic density at a regional level.

1. Introduction

The analysis of radiocarbon date series has been a very fruitful field in archaeology for the last decades. Since the 1980's, the use of radiocarbon datasets (Rick, 1987) as a demographic proxy started to grow exponentially until it became one of the main tools for assessing different problems, such as changes in the density of human settlement of an area over time, processes of geographic distribution of populations, regional cultural chronologies, among others (e.g., Wendorf et al., 1979; Rick, 1987; Straus et al., 2000; Steele, 2010; Gajewski et al., 2011; Selden, 2012; Williams, 2012; Russel et al., 2014).

The use of frequency distribution of radiocarbon dates in South American archaeology has also received increasing attention, and it has been applied to different scales. In this sense, this tool has been used to identify macro-regional trends during the first millennia of the continent settlement (e.g., Bueno et al., 2013; López Mazz, 2013; Méndez, 2013; Prates et al., 2013) and for the recognition of regional patterns in more geographically bounded areas (Berón et al., 2007; Barberena, 2008; Barrientos, 2009; García, 2010; Neme and Gil, 2009, 2010; Marquet et al., 2012; Favier Dubois, 2013; Martínez et al., 2013a; see also this volume). In the particular case of the Pampean region, the probabilistic distribution of radiocarbon dates has also been used to discuss the continuity and/or discontinuity of population which implied the expansion, contraction, replacement or even extinction processes in specific periods, such as the Middle Holocene and the beginning of the Late Holocene (Barrientos, 2001, 2009; Barrientos and Perez, 2004, 2005; Barrientos and Masse, 2014). Archaeological gaps during the Late Holocene that are related with regional mobility along different areas have also been proposed (Berón et al., 2007, see also

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this volume). Moreover, trends in the chronology of human occupation of particular areas have also been addressed, considering the existence of biases (e.g., taphonomic and scientific ones) that preclude finding sites in particular periods (Martínez et al., 2013a).

This paper attempts to deepen and renew the discussion of issues such as those mentioned above for the Pampean region, based on the study of a database of radiocarbon dates from the final Late Pleistocene to the Late Holocene. The main subjects of this paper are: a) to identify the variations in the intensity of the archaeological signal over time, and to assess its implications regarding human occupation and demography of the region; b) to evaluate factors related to paleoenvironmental dynamics and differential productivity in specific sectors of the landscape that could have influenced human occupations and temporal frequency distributions; c) to evaluate the action of geomorphological agents and processes that could have affected the visibility and preservation of the archaeological record (e.g., taphonomic agents); and d) to explore possible scientific bias and differential research efforts (e.g., intensity of investigations in each area, systematic and continuous research programs, etc.) that could have affected the observed temporal patterns.

2. Environmental settings

The Pampean region is located in Central-East Argentina (~666,000 km^2) and it is bordered by the Atlantic coast to the East, the Paraná basin to the North, and Patagonia region to the South. It is dominated by grassland plains, with a flat to gently undulating landscape, and interrupted by only two main hill systems: Tandilia and Ventania.

In this paper, the micro-regions of Pampa defined by Berón and Politis (1997) on the basis of geomorphological, phytogeographic, and climatic criteria (see Berón and Politis, 1997) are considered, with slight modifications. As some micro-regions could not be defined in a precise way because they are located in ecotonal areas, in some cases slightly changed limits were used. Following this, ten micro-regions were considered for the analysis: Delta and Adjacent Plains, North, West, Salado Depression, Tandilia, Interserrana,

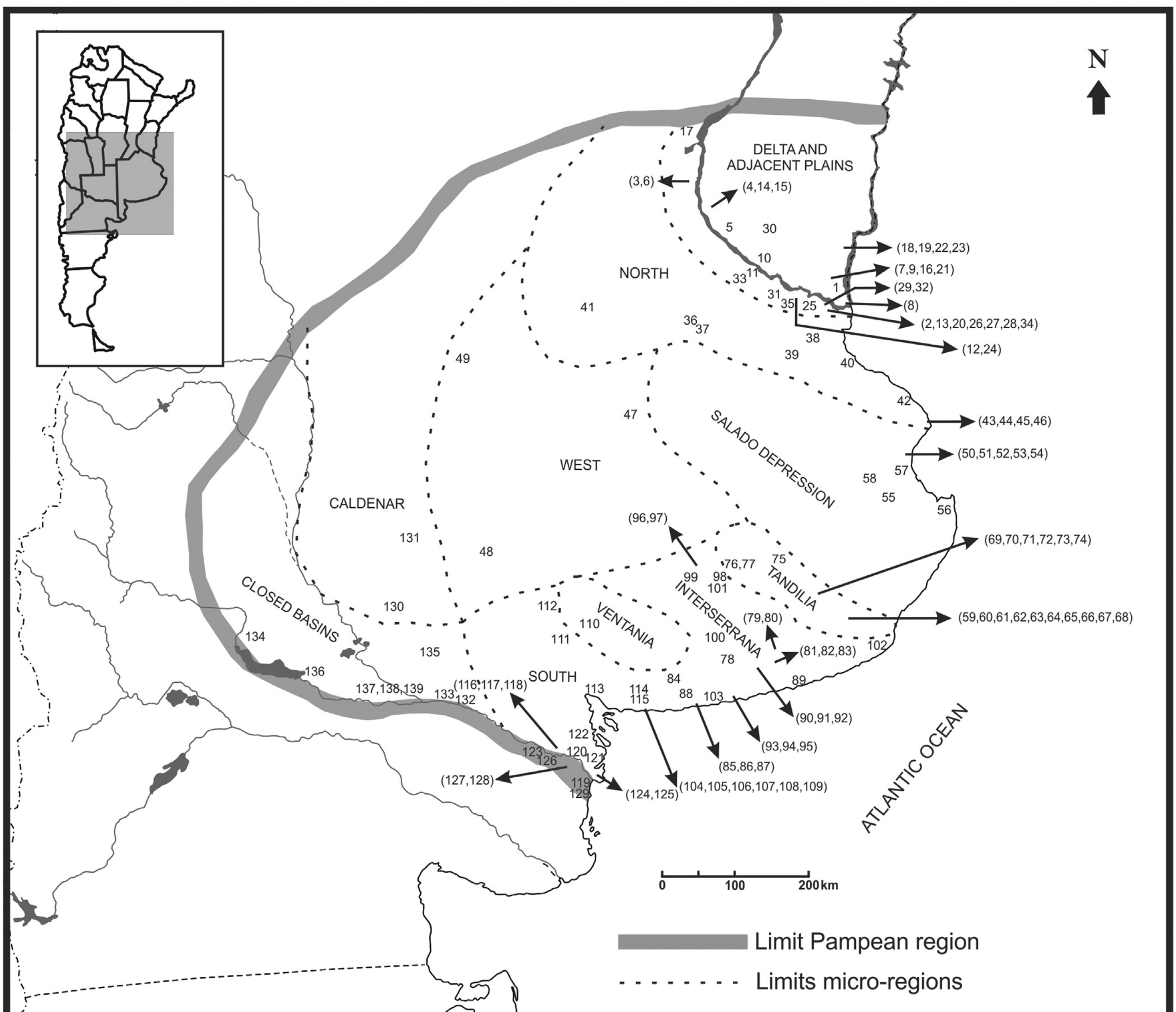

Fig. 1. Distribution of archaeological sites in each micro-region of the Pampean region. Only sites whose geographic coordinates were available are included in this Figure.

Ventania, South, Caldenar, and Closed Basins (Fig. 1). The main features of each one are described below.

2.1. Delta and Adjacent Plains

This micro-region is formed by a flood plain at the lower Paraná River, and it develops in areas that bore strong marine influence during the Middle Holocene. It is constituted by two large geomorphological units: one fluvial (the coastal plains of the lower Paraná basin that were not affected by the postglacial marine transgression), and the other deltaic (the subaerial plain of the Paraná Delta that was originated in times of higher sea levels; Cavallotto et al., 2005). Archaeological sites are mainly located in the islands (internal alluvial deposits) on mounds and ridges (Bonomo et al., 2010).

2.2. North

This sector is represented by a slightly undulating plain, drained by well defined streams and water courses. It also comprises several landforms (ravines, river terraces and lowlands) originated by a slight elevation of the crystalline basement and by river erosion. Archaeological sites are mainly located close to water sources, on the top of levees.

2.3. West

This micro-region is dominated by an undulating topography shaped by the overlapping of sand dunes. Most of these landforms are partially stabilized, and central basins are generally occupied by endorheic spring fed lakes (Heider, 2009). Towards the East of La Pampa province, elongated depressions (or transverse valleys) divide the plain into plateaus (Camels, 1996). Along these valleys there are salt marshes, and temporary water courses and ponds. Archaeological sites are located by water bodies.

2.4. Salado Depression

A flat landscape with low gradient slopes, crossed by the Salado River, and with numerous ponds, depressions and levees characterizes this micro-region (González de Bonaveri and Zárate, 1993–1994). Dunes are several meters high, and are suitable areas for human settlement because they have good visibility, they avoid flood risk, and they have an adequate system of internal drainage. From the geomorphological point of view, these environments were probably stable since the beginning of the Holocene (see discussion in González de Bonaveri and Zárate, 1993–1994).

2.5. Tandilia

This area is characterized by hills (525 m.a.s.l.), isolated rock outcrops, and extensive table-form massifs with interior valleys. It has an east-west orientation, and extends to the Atlantic Ocean. Most of the archaeological sites are located in caves and rock shelters formed primarily by dissolution of the siliceous cement of quartzites during wet periods in the Cenozoic (Martínez et al., 2013b).

2.6. Interserrana

This micro-region is an area of herbaceous plains with low slopes on loessic sediments (Politis, 2008). The topography is slightly undulating with a gentle Northwest-Southeast slope. It is drained by streams, ponds, and watersheds flowing into the Atlantic Ocean. Archaeological sites are mainly located along riverine areas, which have long stratigraphic sequences with a high chronological resolution (Favier Dubois, 2006; Johnson et al., 2012).

2.7. Ventania

This arch-shape hilly system (~1000 m s.a.l.) is formed by numerous elevations. The largest fold is located in the western sector, while the eastern one has gentler slopes. Many caves with good inhabiting conditions and greater temporal stability for human populations are available in Ventania; it is in these features where most archaeological sites are located. The plains surrounding the mountains are well drained by temporary and permanent water bodies (Bohn et al., 2011).

2.8. South

The southernmost micro-region of the Pampean region comprises two main areas: the plains located between Ventania hill system and the Atlantic Ocean, and the Colorado River basin, located to the South, in the ecotone between Pampas and Patagonia. In the former, human occupations are generally located in river valleys, along the sea coast and near to lagoons (Bayón et al., 2006, 2010; Vecchi et al., 2013). In the Colorado River basin archaeological sites are in different geomorphological units, such as contemporary and sub-modern drainage networks, old shorelines and degraded dunes (Spalletti and Isla, 2003; Martínez and Martínez, 2011).

2.9. Caldenar

This area is flat to slightly undulating, characterized by sandy eolian deposits, and typical landforms created by the intense action of the wind: dunes, interdune depressions that can hold water bodies, and blowouts (Camels, 1996), where archaeological sites are located.

2.10. Closed Basins

This micro-region is characterized by a plain with staggered levels, in some places below the sea level. Morphogenetic processes related to water runoff of the Colorado River paleochannels and the subsequent wind erosion originated the main features of the landscape: depressions and lowlands associated to dunes, salt flats, and salt marshes. It is a dynamic environment with temporary or permanent water bodies. Most archaeological sites are located around water sources (Carrera Aizpitarte et al., 2013).

3. Materials and methods

For data processing, the time scale and periods proposed by Politis and Madrid (2001) is used. Though these authors expressed ages in radiocarbon years BP, in this paper calibrated years are used for heuristic purposes. In this regard, the following periods are considered: final Late Pleistocene-Early Holocene (ca. 13,000–6500 years BP; ca. 14,845–7375 cal BP), Middle Holocene (ca. 6500–3500 years BP, ca. 7375–3734 cal BP), and Late Holocene (ca. 3500–250 years BP, ca. 3734–228 cal BP). The latter period was divided into two sub-periods: initial Late Holocene (ca. 3500–1000 years BP; ca. 3734–863 cal BP), and final Late Holocene (ca. 1000–250 years BP; ca. 863–228 cal BP).

The ^{14}C database was built through an exhaustive review of published information in order to get chronological data for all micro-regions. It was standardized by considering the following variables: site name and/or collection, altitude and longitude, laboratory code, dated material, radiocarbon age with standard deviation, calibrated age with two sigma, and bibliographic reference. Both standard and AMS radiocarbon dates were considered. Only the ages considered as acceptable for the authors of the original papers were taken into account for the analysis and dates are shown in Tables 1–10. Furthermore, additional criteria were considered in this paper in order to establish the database. In this sense, dates obtained from organic material in sediments and soils were not considered since they provide an age of the sedimentary unit containing the archaeological materials. Though these dates can be reliable to estimate human occupation chronologies, they are not used herein because radiocarbon dates from organic material of buried soils can be obtained from bulk, humates, and residue fractions, and always need to be considered as minimal ages (Johnson et al., 2012). The same criteria were applied to radiocarbon dates obtained from gastropods deposited in sediments from archaeological contexts but whose anthropogenic origin (e.g., middens) was not clear. Furthermore, when the same individual or bone element was dated more than once, the weighted mean of the obtained values was considered in order to avoid sample overestimation.

Table 1
Radiocarbon dates from the Delta and Adjacent Plains micro-region.

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. Code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
1	Arroyo Fredes	34°11′11″	58°33′10″	UGA-10789	AMS	*Homo sapiens*	690	70	528–718	Loponte et al., 2011
	Arroyo Fredes	34°11′11″	58°33′10″	LP-1428	Standard	*Homo sapiens*	370	50	306–492	Loponte et al., 2011
	Arroyo Fredes	34°11′11″	58°33′10″	AA-77309	AMS	*Homo sapiens*	402	40	323–497	Loponte et al., 2011
2	Arroyo Sarandí	34°23′	58°39′	UGA-10788	AMS	*Homo sapiens*	1290	40	1069–1269	Loponte, 2008
	Arroyo Sarandí	34°23′	58°39′	AA-93219	AMS	*Homo sapiens*	688	42	555–665	Bonomo et al., 2011a
3	Cerro de las Pajas Blancas 1	32°06′36.8″	60°44′33″	LP-1925	Standard	Charcoal	650	70	515–671	Bonomo et al., 2011a
4	Cerro El Castaño 2	32°50′11.6″	60°37′44.7″	LP-861	Standard	*Homo sapiens*	700	90	514–736	Cornero, 2009
5	Cerro Grande de la Isla de los Marinos	32°55′26.6″	60°33′48.9″	LP-2464	Standard	*Homo sapiens*	460	50	325–538	Politis and Bonomo, 2011
	Cerro Grande de la Isla de los Marinos	32°55′26.6″	60°33′48.9″	LP-2437	Standard	*Homo sapiens*	590	60	500–650	Politis and Bonomo, 2011
	Cerro Grande de la Isla de los Marinos	32°55′26.6″	60°33′48.9″	LP-2464	Standard	*Homo sapiens*	660	70	517–675	Politis and Bonomo, 2011
6	Cerro Tapera Vázquez	32°8′16.6″	60°38′7.5″	LP-1989	Standard	Charcoal	650	60	526–665	Bonomo et al., 2011b
	Cerro Tapera Vázquez	32°8′16.6″	60°38′7.5″	LP-1993	Standard	Charcoal	520	60	330–632	Bonomo et al., 2011b
7	Don Santiago	33° 43′	58° 55′	Ingeis AC-0136	Standard	Shell	1090	80	773–1171	Caggiano, 1984
	Don Santiago	33° 43′	58° 55′	Ingeis AC-0183	Standard	Shell	1300	80	981–1303	Caggiano, 1984
8	El Arbolito	34°10′	58°14′	GrN-5146	Standard	Charcoal	405	35	323–498	Cigliano, 1968
9	El Cerrillo o Tumulo 1 del Paraná Guazú	34°1′	58°41′	AA-93215	AMS	*Homo sapiens*	576	42	502–631	Bonomo et al., 2011a
10	Isla Lechiguanas	33°44′ 28.3″	59°13′40.5″	AA-97462	AMS	*Myocastor coypus*	408	30	324–499	Loponte et al., 2012
	Isla Lechiguanas	33°44′28.3″	59°13′40.5″	AA-97467	AMS	*Blastocerus dichotomus*-bone	2296	34	2158–2347	Loponte et al., 2012
	Isla Lechiguanas	33°44′28.3″	59°13′40.5″	AA-97461	AMS	*Blastocerus dichotomus*-bone	2267	34	2154–2334	Loponte et al., 2012
11	Isla Talavera (BD-S1)	33°52′07″	59°10′46″	LP-1300	Standard	*Homo sapiens*	310	80	1–499	Caggiano and Flores, 2001
12	Isla Talavera (Águila Negra)	33°57′5″	58°55′49″	LP-1265	Standard	*Homo sapiens*	570	70	468–657	Caggiano and Flores 2001
13	La Glorieta	34°18′	58°41′	AA-93216	AMS	*Homo sapiens*	416	41	323–503	Bonomo, 2013
14	Laguna de Los Gansos 2	32°29′66.5″	60°38′42.7″	AA-98851	AMS	*Homo sapiens*	570	43	500–630	Bonomo et al., 2014
15	Laguna de Los Gansos 1	32°29′66.5″	60°38′42.7″	AA-98845	AMS	Bone indet.	1740	47	1514–1726	Bonomo et al., 2014
16	Los Tres Cerros 1	34°8′55.2″	58°43′47.58″	LP-2295	Standard	*Diplodon* sp.	560	80	333–663	Politis et al., 2011b
	Los Tres Cerros 1	34°8′55.2″	58°43′47.58″	LP-2292	Standard	*Homo sapiens*	650	70	515–671	Politis et al., 2011b
	Los Tres Cerros 1	34°8′55.2″	58°43′47.58″	AA-98852	AMS	*Homo sapiens*	657	43	544–658	Scabuzzo et al., 2014
	Los Tres Cerros 1	34°8′55.2″	58°43′47.58″	LP-2243	Standard	*Diplodon* sp.	830	50	654–793	Politis et al., 2011b
	Los Tres Cerros 1	34°8′55.2″	58°43′47.58″	LP-2289	Standard	Charcoal	650	70	515–671	Bonomo et al., 2011a
	Los Tres Cerros 1	34°8′55.2″	58°43′47.58″	LP-2284	Standard	*Diplodon* sp.	660	70	517–675	Politis et al., 2011b
	Los Tres Cerros 1	34°8′55.2″	58°43′47.58″	LP-2302	Standard	Charcoal	790	100	544–904	Politis et al., 2011b
	Los Tres Cerros 1	34°8′55.2″	58°43′47.58″	AA-93218	AMS	*Homo sapiens*	775	85	544–878	Bonomo et al., 2011a
	Los Tres Cerros 1	34°8′55.2″	58°43′47.58″	LP-2332	Standard	Charcoal	760	70	553–760	Politis et al., 2011b
	Los Tres Cerros 1	34°8′55.2″	58°43′47.58″	LP-2281	Standard	Charcoal	580	70	475–661	Politis et al., 2011b
	Los Tres Cerros 1	34°8′55.2″	58°43′47.58″	LP-2296	Standard	Charcoal	860	40	673–791	Politis et al., 2011b
	Los Tres Cerros 1	34°8′55.2″	58°43′47.58″	LP-2750	Standard	Charcoal	880	50	668–904	Politis and Bonomo, 2012
	Los Tres Cerros 1	34°8′55.2″	58°43′47.58″	LP-2572	Standard	Charcoal	1030	50	773–965	Politis and Bonomo, 2012
	Los Tres Cerros 1	34°8′55.2″	58°43′47.58″	LP-2576	Standard	Charcoal	970	60	727–952	Politis and Bonomo, 2012
17	Río Salado Coronda	31°41′53.2″	60°44′59″	UGAMS-0247	AMS	*Homo sapiens*	1000	30	797–926	Coll et al., 2010
18	Rodeo Viejo de la Nena	33° 37′	58° 45′	Ingeis AC-0187	Standard	Shell	1420	80	1074–1421	Caggiano, 1984
	Rodeo Viejo de la Nena	33° 37′	58° 45′	Ingeis AC-0188	Standard	Shell	1420	80	1074–1421	Caggiano, 1984
19	Túmulo 1 Brazo Largo	33°44′44″	58°32′	AA-93217	AMS	*Homo sapiens*	656	42	544–657	Bonomo et al., 2011a
	Túmulo 1 del Brazo Gutiérrez	n/i	n/i	AA-72635	AMS	*Homo sapiens*	752	41	563–724	Bernal, 2008
20	Túmulo 2 Paraná Guazú	34°0′59.34″	58°33′19.2″	AA-72633	AMS	*Homo sapiens*	846	41	667–788	Bernal, 2008
21	Arroyo Malo	34°18′	58°41′	AA-93216	AMS	*Homo sapiens*	416	41	323–503	Bonomo et al., 2011a
22	Cerro Lutz	33°38′47.4″	58°36′20.8″	AA-77310	AMS	*Homo sapiens*	976	42	750–926	Mazza, 2010
	Cerro Lutz	33°38′47.4″	58°36′20.8″	AA-77311	AMS	*Homo sapiens*	796	42	572–744	Mazza, 2010
	Cerro Lutz	33°38′47.4″	58°36′20.8″	LP-1711	Standard	*Homo sapiens*	730	70	548–731	Mazza, 2010

Table 1 (*continued*)

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. Code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
	Cerro Lutz	33°38′47.4″	58°36′20.8″	AA-77312	AMS	*Cannis familiaris*	916	42	688–907	Mazza, 2010
	Cerro Lutz	33°38′47.4″	58°36′20.8″	AIE-26923	AMS	*Blastocerus dichotomus*	790	42	571–739	Loponte and Corriale, 2013
23	Cerro Mayor 1	33°37′	58°37′	AA-97457	AMS	*Blastocerus dichotomus*	1574	45	1321–1527	Loponte and Corriale, 2013
	Cerro Mayor 2	n/i	n/i	AA-97469	AMS	*Blastocerus dichotomus*	1561	45	1316–1518	Loponte and Corriale, 2013
	La Argentina	n/i	n/i	AA-97463	AMS	*Blastocerus dichotomus*	1645	34	1409–1570	Loponte and Corriale, 2013
24	Anahí	34°16′95″	58°48′47″	Beta-147108	AMS	*Myocastor coypus*	1020	70	736–1048	Acosta, 2005
25	Garín	34°22′38″	58°42′30″	LP-240	Standard	*Myocastor coypus*	1060	60	791–1057	Loponte, 2008
26	Guazunambí	34°23′23″	58°37′48″	Beta-147109	AMS	Mammalia indet.	940	60	688–926	Loponte, 2008
27	La Bellaca 1	34°22′79″	58°39′53″	LP-1288	Standard	*Myocastor coypus*	1110	70	801–1171	Loponte, 2008
28	La Bellaca 2	34°22′79″	58°39′53″	LP-1263	Standard	Mammalia indet.	680	80	516–721	Loponte, 2008
29	Las Vizcacheras	34°16′81″	58°48′65″	Beta-148237	AMS	*Lama guanicoe*	1090	40	819–1058	Loponte, 2008
	Las Vizcacheras	34°16′81″	58°48′65″	LP-1401	Standard	Burned seeds	1070	60	797–1058	Loponte, 2008
30	Playa Mansa	33°10′12″	59°31′48″	UGAMS-03302	AMS	*Lama guanicoe*-bone	2400	20	2330–2482	Coll et al., 2010
31	Túmulo de Campana 2	34°12′18″	58°54′22″	Beta-172059	AMS	Mammalia indet.	1640	70	1323–1697	Loponte, 2008
32	Médanos de Escobar	34°19′	58°44′	AA-97465	AMS	*Blastocerus dichotomus*	1752	33	1544–1703	Acosta et al., 2013
33	Cañada Honda	33°56′34.76″	59°20′53.46″	LP-2368	Standard	*Lama guanicoe*-bone	2030	100	1707–2300	Lanzelotti et al., 2011
	Cañada Honda	33°56′34.76″	59°20′53.46″	LP-2422	Standard	*Lama guanicoe*-bone	2130	60	1917–2304	Lanzelotti et al., 2011
34	Punta Canal	34°22′38″	58°42′30″	LP-2193	Standard	*Blastocerus dichotomus*	900	80	667–924	Loponte and Corriale, 2013
35	Río Luján	34°17′06.37″	58°53′05″	Beta-220780	AMS	*Homo sapiens*	650	40	543–654	Toledo, 2011
	Río Luján 2	34°26′	n/i	AA-97458	AMS	*Blastocerus dichotomus*	1692	42	1424–1698	Acosta et al., 2013
	El Cazador Site 3	34°32′	n/i	AIE-26939	Standard	*Blastocerus dichotomus*	920	43	689–911	Loponte and Corriale, 2013

Table 2
Radiocarbon dates from the North micro-region.

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
36	Hunter	34°14′17.84″	60°30′29.69″	Beta-284161	AMS	*Lama guanicoe*-bone	1990	40	1757–2002	Loponte and Acosta, 2012
37	Meguay	34°16′57.97″	60°19′57.69″	UGAMS-3301	AMS	*Lama guanicoe*-bone	1120	20	930–1054	Loponte et al., 2010
38	Cañada de Rocha (paradero)	34°30′51.41″	59°8′42.14″	Beta-220693	AMS	*Lama guanicoe*-bone	540	40	492–559	Toledo, 2011
	Cañada de Rocha (paradero)	34°30′51,41″	59°8′42.14″	Beta-220695	AMS	*Lama guanicoe*-bone	560	40	499–626	Toledo, 2011
39	Arroyo de Frías	34°39′15.83″	59°25′50.66″	CAMS-16598	AMS	*Homo sapiens*	10,300	60	11,724–12,390	Politis et al., 2011a
	Arroyo de Frías	34°39′15.83″	59°25′50.66″	OxA-8545	AMS	*Homo sapiens*	9529	75	10,561–11,102	Politis et al., 2011a
40	La Higuera	34°53′42″	57°48′31″	n/i	n/i	*Pomacea canaliculata*	530	50	459–627	Brunazzo, 1997
41	Laguna El Doce	33°54′20″	62°08′43″	AA-89915	AMS	*Homo sapiens*-tooth	8274	68	9022–9407	Ávila, 2011
	Laguna El Doce	33°54′20″	62°08′43″	AA-89914	AMS	*Lama guanicoe*-bone	7026	58	7690–7936	Ávila, 2011
	Laguna El Doce	33°54′20″	62°08′43″	AA-89919	AMS	Organic matter (ceramic)	2350	180	1920–2757	Ávila, 2011
	Laguna El Doce	33°54′20″	62°08′43″	AA-89918	AMS	Organic matter (ceramic)	1555	85	1277–1581	Ávila, 2011
42	Las Marías	35°10′18″	57°21′18″	CURL-6073	AMS	*Pogonia cromis*-bone	1820	50	1580–1826	Paleo and Pérez Meroni, 2007
	Las Marías	35°10′18″	57°21′18″	CURL-6072	AMS	*Lama guanicoe*	1590	40	1354–1534	Paleo and Pérez Meroni, 2007
43	San Clemente II o El Ancla	35°14′18″	57°16′36″	AA-13822	AMS	*Lama guanicoe*	817	48	576–787	Paleo and Pérez Meroni, 1999 Paleo and Pérez Meroni, 1999
	San Clemente II o El Ancla	35°14′18″	57°16′36″	LP-258	Standard	charcoal	220	60	1–322	Miotti and Tonni, 1991
44	San Clemente III	35°14′18″	57°16′36″	LP-353	Standard	*Homo sapiens*	1550	90	1195–1593	Balesta et al., 1997
45	San Clemente IV	35°14′18″	57°16′36″	LP-752	Standard	*Bos taurus*	340	45	292–486	Paleo et al., 2002
46	San Clemente VI	35°14′18″	57°16′36″	AA-28412	AMS	*Lama guanicoe*	935	55	689–923	Paleo et al., 2002

Table 3
Radiocarbon dates from the West micro-region.

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
47	Laguna de los Pampas	35°19′42″	61°31′50″	AA-90127	AMS	*Homo sapiens*-tooth	8971	77	9749–10,233	Politis et al., 2012
	Laguna de los Pampas	35°19′42″	61°31′50″	AA-93221	AMS	*Homo sapiens*-tooth	8835	83	9560–10,155	Politis et al., 2012
	Laguna de los Pampas	35°19′42″	61°31′50″	AA-93220	AMS	*Lama guanicoe*-bone	5684	61	6296–6615	Politis et al., 2012
	Laguna Chadilauquen	n/i	n/i	AA-89807	AMS	*Homo sapiens*-tooth	3714	56	3839–4155	Mendonça et al., 2013
	Laguna Chadilauquen	n/i	n/i	AA-89808	AMS	*Homo sapiens*-tooth	3629	56	3705–4081	Mendonça et al., 2013
48	Chillhué 3	37°17′	64°9′	UGA-2009	AMS	*Homo sapiens*-tooth	1930	30	1739–1900	Berón et al., 2009
49	El Castillo	34°36′40.5″	64°12′41.9″	LP-1674	Standard	*Homo sapiens*-bone	1430	60	1181–1405	Berberían et al., 2013

Table 4
Radiocarbon dates from the Salado Depression micro-region.

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
50	La Guillerma 1	35°50′10″	57°38′50″	ISGS-2348	AMS	Charcoal	1190	110	901–1286	González de Bonaveri and Zárate, 1993–1994
	La Guillerma 1	35°50′10″	57°38′50″	ISGS-2350	AMS	Charcoal	610	150	297–795	González de Bonaveri and Zárate, 1993–1994
	La Guillerma 1	35°50′10″	57°38′50″	CRNR-106303	AMS	*Homo sapiens*-tooth	410	40	423–500	Scabuzzo and González, 2007
51	La Guillerma 2	35°50′10″	57°38′50″	ISGS-2351	AMS	Charcoal	1080	100	739–1118	González de Bonaveri and Zárate, 1993–1994
52	La Guillerma 4	35°50′10″	57°38′50″	Beta-53560	Standard	Charcoal	1730	110	1355–1837	González de Bonaveri and Zárate, 1993–1994
53	La Guillerma 5	35°50′10″	57°38′50″	ISGS-2349	AMS	Charcoal	1150	100	1275–1545	González, 2005
	La Guillerma 5	35°50′10″	57°38′50″	Beta-49350	Standard	Charcoal	1400	90	1058–1431	González, 2005
	La Guillerma 5	35°50′10″	57°38′50″	GX-26477	AMS	Fish indet.	1340	40	1166–1299	González, 2005
	La Guillerma 5	35°50′10″	57°38′50″	Beta-13774	AMS	*Homo sapiens*-bone	370	40	878–1189	González, 2005
	La Guillerma 5	35°50′10″	57°38′50″	GX-25335	AMS	*Homo sapiens*-tooth	430	40	637–803	González, 2005
54	La Guillerma Ñandú	35°50′10″	57°38′50″	CAMS-22030	AMS	*Homo sapiens*-tooth	1640	40	1402–1575	González, 2005
55	San Ramón 7	36°37′67.5″	58°7′62.5″	AA-71660	AMS	Organic matter (ceramic)	2433	36	2337–2511	González et al., 2006
	San Ramón 7	36°37′67.5″	58°7′62.5″	AA-71661	AMS	*Myocastor coypus*	1040	44	962–1120	González et al., 2006
	San Ramón 7	36°37′67.5″	58°7′62.5″	AA-71662	AMS	*Myocastor coypus*	1121	43	922–1064	González et al., 2006
	San Ramón 7	36°37′67.5″	58°7′62.5″	AA-71663	AMS	*Myocastor coypus*	1197	43	793–966	González et al., 2006
	San Ramón 7	36°37′67.5″	58°7′62.5″	AA-71664	AMS	Cervidae (*Ozotoceros bezoarticus*?)	839	66	635–816	González et al., 2006
56	El Divisadero Monte 6	36°23′17″	56°49′13″	LP-1687	Standard	Charcoal	540	60	450–570	Aldazabal et al., 2007
57	La Salada	36°2′	57°40′	LP-407	Standard	*Homo sapiens*-bone	1470	20	1298–1356	Aldazabal, 1993
	Los Paraísos	n/i	n/i	AA-62804	AMS	Organic matter (ceramic)	1539	39	1305–1483	González and Frère, 2009
	San Genaro	n/i	n/i	AA-62805	AMS	Organic matter (ceramic)	1770	39	1557–1720	González and Frère, 2009
58	La Colorada	36°29′	58°37′	LP-807	Standard	*Homo sapiens*	3140	70	3136–3457	Aldazabal et al., 2004
	Pessi	n/i	n/i	LP-516	Standard	*Lama guanicoe*	2980	70	2879–3332	Aldazabal et al., 2004

Table 5
Radiocarbon dates from the Tandilia micro-region.

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
59	Cueva Tixi	37°50′26″	58°3′57″	AA-12127	AMS	Charcoal	170	60	1–282	Mazzanti and Quintana, 2001
	Cueva Tixi	37°50′26″	58°3′57″	AA-15809	AMS	Charcoal	715	45	556–677	Mazzanti and Quintana, 2001
	Cueva Tixi	37°50′26″	58°3′57″	AA-12128	AMS	Charcoal	3255	75	3240–3613	Mazzanti and Quintana, 2001
	Cueva Tixi	37°50′26″	58°3′57″	AA-12129	AMS	Charcoal	4865	65	5326–5711	Mazzanti and Quintana, 2001
	Cueva Tixi	37°50′26″	58°3′57″	AA-12129	AMS	Charcoal	10,045	95	11,232–11,929	Mazzanti and Quintana, 2001
	Cueva Tixi	37°50′26″	58°3′57″	AA-12130	AMS	Charcoal	10,375	90	11,775–12,541	Mazzanti and Quintana, 2001
60	Amalia Sitio 2	38°2′53″	58°11′39″	AA-35498	AMS	Charcoal	7700	65	8367–8586	Mazzanti, 2002
	Amalia Sitio 2	38°2′53″	58°11′39″	AA-35499	AMS	Charcoal	10,425	75	11,970–12,546	Mazzanti, 2002
61	Amalia Sitio 4	38°2′54″	58°11′49″	LP-772	Standard	Eggshell	225	60	1–427	Mazzanti, 1995–1996, Mazzanti, 2007
62	Lobería 1-Sitio 1	37°58′27″	58°29′40″	AA-77317	AMS	Charcoal	158	32	1–277	Mazzanti et al., 2010

Table 5 (*continued*)

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
	Lobería 1-Sitio 1	37°58′27″	58°29′40″	Beta-4485	AMS	Charcoal	440	120	146–650	Ceresole and Slavsky, 1985
	Lobería 1-Sitio 1	37°58′27″	58°29′40″	AA-81060	AMS	Charcoal	676	41	552–661	Mazzanti et al., 2010
	Lobería 1-Sitio 1	37°58′27″	58°29′40″	AA-77319	AMS	Charcoal	682	32	557–658	Mazzanti et al., 2010
	Lobería 1-Sitio 1	37°58′27″	58°29′40″	AA-74483	AMS	Charcoal	782	45	567–738	Mazzanti et al., 2010
	Lobería 1-Sitio 1	37°58′27″	58°29′40″	AA-81059	AMS	Charcoal	883	41	675–898	Mazzanti et al., 2010
	Lobería 1-Sitio 1	37°58′27″	58°29′40″	AA-81061	AMS	Charcoal	3104	46	3081–3383	Mazzanti et al., 2010
	Lobería 1-Sitio 1	37°58′27″	58°29′40″	AA-77320	AMS	Charcoal	3117	35	3177–3375	Mazzanti et al., 2010
	Lobería 1-Sitio 1	37°58′27″	58°29′40″	AA-81062	AMS	Charcoal	7888	54	8460–8975	Mazzanti et al., 2010
	Lobería 1-Sitio 1	37°58′27″	58°29′40″	AA-77321	AMS	Charcoal	7921	44	8554–8976	Mazzanti et al., 2010
	Lobería 1-Sitio 1	37°58′27″	58°29′40″	AA-81063	AMS	Charcoal	9787	81	10,783–11,314	Mazzanti et al., 2010
63	Abrigo Los Pinos	37°56′30″	58°5′51″	AA-24045	AMS	Charcoal	10,465	65	12,028–12,549	Mazzanti, 1995–1996, Mazzanti, 1999, 2003
	Abrigo Los Pinos	37°56′30″	58°5′51″	AA-24046	AMS	Charcoal	10,415	70	11,961–12,541	Mazzanti, 1995–1996, 1999, 2003
	Abrigo Los Pinos	37°56′30″	58°5′51″	LP-630	Standard	Charcoal	9570	150	10,477–10,469	Mazzanti, 1995–1996, Mazzanti, 1996–1998, 2003
	Abrigo Los Pinos	37°56′30″	58°5′51″	AA-77323	AMS	Charcoal	5120	38	5723–5918	Martínez et al., 2013b
	Abrigo Los Pinos	37°56′30″	58°5′51″	AA-15808	AMS	Charcoal	5170	60	5664–6000	Martínez et al., 2013b
64	Cueva Burucuyá	37°57′33″	58°7′24″	AA-94640	AMS	Charcoal	10,672	56	12,435–12,703	Mazzanti et al., 2012
	Cueva Burucuyá	37°57′33″	58°7′24″	LP-863	Standard	Charcoal	10,000	120	11,184–11,946	Mazzanti, 1999, 2003
65	Cueva El Abra	37°58′6″	58°9′8″	AA-94641	AMS	Charcoal	10,270	200	11,268–12,550	Mazzanti et al., 2012
	Cueva El Abra	37°58′6″	58°9′8″	AA-38098	AMS	Charcoal	9834	65	10,880–11,389	Mazzanti, 2003
	Cueva El Abra	37°58′6″	58°9′8″	AA-77322	AMS	Charcoal	6654	42	7434–7570	Martínez et al., 2013b
	Cueva El Abra	37°58′6″	58°9′8″	AA-74481	AMS	Charcoal	2943	35	2993–3165	Martínez et al., 2013b
	Cueva El Abra	37°58′6″	58°9′8″	AA-81064	AMS	Charcoal	2942	44	2881–3173	Martínez et al., 2013b
	Cueva El Abra	37°58′6″	58°9′8″	AA-33419	AMS	Charcoal	958	32	750–917	Martínez et al., 2013b
66	Cueva La Brava	37°53′54″	57°57′55″	AA-9463	AMS	Charcoal	10,178	54	11,407–12,008	Martínez et al., 2013b
	Cueva La Brava	37°53′54″	57°57′55″	LP-550	Standard	Charcoal	9670	120	10,602–11,241	Mazzanti, 1995–1996
67	Alero El Mirador	37°55′14″	58°5′52″	AA-94635	AMS	Charcoal	5247	47	5770–6178	Mazzanti et al., 2013
	Alero El Mirador	37°55′14″	58°5′52″	AA-95253	AMS	Charcoal	5089	40	5662–5906	Mazzanti et al., 2013
	Alero El Mirador	37°55′14″	58°5′52″	AA-98681	AMS	Charcoal	5104	42	5664–5913	Mazzanti et al., 2013
	Alero El Mirador	37°55′14″	58°5′52″	AA-98683	AMS	Charcoal	8920	51	9747–10,186	Mazzanti et al., 2013
68	Abrigo La Grieta	37°57′29″	58°7′19″	AA-94637	AMS	Charcoal	3083	37	3080–3363	Mazzanti et al., 2013
	Los Helechos	n/i	n/i	Beta-137747	AMS	Charcoal	9640	40	10,752–11,145	Flegenheimer and Bayón, 2000
69	Cueva Zoro	37°49′29″	58°38′35″	AA-82706	AMS	Charcoal	10,094	62	11,276–11,921	Mazzia and Flegenheimer, 2012
	Cueva Zoro	37°49′29″	58°38′35″	AA-82707	AMS	Charcoal	10,153	61	11,397–11,983	Mazzia and Flegenheimer, 2012
	Cueva Zoro	37°49′29″	58°38′35″	AA-85687	AMS	Charcoal	8859	64	9630–10,167	Mazzia, 2011
m	El Alfaraje	37°52′15″	58°32′2″	AA-84037	AMS	Charcoal	8574	42	9465–9553	Mazzia, 2011
	El Alfaraje	37°52′15″	58°32′2″	AA-84039	AMS	Charcoal	8787	41	9559–9899	Mazzia, 2011
	El Alfaraje	37°52′15″	58°32′2″	AA-84038	AMS	Charcoal	2118	36	1932–2152	Mazzia, 2011
	El Alfaraje	37°52′15″	58°32′2″	AA-84036	AMS	Charcoal	746	35	563–719	Mazzia, 2011
71	Cerro La China-Sitio 1	37°57′	58°37′	AA-8953	AMS	Charcoal	10,804	75	12,558–12,777	Flegenheimer and Zárate, 1997
	Cerro La China-Sitio 1	37°57′	58°37′	AA-1327	AMS	Charcoal	10,790	120	12,419–12,928	Flegenheimer, 1987
	Cerro La China-Sitio 1	37°57′	58°37′	AA-8952	AMS	Charcoal	10745	75	12,440–12,741	Flehengeimer and Zárate, 1997
	Cerro La China-Sitio 1	37°57′	58°37′	I-12741	Standard	Charcoal	10,720	150	12,057–12,838	Flehengeimer, 1987
	Cerro La China-Sitio 1	37°57′	58°37′	AA-8954	AMS	Charcoal	10,525	75	12,059–12,645	Politis et al., 2004
72	Cerro La China-Sitio 2	37°57′	58°37′	AA-89579	AMS	Charcoal	1465	60	1185–1449	Mazzia and Flegenheimer, 2007
	Cerro La China-Sitio 2	37°57′	58°37′	AA-89580	AMS	Charcoal	255	60	1–447	Mazzia and Flegenheimer, 2007
	Cerro La China-Sitio 2	37°57′	58°37′	AA-8955	AMS	Charcoal	11,150	135	12,721–13,203	Flegenheimer, 1987
	Cerro La China-Sitio 2	37°57′	58°37′	AA-8956	AMS	Charcoal	10,560	75	12,081–12,663	Flegenheimer, 1987
73	Cerro La China-Sitio 3	37°57′	58°37′	AA-1328	AMS	Charcoal	10,610	180	11,829–12,780	Flegenheimer, 1987
74	Cerro El Sombrero-abrigo 1	37°48′35″	58°34′12″	AA-4765	AMS	Charcoal	10,725	90	12,432–12,734	Flegenheimer and Zárate, 1997
	Cerro El Sombrero-abrigo 1	37°48′35″	58°34′12″	AA-4766	AMS	Charcoal	10,270	85	11,501–12,316	Flegenheimer and Zárate, 1997
	Cerro El Sombrero-abrigo 1	37°48′35″	58°34′12″	AA-4767	AMS	Charcoal	10,675	110	12,117–12,739	Flegenheimer and Zárate, 1997
	Cerro El Sombrero-abrigo 1	37°48′35″	58°34′12″	AA-5220	AMS	Charcoal	10,480	70	12,034–12,554	Flegenheimer and Zárate, 1997
75	Picadero	37°39′26″	59°6′52″	AA-94615	AMS	*Ozotoceros bezoarticus*-bone	623	41	523–650	Colombo, 2013
	Picadero	37°39′26″	59°6′52″	AA-94614	AMS	*Ozotoceros bezoarticus*	634	51	525–656	Colombo, 2013
	Picadero	37°39′26″	59°6′52″	AA-94613	AMS	*Chaetophractus*-bone	718	42	559–676	Colombo, 2013

(*continued on next page*)

Table 5 (*continued*)

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
	Picadero	37°39′26″	59°6′52″	AA-94611	AMS	Charcoal	4690	39	5298–5575	Colombo, 2013
	Picadero	37°39′26″	59°6′52″	AA-94612	AMS	Charcoal	4705	38	5307–5576	Colombo, 2013
	Siempre Verde	n/i	n/i	n/i	n/i	*Ovis aries*	175	65	1–284	Lanza, 2007
	Siempre Verde	n/i	n/i	n/i	n/i	Charcoal	310	60	148–491	Lanza, 2007
76	Calera	36°59′	60°14′	AA-67735	AMS	*Lama guanicoe*-bone	1748	42	1534–1709	Politis et al., 2005
	Calera	36°59′	60°14′	AA-67733	AMS	*Lama guanicoe*-bone	2075	44	1888–2144	Politis et al., 2005
	Calera	36°59′	60°14′	AA-64617	AMS	*Lama guanicoe*-tooth	2232	55	2057–2337	Politis et al., 2005
	Calera	36°59′	60°14′	AA-71671	AMS	*Lama guanicoe*-bone	3005	66	2930–3344	Politis et al., 2005
	Calera	36°59′	60°14′	AA-67732	AMS	*Lama guanicoe*-bone	3008	44	2968–3324	Politis et al., 2005
	Calera	36°59′	60°14′	AA-71669	AMS	*Lama guanicoe*-bone	3390	170	3170–4080	Politis et al., 2005
77	El Puente	36°58′44″	60°14′17″	AA-90377	AMS	*Lama guanicoe*-bone	2900	51	2849–3158	Messineo, 2011
	El Puente	36°58′44″	60°14′17″	AA-95300	AMS	*Lama guanicoe*	2069	53	1842–2147	Messineo et al., 2014
	El Puente	36°58′44″	60°14′17″	AA-90374	AMS	*Lama guanicoe*	1220	340	525–1816	Messineo et al., 2014
	El Puente	36°58′44″	60°14′17″	AA-90377	AMS	*Charcoal*	5691	34	6312–6505	Messineo et al., 2014

Table 6
Radiocarbon dates from the Interserrana micro-region.

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
78	Arroyo Seco 2	38°21′38″	60°14′39″	OXA-4591	AMS	*Glosotherium robustus*-bone	12,240	110	13,795–14,713	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-9049	AMS	*Glosotherium robustus*-bone	10,500	90	12,023–12,643	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	CAMS-58182	AMS	*Megatherium americanum*-bone	12,200	170	13,717–14,939	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	OxA-15871	AMS	*Megatherium americanum*-bone	12,179	55	13,850–14,227	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	OxA-10387	AMS	*Megatherium americanum*-bone	12,155	70	13,785–14,212	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-62514	AMS	*Megatherium americanum*-bone	11,770	120	13,318–13,845	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	OxA-9243	AMS	Megammamal-bone	12,070	140	13,558–14,397	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	CAMS-16389	AMS	*Toxodon platensis*-bone	11,750	70	13,451–13,737	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-7964	AMS	*Toxodon platensis*-bone	11,590	90	13,239–13,588	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	OxA-9242	AMS	Megafauna-bone	11,730	70	13,437–13,732	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-39365	AMS	*Hippidion* sp.-bone	11,320	110	12,985–13,420	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-7964	AMS	*Equus A. neogeous*	11,250	105	12,843–13,306	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	OXA-4590	AMS	*Equus A. neogeous*	11,000	100	12,718–13,057	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-90118	AMS	Equidae indet-bone	11,190	110	12,796–13,268	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-90117	AMS	*Eutatus seguini*-bone	7388	74	8009–8338	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-90120	AMS	*Lama guanicoe*-bone	8461	74	9154–9542	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-24052	AMS	*Lama guanicoe*-bone	7540	80	8067–8451	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-90119	AMS	*Lama guanicoe*-bone	5793	64	6403–6717	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-52613	AMS	*Lama guanicoe*-bone	8390	410	8345–10,365	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-7966	AMS	*Homo sapiens*-bone (E1, AS3)	6300	70	6954–7323	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	LP-186	Standard	*Homo sapiens*-bone (E2, AS6)	6560	60	7295–7564	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-62517	AMS	*Homo sapiens*-bone (E3, AS7)	7043	82	7673–7970	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-67737	AMS	*Homo sapiens*-bone (E7, AS12)	4487	45	4876–5286	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-59506	AMS	*Homo sapiens*-bone (E8, AS13)	4793	69	5319–5600	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-67738	AMS	*Homo sapiens*-bone (E9, AS14)	6838	73	7508–7793	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	TO-1503	AMS	*Homo sapiens*-bone (E10, AS15)	7000	80	7627–7953	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	CAMS-16170	AMS	*Homo sapiens*-bone (E10, AS15)	6970	60	7627–7930	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	NZA-1101	AMS	*Homo sapiens*-bone (E10, AS15)	6880	90	7515–7921	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-7967	AMS	Cánido-tooth (E11, AS18)	6495	65	7253–7487	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-9045	AMS	*Homo sapiens*-bone (E12, AS19)	6860	60	7570–7790	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-67739	AMS	*Homo sapiens*-bone (E14, AS21)	6908	76	7577–7917	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-9046	AMS	*Homo sapiens*-bone (E17, AS24)	7800	115	8370–8977	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	Beta-80909	AMS	*Homo sapiens*-bone (E19, AS26)	7580	50	8201–8422	Politis et al., 2014

Table 6 (*continued*)

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-9048	AMS	*Homo sapiens*-bone (E24, AS31)	7615	90	8188–8545	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-19286	AMS	*Homo sapiens*-bone (E25, AS34)	7685	95	8206–8626	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-24050	AMS	*Homo sapiens*-bone (E27, AS36)	7805	85	8382–8948	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-59503	AMS	*Homo sapiens*-bone (E30, AS38)	6823	69	7507–7784	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-24051	AMS	*Homo sapiens*-bone (E31, AS40)	6940	75	7594–7925	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-59504	AMS	*Homo sapiens*-bone (E33, AS42 a 45)	7636	87	8198–8555	Politis et al., 2014
	Arroyo Seco 2	38°21′38″	60°14′39″	AA-59505	AMS	*Homo sapiens*-bone (E33, AS42 a 45)	7602	87	8188–8538	Politis et al., 2014
79	Zanjón Seco 2	38°10′7″	59°10′8″	CAMS-48493	AMS	*Lama guanicoe*-bone	3070	40	3077–3357	Politis et al., 2004
	Zanjón Seco 2	38°10′7″	59°10′8″	CAMS-48494	AMS	*Lama guanicoe*-bone	3080	40	3079–3362	Politis et al., 2004
	Zanjón Seco 2	38°10′7″	59°10′8″	LP-1086	Standard	*Lama guanicoe*-bone	2270	70	2024–2355	Politis et al., 2004
80	Zanjón Seco 3	38°10′7″	59°10′8″	LP-189	Standard	*Lama guanicoe*-bone	1450	50	1187–1409	Politis and Beukens, 1991
81	Paso Otero 1	38°11′58.14″	59°6′53″	AA-72844	AMS	*Lama guanicoe*-tooth	3056	42	3067–3353	Martínez, 2006
82	Paso Otero 4	38°13′2.15″	59°6′41.02″	AA-87934	AMS	charcoal	8556	65	9327–9624	Álvarez et al., 2013
83	Paso Otero 5	38°12′8″	59°6′58″	AA-39363	AMS	*Megatherium americanum*-bone	10,440	100	11,839–12,561	Martínez and Gutiérrez, 2011
	Paso Otero 5	38°12′8″	59°6′58″	AA-19291	AMS	Megamammal-bone	10,190	120	11,268–12,380	Martínez and Gutiérrez, 2011
	Paso Otero 5	38°12′8″	59°6′58″	GX-29795	AMS	*Megatherium americanum*-bone	9560	50	10,655–11,089	Martínez and Gutiérrez, 2011
84	La Toma	38°17′10″	61°41′40″	SI-6452	Standard	Charcoal	995	65	735–960	Madrid and Politis, 1991/Politis and Madrid, 2001
	La Toma	38°17′10″	61°41′40″	SI-6451	Standard	*Homo sapiens*-bone	2075	70	1827–2298	Politis and Madrid, 2001
	La Toma	38°17′10″	61°41′40″	AA-7968	AMS	*Lama guanicoe*-bone	1390	80	1067–1401	Madrid and Politis, 1991/Politis and Madrid, 2001
	La Toma	38°17′10″	61°41′40″	AA-7969	AMS	*Lama guanicoe*-bone	1960	50	1739–1997	Politis and Madrid, 2001
85	Quequén Salado 1	38°39′44.2″	60°32′11.8″	Beta-169820	AMS	*Lama guanicoe*-bone	360	40	305–486	Madrid et al., 2002
	Quequén Salado 1	38°39′44.2″	60°32′11.8″	Beta-157398	AMS	*Lama guanicoe*-bone	790	40	672–738	Madrid et al., 2002
	Quequén Salado 1	38°39′44.2″	60°32′11.8″	Beta-157397	AMS	*Lama guanicoe*-bone	940	40	734–912	Madrid et al., 2002
	Quequén Salado 1	38°39′44.2″	60°32′11.8″	Beta-169821	AMS	*Lama guanicoe*-bone	960	40	746–919	Madrid et al., 2002
86	Quequén Salado 2	38°49′55.6″	60°33′4.5″	Beta-169822	AMS	*Lama guanicoe*-bone	1720	40	1487–1705	Madrid et al., 2002
87	Quequén Salado 4	38°47′	60°33′	Beta-169824	AMS	*Lama guanicoe*-bone	1240	40	983–1262	Madrid et al., 2002
88	La Represa Antigua	38°44′	60°34′	Beta-169823	AMS	*Lama guanicoe*-bone	3050	40	3063–3349	Hoguin and March, 2007–2008
	La Represa Antigua	38°44′	60°34′	Beta-194611	AMS	*Lama guanicoe*-bone	3430	40	3483–3820	Hoguin and March, 2007–2008
	La Represa Antigua	38°44′	60°34′	Beta-194609	AMS	*Lama guanicoe*-bone	2110	40	1930–2150	Hoguin and March, 2007–2008
	La Represa Antigua	38°44′	60°34′	n/i	n/i	*Lama guanicoe*-bone	2900	40	2855–3141	March et al., 2011
	La Represa Antigua	38°44′	60°34′	n/i	n/i	*Lama guanicoe*-bone	3180	40	3267–3543	March et al., 2011
89	Nutria Mansa 1	38°24′52″	58°15′50″	AA-55114	AMS	*Lama guanicoe*-tooth	2705	66	2516–2951	Bonomo, 2005
	Nutria Mansa 1	38°24′52″	58°15′50″	AA-55115	AMS	*Lama guanicoe*-tooth	3080	110	2967–3556	Bonomo, 2005
	Nutria Mansa 1	38°24′52″	58°15′50″	AA-55116	AMS	*Lama guanicoe*-tooth	2920	110	2768–3332	Bonomo, 2005
90	Las Brusquillas 1	38°16′21″	59°47′35″	AA-81453	AMS	*Lama guanicoe*-tooth	3334	43	3402–3635	Massigoge, 2012a
91	Las Brusquillas 2	38°16′17″	59°47′27″	AA-94555	AMS	*Ozotoceros bezoarticus*-bone	1795	88	1433–1885	Massigoge, 2012b
92	Cortaderas	38°19′15″	59°39′47″	AA-67736	AMS	*Lama guanicoe*-bone	2270	190	1827–2742	Massigoge, 2007
93	El Guanaco	38°41′	59°39′	Beta-128180	Standard	*Homo sapiens*-bone	2470	60	2350–2710	Flegenheimer et al., 2002
	El Guanaco	38°41′	59°39′	Beta-137745	AMS	*Homo sapiens*-bone	2280	30	2157–2340	Flegenheimer et al., 2002
	El Guanaco	38°41′	59°39′	PTA-8520	AMS	*Homo sapiens*-bone	2460	60	2347–2708	Mazzia et al., 2004
94	El Guanaco-sitio 1	38°41′	59°39′	SR-6381	AMS	*Lama guanicoe*-bone	9250	40	10,250–10,496	Flegenheimer et al., 2010
95	El Guanaco-sitio 2	38°41′	59°39′	AA-82713	AMS	*Rhea americana*-bone	9140	120	9888–10,640	Flegenheimer et al., 2010
	El Guanaco-sitio 2	38°41′	59°39′	AA-82713	AMS	*Rhea americana*-bone	9048	69	9898–10,292	Flegenheimer et al., 2010
	El Guanaco-sitio 2	38°41′	59°39′	AA-82712	AMS	*Lama guanicoe*-bone	8507	84	9255–9599	Flegenheimer et al., 2010
	El Guanaco-sitio 2	38°41′	59°39′	AA-71658	AMS	*Lama guanicoe*-bone	8411	80	9137–9526	Flegenheimer et al., 2010

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Table 6 (*continued*)

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
	El Guanaco-sitio 2	38°41′	59°39′	AA-82710	AMS	*Homo sapiens*-bone	8123	82	8653–9264	Flegenheimer et al., 2010
	El Guanaco-sitio 2	38°41′	59°39′	AA-82705	AMS	*Homo sapiens*-bone	8433	84	9138–9535	Flegenheimer et al., 2010
96	Campo Laborde	37°0′36″	60°23′5″	AA-55118	AMS	*Megatherium americanum*-bone	8080	200	8456–9430	Politis and Messineo, 2008
	Campo Laborde	37°0′36″	60°23′5″	AA-55117	AMS	*Megatherium americanum*-bone	7750	250	8003–9235	Politis and Messineo, 2008
97	Empalme Querandies	37°0′22″	60°22′39″	AA-94557	AMS	*Lama guanicoe*-bone	2052	62	1828–2147	Messineo et al., 2013
	Empalme Querandies	37°0′22″	60°22′39″	AA-94558	AMS	*Lama guanicoe*-bone	2816	49	2762–2995	Messineo et al., 2013
	Empalme Querandies	37°0′22″	60°22′39″	AA-94559	AMS	*Lama guanicoe*-bone	3095	50	3078–3380	Messineo et al., 2013
98	La Moderna	37°4′35″	60°4′35″	TO-1507-1	AMS	*Doedicurus clavicaudatus*-bone	7010	100	7616–7969	Politis and Gutiérrez, 1998
	La Moderna	37°4′35″	60°4′35″	TO-1507-2	AMS	*Doedicurus clavicaudatus*-bone	7510	370	7579–9233	Politis and Gutiérrez, 1998
	La Moderna	37°4′35″	60°4′35″	TO-2610	AMS	*Doedicurus clavicaudatus*-bone	7460	80	8045–8381	Politis and Gutiérrez, 1998
99	Fortín Necochea (LC)	37°23′49″	61°8′37″	LP-88	Standard	*Lama guanicoe*-bone	6010	400	5938–7584	Crivelli et al., 1987–1988
	Fortín Necochea (LC)	37°23′49″	61°8′37″	CSIC-593	AMS	*Lama guanicoe*-bone	3630	60	3702–4083	Crivelli et al., 1987–1988
100	Laguna Tres Reyes	37°56′	60°34′	AA-7970	AMS	*Lama guanicoe*-bone	1845	50	1590–1865	Madrid and Barrientos, 2000
	Laguna Tres Reyes	37°56′	60°34′	LP-287	Standard	*Lama guanicoe*-bone	2280	60	2094–2353	Madrid and Barrientos, 2000
	Laguna Tres Reyes	37°56′	60°34′	AA-7971	AMS	*Lama guanicoe*-bone	2235	50	2062–2337	Madrid and Barrientos, 2000
	Laguna Tres Reyes	37°56′	60°34′	AA-24048	AMS	*Homo sapiens*-bone	2245	55	2063–2343	Madrid and Barrientos, 2000
	Laguna Tres Reyes	37°56′	60°34′	AA-24047	AMS	*Homo sapiens*-bone	2470	60	2350–2710	Madrid and Barrientos, 2000
101	Laguna La Barrancosa 1	37°19′39″	60°6′40″	AA-59507	AMS	*Lama guanicoe*-bone	1676	46	1410–1696	Pal, 2007
	Laguna Seca 1	n/i	n/i	AA-94554	AMS	*Homo sapiens*-tooth	579	42	503–632	Kaufmann and González, 2013
102	Alfar	38°5′48.9″	57°33′20.7″	AA-82081	AMS	Sea lion-tooth	5704	64	6307–6629	Bonomo and León, 2010
103	Claromecó 1	38°50′21.8″	60°5′20.8″	AA-64621	AMS	Mammal-bone	800	34	656–735	Bonomo et al., 2008
	Meseta del Chocorí	n/i	n/i	AA-90124	AMS	*Homo sapiens*-bone	7623	78	8201–8542	Bonomo et al., 2013
	Arroyo Chocorí	n/i	n/i	CAMS-16593	AMS	*Homo sapiens*-bone	7010	60	7682–7932	Politis et al., 2011a
	Arroyo Chocorí	n/i	n/i	Beta-223181	AMS	*Homo sapiens*	6830	40	7573–7690	Bonomo et al., 2013
	La Tigra	n/i	n/i	CAMS-16173	AMS	*Homo sapiens*-bone	7270	60	7949–8174	Politis et al., 2011a
	Túmulo de Malacara	n/i	n/i	AA-24049	AMS	*Homo sapiens*-bone	2710	40	2739–2860	Politis et al., 2011a
	Necochea	n/i	n/i	AA-90125	AMS	*Homo sapiens*-bone	7162	74	7765–8157	Politis and Bonomo, 2011
	Necochea	n/i	n/i	AA-90122	AMS	*Homo sapiens*-bone	7013	67	7676–7938	Politis and Bonomo, 2011
	Necochea	n/i	n/i	Beta-223188	AMS	*Homo sapiens*	6220	40	6947–7239	Bonomo et al., 2013
	Arroyo del Moro	n/i	n/i	AA-90123	AMS	*Homo sapiens*-bone	6885	73	7570–7843	Politis and Bonomo, 2011
	Arroyo del Moro	n/i	n/i	Beta-223187	AMS	*Homo sapiens*	6220	40	6947–7239	Bonomo et al., 2013
	Fontezuelas	n/i	n/i	UCIAMS-85299	AMS	*Homo sapiens*-bone	1985	15	1836–1981	Politis and Bonomo, 2011
	Puerto de Buenos Aires	n/i	n/i	UCR-3590/ CAMS-44656	AMS	*Homo sapiens*-bone	230	40	1–313	Politis and Bonomo, 2011
	La Pandorga	n/i	n/i	LP-2345	Standard	*Homo sapiens*-bone	1990	90	1701–2147	Bonomo et al., 2013
	Laguna La Salada Grande	n/i	n/i	LP-2360	Standard	*Homo sapiens*-bone	2790	80	2741–3066	Bonomo et al., 2013
104	Monte Hermoso 1	38°59′21.73″	61°21′2.63″	AA-64620	AMS	*Homo sapiens*-bone	7866	75	8426–8975	Politis et al., 2009
	Monte Hermoso 1	38°59′21.73″	61°21′2.63″	AA-64619	AMS	*Homo sapiens*-bone	6606	79	7314–7587	Politis et al., 2009
	Monte Hermoso 1	38°59′21.73″	61°21′2.63″	LP-271	Standard	Otaridae-bone	7030	100	7624–7996	Bayón and Politis, 1996

Table 6 (*continued*)

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
	Monte Hermoso 1	38°59′21.73″	61°21′2.63″	AA-7974	AMS	*Ruppia* sp.	7125	75	7713–8031	Bayón and Politis, 1996
	Monte Hermoso 1	38°59′21.73″	61°21′2.63″	AA-8699	AMS	Wood	6795	120	7425–7845	Bayón and Politis, 1996
105	Barrio Las Dunas	38°59′14.56″	61°19′27.41″	AA-71654	AMS	Otaridae-bone	6924	69	7588–7917	Bayón et al., 2012
	Barrio Las Dunas	38°59′14.56″	61°19′27.41″	AA-93961	AMS	*Pogonias cromis*-bone	6820	100	7461–7833	Bayón et al., 2012
106	La Olla 1	38°59′22.44″	61°21′3.84″	LP-303	Standard	Otaridae-bone	6640	90	7318–7651	Blasi et al., 2013
	La Olla 1	38°59′22.44″	61°21′3.84″	AA-7972	AMS	Otaridae-bone	7315	55	7970–8186	Blasi et al., 2013
107	La Olla 2	38°59′22.44″	61°21′3.84″	AA-19292	AMS	Otaridae-bone	7400	95	7998–8370	Blasi et al., 2013
108	La Olla 3	38°59′22.4″	61°21′3.3″	AA-80666	AMS	Wood	6885	47	7589–7786	Blasi et al., 2013
	La Olla 3	38°59′22.4″	61°21′3.3″	AA-80668	AMS	Wood	6898	47	7589–7794	Blasi et al., 2013
	La Olla 3	38°59′22.5″	61°21′3.3″	AA-80663	AMS	Otaridae	6904	71	7576–7850	Blasi et al., 2013
109	La Olla 4	38°59′22.44″	61°21′8.16″	AA-80667	AMS	Wood	6931	47	7619–7835	Blasi et al., 2013
	La Olla 4	38°59′22.44″	61°21′8.16″	AA-80664	AMS	*Lama guanicoe*	6960	71	7616–7929	Blasi et al., 2013

Table 7
Radiocarbon dates from the Ventania micro-region.

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
110	La Sofía 4	37°52′42″	62°9′53″	AA-19290	AMS	*Lama guanicoe*	1595	70	1309–1578	Oliva, 2000
	El Abra	38°5′	n/i	LP-91	Standard	charcoal	6230	90	6802–7290	Castro, 1983

Table 8
Radiocarbon dates from the South micro-region.

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
111	Laguna Los Chilenos 1	38°3′	62°30′	LP-501	Standard	*Homo sapiens*-bone	470	40	331–539	Barrientos, 1997
112	Laguna de Puán 1	37°34′	62°48′	LP-253	Standard	*Homo sapiens*-bone	3300	100	3228–3811	Oliva et al., 1991
113	Paso Vanoli	38°40′	62°13′	AA-91414	AMS	*Lama guanicoe*-bone	714	53	550–715	Vecchi et al., 2013
114	Paso Mayor 1	38°36′	61°44′	AA-71656	AMS	Large mammal -bone	5877	63	6474–6793	Bayón et al., 2010
	Paso Mayor 1	38°36′	61°44′	AA-82714	AMS	*Lama guanicoe*-bone	4046	57	4259–4801	Bayón et al., 2010
	Paso Mayor 1	38°36′	61°44′	AA-91415	AMS	*Lama guanicoe*-bone	2774	45	2754–2942	Frontini 2013
	Paso Mayor 1	38°36′	61°44′	AA-82709	AMS	*Lama guanicoe*-bone	3820	47	3981–4383	Bayón et al., 2010
115	Paso Mayor 2	38°36′	61°44′	AA-56780	AMS	*Homo sapiens*-bone	700	42	557–668	Bayón et al., 2010
	Colección Museo de la Plata	n/i	n/i	AA-82513	AMS	*Homo sapiens*-bone	1086	45	809–1055	Gordón, 2011
116	El Puma 2	39°23′46.7″	63°11′17.1″	AA-88421	AMS	*Homo sapiens*-bone	1548	51	1301–1517	Martínez and Martínez, 2011
117	El Puma 3	39°19′53.7″	63°5′57.2″	AA-96142	AMS	*Lama guanicoe*-bone	2209	48	2002–2311	Martínez et al., 2012a
	El Puma 3	39°19′53.7″	63°5′57.2″	AA-96143	AMS	*Lama guanicoe*-bone	2219	47	2006–2319	Martínez et al., 2012a
118	El Puma 4	39°20′23.4″	63°4′49.6″	AA-88420	AMS	*Lama guanicoe*-bone	1862	51	1573–1871	Martínez and Martínez, 2011
119	El Tigre	39°46′49″	62°22′32″	AA-81830	AMS	*Lama guanicoe*-bone	437	43	324–517	Martínez, 2008–2009
	El Tigre	39°46′49″	62°22′32″	Ua-22561	AMS	*Lama guanicoe*-bone	455	45	327–532	Martínez et al., 2005
	El Tigre	39°46′49″	62°22′32″	AA-81834	AMS	*Lama guanicoe*-bone	536	43	488–623	Martínez, 2008–2009
	El Tigre	39°46′49″	62°22′32″	AA-70565	AMS	*Percichthys* sp.-bone	930	47	693–918	Martínez et al., 2009a
120	La Petrona- LP1	39°30′13.92″	62°47′7.99″	AA-43127	AMS	*Homo sapiens*-bone	314	45	154–467	Martínez, 2004
	La Petrona- LP1	39°30′13.92″	62°47′7.99″	AA-43126	AMS	*Homo sapiens*-bone	352	51	298–492	Martínez, 2004
	La Petrona- LP2	39°30′13.92″	62°47′7.99″	AA-43124	AMS	*Homo sapiens*-bone	481	37	339–539	Martínez, 2004
	La Petrona- LP2	39°30′13.92″	62°47′7.99″	AA-43125	AMS	*Homo sapiens*-bone	770	49	563–736	Martínez, 2004
	La Petrona- LP3	39°30′13.92″	62°47′7.99″	AA-43122	AMS	*Homo sapiens*-bone	436	39	326–521	Martínez, 2004
	La Petrona- LP4	39°30′13.92″	62°47′7.99″	AA-70564	AMS	*Homo sapiens*-bone	248	39	0–325	Martínez, 2008–2009
121	La Primavera	39°35′27″	62°23′29″	AA-70560	AMS	*Homo sapiens*-bone	2728	48	2722–2916	Martínez et al., 2009b
	La Primavera	39°35′27″	62°23′29″	GX-28772	AMS	*Homo sapiens*-bone	2800	60	2748–2991	Bayón et al., 2004
	La Primavera	39°35′27″	62°23′29″	AA-70561	AMS	*Homo sapiens*-bone	2882	49	2786–3136	Martínez et al., 2009b
	La Primavera	39°35′27″	62°23′29″	AA-91547	AMS	*Lama guanicoe*-bone	2805	50	2754–2960	Stoessel, 2012
	La Primavera	39°35′27″	62°23′29″	AA-91548	AMS	*Lama guanicoe*-bone	2839	50	2761–3058	Stoessel, 2012
122	Loma Ruiz 1	39°13′11″	62°38′38″	AA-53331	AMS	*Lama guanicoe*-bone	1615	50	1342–1552	Martínez, 2008–2009
	Loma Ruiz 1	39°13′11″	62°38′38″	AA-88418	AMS	*Lama guanicoe*-bone	1749	64	1413–1776	Martínez and Martínez, 2011
	Loma Ruiz 1	39°13′11″	62°38′38″	AA-88419	AMS	*Lama guanicoe*-bone	1775	66	1421–1819	Martínez and Martínez, 2011

(*continued on next page*)

Table 8 (*continued*)

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
	Loma Ruiz 1	39°13′11″	62°38′38″	AA-53332	AMS	*Lama guanicoe*-bone	1935	44	1708–1925	Martínez, 2008–2009
123	Paso Alsina 1- E1	39°23′27″	63°15′36″	AA-63958	AMS	*Homo sapiens*-bone	497	43	340–549	Martínez et al., 2007
	Paso Alsina 1- E10a	39°23′27″	63°15′36″	AA-59696	AMS	*Homo sapiens*-bone	504	34	474–545	Martínez et al., 2007
	Paso Alsina 1- E10b	39°23′27″	63°15′36″	AA-59694	AMS	*Homo sapiens*-bone	483	34	343–538	Martínez et al., 2007
	Paso Alsina 1- E2	39°23′27″	63°15′36″	AA-59695	AMS	*Homo sapiens*-bone	452	35	329–524	Martínez et al., 2007
	Paso Alsina 1- E2c	39°23′27″	63°15′36″	AA-63959	AMS	*Homo sapiens*-bone	471	43	329–543	Martínez et al., 2007
	Paso Alsina 1- E3	39°23′27″	63°15′36″	AA-63960	AMS	*Homo sapiens*-bone	570	44	499–631	Martínez et al., 2007
	Paso Alsina 1- E4	39°23′27″	63°15′36″	AA-63961	AMS	*Homo sapiens*-bone	516	44	460–555	Martínez et al., 2007
	Paso Alsina 1- E5	39°23′27″	63°15′36″	AA-63963	AMS	*Homo sapiens*-bone	448	43	326–526	Martínez et al., 2007
	Paso Alsina 1- E5	39°23′27″	63°15′36″	AA-63962	AMS	*Homo sapiens*-bone	465	43	328–539	Martínez et al., 2007
	Paso Alsina 1- E6	39°23′27″	63°15′36″	AA-63964	AMS	*Homo sapiens*-bone	476	43	331–544	Martínez et al., 2007
	Paso Alsina 1- E7	39°23′27″	63°15′36″	AA-63965	AMS	*Homo sapiens*-bone	485	43	334–546	Martínez et al., 2007
	Paso Alsina 1- E8	39°23′27″	63°15′36″	AA-70562	AMS	*Homo sapiens*-bone	465	41	329–538	Martínez et al., 2007
	Paso Alsina 1- E9	39°23′27″	63°15′36″	AA-63966	AMS	*Homo sapiens*-bone	446	42	326–523	Martínez et al., 2007
124	San Antonio 1	39°39′56″	62°9′59″	AA-81832	AMS	*Lama guanicoe*-bone	773	44	566–733	Martínez, 2008–2009
125	San Antonio 2	39°39′56″	62°9′12″	AA-81831	AMS	*Lama guanicoe*-bone	988	44	749–931	Martínez, 2008–2009
	San Antonio 2	39°39′56″	62°9′12″	AA-85152	AMS	*Homo sapiens*-bone	1053	53	796–1045	Martínez and Martínez, 2011
	San Antonio 2	39°39′56″	62°9′12″	AA-77966	AMS	*Lama guanicoe*-bone	764	45	564–731	Stoessel et al., 2008
126	Zoko Andi	39°28′10.3″	63°5′58.1″	AA-92657	AMS	*Lama guanicoe*-bone	380	43	315–491	Martínez et al., 2014
	Zoko Andi	39°28′10.3″	63°5′58.1″	AA-92656	AMS	*Lama guanicoe*-bone	726	57	553–721	Martínez et al., 2014
	Zoko Andi	39°28′10.3″	63°5′58.1″	AA-94088	AMS	*Lama guanicoe*-bone	793	39	573–739	Martínez et al., 2014
	Zoko Andi	39°28′10.3″	63°5′58.1″	AA-94085	AMS	charcoal	1526	34	1030–1428	Martínez et al., 2014
	Zoko Andi	39°28′10.3″	63°5′58.1″	AA-94086	AMS	charcoal	1527	34	1302–1430	Martínez et al., 2014
	Zoko Andi	39°28′10.3″	63°5′58.1″	AA-94087	AMS	*Lama guanicoe*-bone	1508	44	1289–1465	Martínez et al., 2014
	Zoko Andi	39°28′10.3″	63°5′58.1″	LP-2526	Standard	charcoal	1330	50	1077–1296	Martínez et al., 2014
	Zoko Andi	39°28′10.3″	63°5′58.1″	AA-94089	AMS	*Homo sapiens*-bone	1350	41	1095–1303	Martínez et al., 2014
	Zoko Andi	39°28′10.3″	63°5′58.1″	AA-101877	AMS	*Homo sapiens*-bone	1438	50	1185–1400	Martínez et al., 2014
127	Loma de Los Morteros	39°42′55.9″	62°48′58″	AA-101875	AMS	*Lama guanicoe*-bone	4269	59	4534–4954	Stoessel, 2014
	Loma de Los Morteros	39°42′55.9″	62°48′58″	AA-101876	AMS	*Homo sapiens*-bone	4454	60	4855–5284	Stoessel, 2014
128	La Modesta	39°40′57.4″	62°50′5.8″	AA-101873	AMS	*Lama guanicoe*-bone	5641	66	6279–6541	Stoessel, 2014
129	Cantera de Rodados Villalonga	40°06′59″	62°20′50″	AA-91549	AMS	*Homo sapiens*-bone	4889	58	5330–5710	Martínez et al., 2012b
	Cantera de Rodados Villalonga	40°06′59″	62°20′50″	AA-91550	AMS	*Homo sapiens*-bone	4502	56	4874–5288	Martínez et al., 2012b
	Cantera de Rodados Villalonga	40°06′59″	62°20′50″	LP-2452	Standard	*Homo sapiens*-bone	4100	80	4297–4825	Martínez et al., 2012b

Table 9
Radiocarbon dates from the Caldenar micro-region.

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
130	Chenque I	65°3′	37°69′	AA-35950	AMS	*Homo sapiens*-tooth	1029	43	795–960	Berón, 2003
	Chenque I	65°3′	37°69′	AA-35951	AMS	*Homo sapiens*-tooth	869	43	669–895	Berón, 2003
	Chenque I	65°3′	37°69′	UGA-10627	AMS	*Homo sapiens*-tooth	740	70	549–736	Berón, 2003
	Chenque I	65°3′	37°69′	UGA-10628	AMS	*Homo sapiens*-tooth	730	70	548–731	Berón, 2003
	Chenque I	65°3′	37°69′	AA-35952	AMS	*Homo sapiens*-tooth	904	43	680–905	Berón, 2003
	Chenque I	65°3′	37°69′	AA-35953	AMS	*Homo sapiens*-tooth	901	43	679–904	Berón, 2003
	Chenque I	65°3′	37°69′	UGA-10624	AMS	*Homo sapiens*-tooth	700	40	558–667	Berón, 2003
	Chenque I	65°3′	37°69′	UGA-10625	AMS	*Homo sapiens*-bone	830	40	664–767	Berón, 2003
	Chenque I	65°3′	37°69′	UGA-10626	AMS	*Homo sapiens*-bone	370	40	312–487	Berón, 2003
	Chenque I	65°3′	37°69′	UGA-01999	AMS	*Homo sapiens*-tooth	890	30	684–798	Berón, 2004
	Chenque I	65°3′	37°69′	UGA-02000	AMS	*Homo sapiens*-tooth	370	30	315–485	Berón, 2004
	Chenque I	65°3′	37°69′	UGA-02001	AMS	*Homo sapiens*-tooth	730	50	556–719	Berón, 2004
	Chenque I	65°3′	37°69′	UGA-02002	AMS	*Homo sapiens*-tooth	990	60	740–955	Berón, 2004
	Chenque I	65°3′	37°69′	UGA-02003	AMS	*Homo sapiens*-tooth	320	30	289–449	Berón, 2004
	Chenque I	65°3′	37°69′	UGA-02004	AMS	*Homo sapiens*-tooth	390	30	323–491	Berón, 2004
	Chenque I	65°3′	37°69′	UGA-02005	AMS	*Homo sapiens*-bone	1050	30	804–963	Berón, 2004
	Chenque I	65°3′	37°69′	UGA-02006	AMS	*Canis familiaris*-bone	930	30	730–905	Berón, 2004
	Chenque I	65°3′	37°69′	UGA-02007	AMS	*Homo sapiens*-tooth	390	30	323–491	Berón, 2004
131	Loma Chapalcó	36°52′	64°45′	UGA-2008	AMS	*Homo sapiens*	3040	30	3063–3336	Berón et al., 2009

Table 10
Radiocarbon dates from the Closed Basins micro-region.

N°	Archaeological site/collection	Lat (South)	Long (West)	Lab. code	Method	Dated material	^{14}C years BP	Sigma	Cal years BP	Reference
132	Médano La Enriqueta	39°6′	63°47′	UGAMS-4418	AMS	*Homo sapiens*	1005	25	801–925	Carrera Aizpitarte et al., 2013
133	Don Aldo 1	39°3′16″	63°56′25″	Ua-22560	AMS	*Homo sapiens*	780	45	567–737	Prates et al., 2006
134	Médano Petroquímica	37°55′71″	67°48′47″	AA-74041	AMS	*Homo sapiens*-bone	393	41	321–494	Mendonça et al., 2010
	Médano Petroquímica	37°55′71″	67°48′47″	AA-74042	AMS	*Homo sapiens*-bone	378	41	316–490	Mendonça et al., 2010
135	Puesto Hernández	38°13′55″	64°19′49″	AA-71847	AMS	*Homo sapiens*-bone	896	58	675–906	Mendonça et al., 2010
	Puesto Hernández	38°13′55″	64°19′49″	AA-71848	AMS	*Homo sapiens*-bone	823	41	661–766	Mendonça et al., 2010
136	Casa de Piedra 1	38°11′	67°11′	I 12067	Standard	Charcoal	8620	190	9136–10,169	Gradín, 1984
	Casa de Piedra 1	38°11′	67°11′	I 12159	Standard	Charcoal	7560	230	7871–8977	Gradín, 1984
	Casa de Piedra 1	38°11′	67°11′	I 12065	Standard	Charcoal	6080	120	6635–7245	Gradín, 1984
	Rinconada Giles	n/i	n/i	Ingeis-AC 0731	Standard	Charcoal	320	120	1–511	Berón, 2010
	Rinconada Giles	n/i	n/i	Ingeis-AC 0729	Standard	Charcoal	700	100	506–761	Berón, 2010
137	Tapera Moreira sitio 1	38°33′	65°33′	UGAMS-7446	AMS	Organic matter (ceramic)	360	25	311–460	Berón, 2013
	Tapera Moreira sitio 1	38°33′	65°33′	Beta-81694	Standard	Charcoal	510	67	326–631	Berón, 2010
	Tapera Moreira sitio 1	38°33′	65°33′	LP-265	Standard	Charcoal	1220	67	958–1267	Berón, 2010
	Tapera Moreira sitio 1	38°33′	65°33′	LP-343	Standard	Charcoal	1830	86	1528–1920	Berón, 2010
	Tapera Moreira sitio 1	38°33′	65°33′	Beta-81695	Standard	Charcoal	1900	76	1595–1994	Berón, 2010
	Tapera Moreira sitio 1	38°33′	65°33′	LP-275	Standard	Charcoal	2140	76	1915–2309	Berón, 2010
	Tapera Moreira sitio 1	38°33′	65°33′	LP-352	Standard	Charcoal	1860	105	1523–2003	Berón, 2010
	Tapera Moreira sitio 1	38°33′	65°33′	LP-358	Standard	Charcoal	1970	95	1612–2144	Berón, 2010
	Tapera Moreira sitio 1	38°33′	65°33′	Beta-91936	Standard	Charcoal	3500	86	3482–3964	Berón, 2010
	Tapera Moreira sitio 1	38°33′	65°33′	AA-35955	AMS	Charcoal	3685	40	3845–4087	Berón, 2010
	Tapera Moreira sitio 1	38°33′	65°33′	LP-264	Standard	Charcoal	3040	86	2928–3384	Berón, 2010
	Tapera Moreira sitio 1	38°33′	65°33′	Beta-82557	Standard	Charcoal	2350	76	2102–2698	Berón, 2010
	Tapera Moreira sitio 1	38°33′	65°33′	Beta-91937	AMS	*Lama guanicoe*	4550	60	4892–5435	Berón, 2010
	Tapera Moreira sitio 1	38°33′	65°33′	Beta-91935	AMS	Charcoal	2200	40	2023–2309	Berón, 2010
	Tapera Moreira sitio 1	38°33′	65°33′	Beta-82556	AMS	Charcoal	3900	60	4087–4432	Berón, 2010
	Tapera Moreira sitio 1	38°33′	65°33′	AA-35954	AMS	Charcoal	3995	50	4185–4567	Berón, 2010
	Tapera Moreira sitio 1	38°33′	65°33′	UGAMS-7445	AMS	Charcoal	1750	25	1560–1702	Berón, 2013
138	Tapera Moreira sitio 3	38°33′	65°33′	Beta-82558	AMS	*Homo sapiens*	2630	60	2468–2845	Berón, 2010
139	Tapera Moreira sitio 5	38°33′	65°33′	LP-340	Standard	Charcoal	1710	90	1366–1748	Berón, 2010
	Tapera Moreira sitio 5	38°33′	65°33′	Beta-91938	Standard	Charcoal	730	40	559–682	Berón, 2010
	Tapera Moreira sitio 5	38°33′	65°33′	Beta-81698	Standard	Charcoal	740	50	559–722	Berón, 2010
	La Lomita	n/i	n/i	Beta-91934	AMS	*Homo sapiens*-bone	2960	50	2886–3214	Berón and Baffi, 2003

The chronology of each micro-region was firstly analyzed separately and secondly, all radiocarbon dates were integrated, in order to assess temporal frequency distributions, at a larger spatial scale: the Pampean region. The database is organized with single radiocarbon dates as the basic recording unit. However, in order to assess general demographic trends an attempt was made to standardize for inter-site variation in dating effort by defining ″occupations″ as the units of analysis. Each ″occupation″ was defined considering a set of statistically indistinguishable radiocarbon dates from a single site (at $\alpha = 0.05$ according to Ward and Wilson test, 1978; for a further explanation see Prates et al., 2013). As reducing the effects of non-uniform research efforts or scientific bias was a heuristic device (Ballenger and Marbly, 2011), ″occupations″ should not be considered as real ″human occupation events″ when estimating demographic trends in different sites and regions.

The probability distributions of ^{14}C dates were obtained using CalPal (2007 version). All ^{14}C dates were calibrated using Calib Rev. 7.0.1 (Reimer et al., 2013) and the southern hemisphere calibration curve (SHCal13, Hogg et al., 2013). The ages are expressed in calendar years at a two-sigma confidence level. It is known that temporary fluctuations in the ^{14}C atmospheric content can generate changes in the calibration curves, reflected as peaks in the summed probabilities. They are not related to the frequency of dates (see for example Steele, 2010; Williams, 2012), but this issue will not be explored in the present study.

The database includes 441 ^{14}C dates, 350 (79.4%) of which are AMS dates, and 86 (19.5%) are standard ^{14}C dates; in five cases the method was not informed (1.1%). Although most of them were obtained by dating faunal remains ($n = 160$, 36.3%), human remains ($n = 147$, 33.3%), and charcoal ($n = 113$, 25.6%), other materials were also selected for dating: shells ($n = 8$, 1.8%), residues of organic matter in pottery ($n = 6$, 1.4%), wood ($n = 4$, 0.9%), seeds ($n = 2$, 0.5%), and eggshells ($n = 1$, 0.2%).

4. Results

The analyzed database comprises 441 radiocarbon dates that span from ca. 12,500 to 150 BP, from 168 archaeological sites, with an average of 2.6 dates per site. The sites are located in Interserrana (25.6%; $n = 43$), Delta and Adjacent Plains (23.8%; $n = 40$), South (13.7%; $n = 23$), Tandilia (12.5%; $n = 21$), Salado Depression (7.1%; $n = 12$), North (6.5%; $n = 11$), Closed Basins (6%; $n = 10$), West (2.4%; $n = 4$), Ventania (1.2%; $n = 2$), and Caldenar (1.2%; $n = 2$) micro-regions. Radiocarbon dates were obtained from sites in Interserrana (29%; $n = 128$), Tandilia (17.9%; $n = 79$), Delta and Adjacent Plains (15.6%; $n = 69$), South (14.5%; $n = 64$), Closed Basins (7.5%; $n = 33$), Salado Depression (5%; $n = 22$), Caldenar (4.3%; $n = 19$), North (4.1%; $n = 18$), West (1.6%; $n = 7$), and Ventania (0.5%; $n = 2$) micro-regions. Considering only “occupations”, the estimated minimal number occupations is 289, which correspond to sites of Interserrana (31.5%; $n = 91$), Tandilia (17.6%; $n = 51$), Delta and

Adjacent Plains (16.9%; $n = 49$), Closed Basins (8.6%; $n = 25$), South (8.6%; $n = 25$), Salado Depression (6.6%; $n = 19$), North (5.5%; $n = 16$), West (1.7%; $n = 5$), Caldenar (1.7%; $n = 5$), and Ventania (1.1%; $n = 3$) micro-regions.

The probabilistic distribution of radiocarbon dates strongly vary among micro-regions (Tables 1–10, Fig. 2). The archaeological signal for the final Late Pleistocene/Early Holocene (ca. 14,845–7375 cal BP) was recorded in North, West, Tandilia,

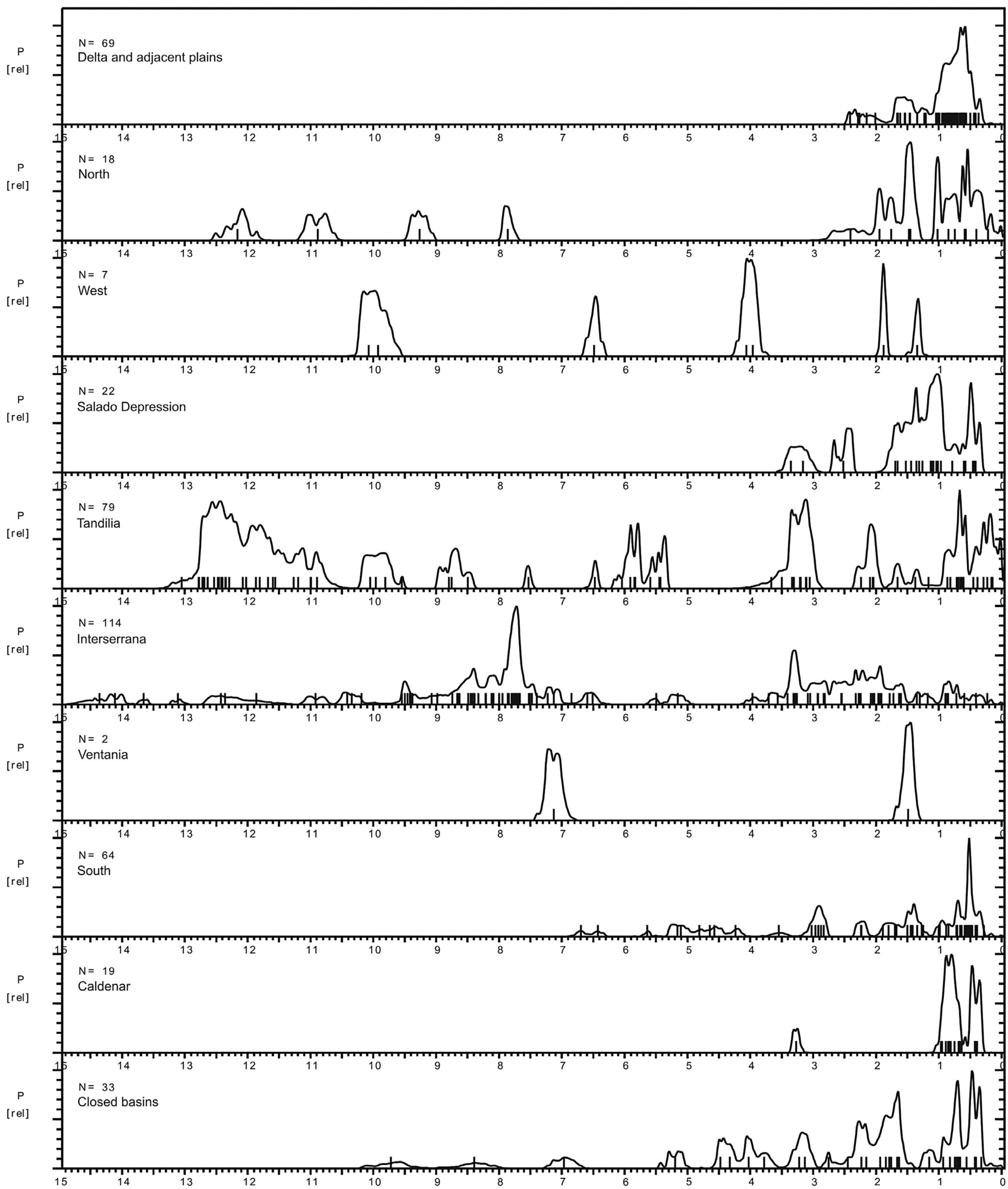

Fig. 2. Temporal frequency distribution by micro-regions.

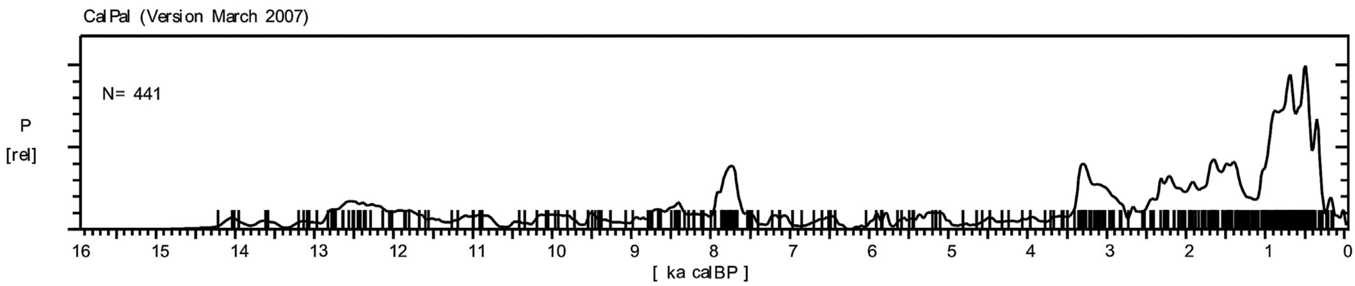

Fig. 3. Temporal frequency distribution for the Pampean region.

Interserrana, and Closed Basins micro-regions. In the Interserrana micro-region the signal is almost continuous, but weak between ca. 14,800 and ca. 9500 cal BP, and moderate between ca. 9500 and ca. 7400 cal BP, with a peak at ca. 7800 cal BP. In Tandilia the signal is continuous, high to moderate, between ca. 13,000–10,800 cal BP, and discontinuous, moderate, between ca. 10,300–7500 cal BP. In the case of Closed Basins, North, and West micro-regions, the archaeological signal is discontinuous and isolated (Fig. 2). No archaeological signal was recorded for this period in Delta and Adjacent Plains, Salado Depression, Ventania, South, and Caldenar (Fig. 2).

For the Middle Holocene (ca. 7375–3734 cal BP) the archaeological signal was recorded in West, Tandilia, Interserrana, Ventania, South, and Closed Basins micro-regions (Fig. 2). In West and Ventania the signal is scarce and isolated, while in Interserrana, Closed Basins, South and Tandilia it is discontinuous but with low to moderate intensity. No archaeological signal was recorded in Delta and Adjacent Plains, North, Salado Depression, and Caldenar micro-regions (Fig. 2).

During the Late Holocene (ca. 3734–228 cal BP) the archaeological signal was detected at all the micro-regions (Fig. 2). The signal is continuous and moderate/high in Interserrana and Closed Basins micro-regions. In Delta and Adjacent Plains, North, Salado Depression, Tandilia, and South though the signal is moderate to high and continuous for long lapses, it shows some gaps (e.g., Tandilia; Fig. 2). In West, Ventania and Caldenar micro-regions the signal is discontinuous and isolated (Fig. 2).

Considering the probability distribution of all radiocarbon dates for the Pampean region (Fig. 3), a continuous and uneven archaeological signal between ca. 14,500 and 100 cal BP is observed. During the final Late Pleistocene and the Early Holocene, the signal is low between ca. 14,500–12,800 cal BP, moderate and continuous between ca. 12,800–7500 cal BP, and with a trough ca. 10,600 cal BP and a peak ca. 7900–7700 cal BP. During the Middle Holocene (ca. 7400–3700 cal BP) the archaeological signal is continuous, going from moderate to low and showing a trough around ca. 6300–6200 cal BP. During the Late Holocene (from ca. 3700 cal BP on) a continuous signal is observed, with an increase in intensity from moderate to high, and with variations in intensity up to ca. 900 cal BP. From this time until ca. 300 cal BP, the archaeological signal shows a constant increase, reaching the highest intensity of all the sequence, and decreasing from ca. 300 cal BP onwards (Fig. 3).

5. Discussion

Demographic signals and population dynamics are not always directly derived from temporal frequency distributions. This is due to several processes, such as scientific and taphonomic biases, that affect the expression of these variables, so they need to be deeply examined before interpreting occupational histories at micro-regional and regional scales (Rick, 1987; Gamble et al., 2005; Holdaway et al., 2005; Shennan and Edinborough, 2007; Surovell and Brantingham, 2007; Buchanan et al., 2008; Hiscock, 2008; Smith and Ross, 2008; Steele, 2010; Williams, 2012; among others). Taking this into account, the kinds of processes which could have affected the trends emerging from radiocarbon distributions are discussed in the next sections.

5.1. Scientific and taphonomic biases

Among the most important factors affecting the distribution of radiocarbon dates of Pampean region are the scientific biases. As shown in the tables and in Fig. 2, there is a strong disparity between the volumes of data in the different micro-regions. Delta and Adjacent Plains, Tandilia, Interserrana and South have a greater number of sites and radiocarbon dates, which reflects a longer scientific tradition and/or more systematic investigations. In other micro-regions such as North, Salado Depression, Caldenar and Closed Basins the number of archaeological sites and dates is lower, in part because the systematic research programs started only recently. In other micro-regions, such as Ventania, although hundreds of sites have been detected (Oliva, 2000), very few radiocarbon dates have been obtained (Table 7). Some micro-regions are overrepresented because of the large number of dates for single sites (see for example Arroyo Seco 2, Chenque 1, and Paso Alsina 1;

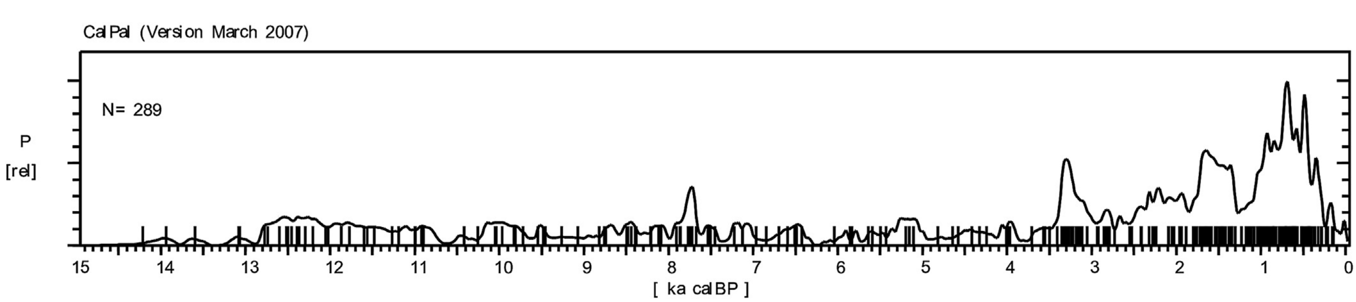

Fig. 4. Temporal frequency distribution according to "occupations" for the Pampean region.

Tables 6, 8 and 9). This is due to the interests of the researchers in certain topics, such as changes in mortuary practices and their chronology, the early settlement of the region and the extinction of megafauna (Berón et al., 2007; Martínez et al., 2007; Politis et al., 2014). Nevertheless, as shown in Figs. 3 and 4, no important differences are observed between the probability distributions of the total ^{14}C dates and the probability distributions of dates that were used for defining "occupations". It implies that the characteristics of the current database -or more importantly, the size of it-do not require a device to reduce the biasing effects of the over-representation of sites with intensive dating.

Taphonomic biases should also be considered. The limited temporal depth in the archaeological signal of some micro-regions can be explained by environmental and geomorphic dynamics. Research in Delta and Adjacent Plains, and Salado Depression micro-regions shows that they were affected by intense geomorphological processes, mainly due to marine ingressions and regressions during the Middle Holocene (Cavallotto et al., 2005). After ca. 3000 BP the stability of the landscape allowed the human occupation of the area and improved the preservation of archaeological record. This would explain the late human signal (post 3000 BP) in these micro-regions and, if occupations have a greater time depth, their visibility and detection would be conditioned by the intense geomorphological dynamics that removed or obliterated the landforms containing sites. In addition, in these micro-regions scarce features of the landscape are favorable for detecting buried archaeological sites, such as exposed stratigraphic profiles. For the Salado Depression, the presence of the so-called ″shallow sites″ (Zárate et al., 2000–2002) was proposed. This term refers to archaeological deposits associated with modern A-horizon characterized as stable geomorphological surfaces. The archaeological materials in these contexts could be associated with occupations separated by thousands of years that have low resolution and integrity and represent palimpsests. Even though in some parts of this micro-region the current topography would have been available at the time of the first human occupations (Zárate et al., 2000–2002), the earliest radiocarbon ages do not exceed ca. 3000 BP. A similar trend can be observed in the North micro-region, although some Pleistocene–Holocene transition dates were obtained. Until quite recently, the archaeological signal for some sectors of the South micro-region did not exceed ca. 3000 BP. For instance, for the lower course of the Colorado River it was proposed that intense geomorphic processes related to semi-arid environments would have affected the archaeological record. These conditions would have produced stratigraphic sequences that represent remarkably unconformities (e.g., stone lines), destruction and exposure (blowouts) of sites, and/or burial of materials under deep eolian mantles. This may not only limit the record of early sites, but also their resolution and integrity (Martínez and Martínez, 2011). However, recent research in areas where older landforms are preserved has revealed the existence of Middle Holocene sites (Martínez et al., 2012b; Stoessel, 2014). Even though no geoarchaeological studies have been carried out in Closed Basins and Caldenar micro-regions, environmental conditions suggest similar processes to those described for the lower Colorado River. In addition, in the latter micro-regions the shortage of river cuts, gullies, and banks exposing buried sites would have had a negative impact on the visibility and accessibility of the archaeological record.

For the Tandilia hill system, although ″shallow sites″ have been detected (e.g., Cerro El Sombrero-Cima; Zárate et al., 2000–2002), most of the studied sequences comprise occupations spanning from the final Late Pleistocene to the final Late Holocene. Archaeological layers are mainly located above erosional or depositional stratigraphic unconformities. The latter separate the coarser and stone-rich Pleistocene sediments from the sandy-clayed Holocene silts, which usually yield signs of pedogenesis and diatomaceous levels (Martínez et al., 2013b). For this micro-region, sedimentary profiles in caves and rock shelters vary from ~0.40 m to 2 m, and in both cases the final Late Pleistocene and the Late Holocene are represented (see Martínez et al., 2013b; Zárate and Flegenheimer, 1991; Flegenheimer and Zárate, 1997; Mazzia, 2011). This situation is clearly shown by emerging trends from radiocarbon distributions (Fig. 2) that suggest high visibility of sites, and high integrity and resolution of the archaeological record. Good preservation of organic materials (e.g., charcoal) is a key issue in this micro-region, and also influences the chance of obtaining radiocarbon dates.

In the Interserrana micro-region all the periods herein considered are also represented. Riverine areas yield high rates of fluvial, lacustrine and eolian sediments, under which high chronological resolution soils are generally buried (Zárate et al., 2000–2002; Favier Dubois, 2006; Johnson et al., 2012). The lagoon contexts also offer possibilities for recording sites of different chronologies (Madrid and Barrientos, 2000; Pal, 2007). Also, watersheds dominated by loessic mounds present ages for several periods, but with a lower archaeological resolution (Flegenheimer et al., 2010; Politis et al., 2014). The modern Atlantic coastline of Pampas also shows chronologies of several periods, from the final Late Pleistocene to Late Holocene (Bayón and Politis, 1996; Bonomo and León, 2010; Bayón et al., 2012; Blasi et al., 2013).

As stated above, some taphonomic biases caused by environmental and geomorphological agents can be inferred. These biases affect the rates of preservation and discovery of archaeological sites for certain periods. In some micro-regions such as Delta and Adjacent Plains, and Salado Depression, condensed stratigraphic sequences (the so-called ″shallow sites″) with low degrees of resolution and integrity are often recorded; in these cases chronologies are mainly related to the Late Holocene. In North, South, Caldenar and Closed Basins micro-regions, condensed and/or impacted stratigraphic sequences with low degrees of resolution and integrity are recorded; in these cases chronologies are also related to the Late Holocene, but with isolated evidence from the Early and Middle Holocene. In Tandilia and Interserrana micro-regions, extensive and aggradational stratigraphic sequences are recorded. In these cases, high sedimentation rates (e.g., floodplains), "A" buried soil horizons with higher degrees of resolution and integrity, and multicomponent sites with chronologies ranging from the final Late Pleistocene to the Late Holocene are also typical. Finally, in the case of West and Ventania micro-regions the scarce information on the detected sites, as well as the small sample of radiocarbon dates does not allow the same analysis to be performed.

5.2. Population dynamics: models and implications of the chronological trends

Based on research carried out in the different micro-regions, some general models for the human occupation in the Pampean region have been proposed (Politis and Madrid, 2001; Martínez and Gutiérrez, 2004; Politis, 2008). The earliest occupations (final Late Pleistocene/Early Holocene transition) are concentrated in Tandilia and Interserrana micro-regions. Some scholars state that the early occupations in these sectors match with an amelioration of climatic conditions (e.g., warmer) when environmental changes led to an increased availability of resources (Gutiérrez et al., 2011; Martínez et al., 2013b). Other authors have proposed that the spatial organization of early occupations of the area would have been influenced by the availability of lithic raw material (Politis et al., 2004). While Fig. 2 indicates a greater archaeological signal in these two micro-regions, recent projects and studies on museum collections

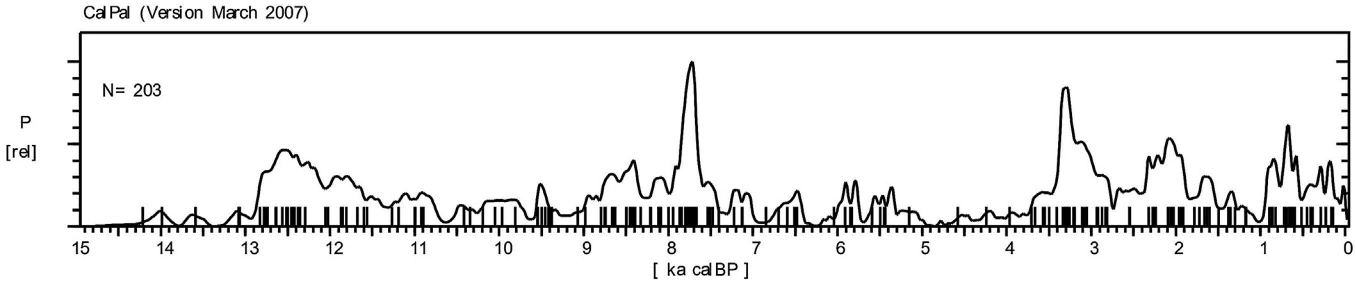

Fig. 5. Temporal frequency distribution for the Southeastern Pampean region.

from other micro-regions (e.g., North, West; Fig. 2; Politis et al., 2011a, 2012) have provided occupations for these moments. This suggests that some of the biases that were mentioned above may influence the building of models. Occupational gaps that had been previously recorded for this period (ca. 9600–8800 cal BP; Fig. 2 in Barrientos et al., 2005) are no longer observable (see Figs. 3 and 5).

Considering the Southeast of the Pampean region two models, with different implications for Middle Holocene population dynamics, have been proposed: a) one that considers the peopling and local cultural evolution as a continuous processes (Politis, 1984, 1988, 2008; Martínez, 1999, 2002; Politis and Madrid, 2001), and b) the other conceives regional peopling as discontinuous, characterized by local extinctions, recolonization and population replacements (Barrientos, 2001; Barrientos and Pérez, 2002, 2005; Barrientos et al., 2005; Pérez, 2006; Barrientos and Masse, 2014). Both radiocarbon analysis and cranial morphometry were used to support this latter model. Based on the study of radiocarbon date sequences by different methods (e.g., statistical analysis, evaluation of trends of calibrated and uncalibrated dates in scatter plots) the presence of hiatuses was proposed (Barrientos and Pérez, 2002, 2005; Barrientos, 2009). The most discussed lapses include part of the Middle Holocene (ca. 5000–4300 cal BP; Barrientos et al., 2005).[1] According to Barrientos et al. (2005), this hiatus is related to the worst climatic conditions of the post-hypsithermal and the period of marine regression, an event regarded as one of the major ecosystem regulators that affected both terrestrial and marine biota of Southeast Pampean region (see discussion in Barrientos et al., 2005). Barrientos and Pérez (2005) stated that studies on craniofacial morphological variation are consistent with the population disruption, since they show differences between the samples before and after the hiatus, thus indicating a biological discontinuity at a population level (see also Barrientos et al., 2005). Nevertheless, craniometric studies and the results obtained to support population disruptions and replacements (Barrientos and Pérez, 2004) should still be taken with caution since a large divergence in craniofacial features can arise in a short time as a result of the influence of ecological variables such as diet and climate (Perez and Monteiro, 2009; Bernal et al., 2010). Variations in the skull can be highly influenced by the environment during ontogeny (see discussion in Perez and Monteiro, 2009) and therefore may not reflect significant population changes.

As part of the model that considers the peopling of the Pampas as a continuous processes, and given the lack of archaeological evidence for the Middle Holocene, Politis (1984) suggested that population density declined in the Interserrana micro-region due to the contraction of the species adapted to semi-arid environments (e.g, *Lama guanicoe*). Later, this author rejects the disruption model, stating that the "available evidence suggests continuity of several patterns (technology, subsistence, burial places, use of space) rather than a disruption, as the local extinction or emigration of the local population would have produced" (Politis, 2008:247; see also Politis, 2014: 455–456). He states that the cranio-facial differences between the Middle and initial Late Holocene as a by-product of two different populations needs to be proven and other explanations (e.g., micro-evolutionary processes) needs to be taken into consideration (Politis, 2008, 2014). Martínez (1999, 2002) has suggested that population densities would have been low during the Middle Holocene, but that does not necessarily imply a reduction when compared to previous times. Poor visibility of sites would be a consequence of a strategy of high residential mobility based on short-term occupations related to the exploitation of specific resources in some particular sectors of landscape (e.g., inland plains, hills, coast, etc.; Martínez, 1999, 2002). This would result in an archaeological record with a less intense signal.

The results obtained in this paper indicate that the Middle Holocene archaeological signal for the Pampean region is continuous, despite alternating between moderate and low, and showing some troughs (Fig. 3). Considering only the Southeastern Pampas (37°–39° SL and 57°–63° WL; *sensu* Barrientos et al., 2005), continuity is also observed in the archaeological signal, and no hiatuses are detected (Fig. 5). This information makes population discontinuities difficult to be supported, at least by radiocarbon evidence. We propose that the fluctuations in the intensity of the archaeological signal may be related to several factors, such as archaeological visibility, sampling and taphonomic biases (see Favier Dubois, 2006; Martínez et al., 2013a; Politis, 2014), organization of prehistoric populations (e.g., settlement patterns and mobility systems; see discussion in Politis, 1984; Martínez, 1999), and even a lower population density. Current radiocarbon evidence does not support extinctions and population replacement processes; on the contrary, data are consistent with the models suggesting population continuity for the Southeastern Pampean region.

During the Late Holocene, human occupations are recorded at all micro-regions of the Pampean region (Fig. 2). During this period, a return to warm and humid conditions and the coastline stabilization occurred at around 1000 cal BP, thus the modern ecosystems were established (Politis and Madrid, 2001). There is also an increase in the archaeological visibility of sites which may be correlated to an increase in population density. In addition, longer occupations and/or occupational redundancy are proposed, due to a reduction in residential mobility and the development of logistical mobility strategies. All these factors would have allowed a greater archaeological visibility, and thus an increased intensity of the archaeological signal for the final Late Holocene. Despite some differences between micro-regions, this becomes evident when the database is considered as a whole (Fig. 3). In this regard, in West and Ventania micro-regions the intensity of the archaeological

[1] Barrientos and Masse (2014) have recently proposed a connection between "the depressed archaeological signal" for the interval between 5000 and 4400 cal BP in central Argentina with a cosmic impact.

signal shows no major differences when compared to previous moments, which could be linked to scientific biases.

6. Conclusions

Tandilia and Interserrana micro-regions show signs of almost continuous human occupation for the Pampean region. This may reflect the actual distribution of early occupations through the landscape, but it may also have been affected by some scientific and taphonomic biases. On one hand, the strong early human signal in Tandilia is possibly due to the high visibility of the archaeological record, and also to the preference of humans for inhabiting sectors like rock shelters during the early stages of peopling. Moreover, the geomorphological features of this hill system are characterized by a high landscape visibility, access to key resources (e.g., lithic raw material) and the proximity to the Interserrana micro-region, which offers typical resources of grassland plains (e.g., large mammals). The archaeological signal from these two micro-regions is weak between ca. 14,500 and 12,800 cal BP. A tendency towards a more stable and sustained occupation between ca. 12,800 and 7500 cal BP is observed (see Prates et al., 2013; Martínez et al., 2013b). The lack/low archaeological signal at other micro-regions (e.g., Delta and Adjacent Plains, Salado Depression, Ventania, Caldenar, Closed Basins) is probably due to scientific or taphonomic biases for the final Late Pleistocene and Early Holocene.

Regarding the Middle Holocene, it seems clear that the gaps identified and discussed by some authors (Barrientos, 2001, 2009; see Fig. 2 in Barrientos et al., 2005) have been disappearing along with the incorporation of new data. Although the archaeological signal for this period is still low, it is continuous at different scales of analysis (e.g., Southeastern of Pampean region, and Pampean region as a whole). In this sense, the probability distribution of radiocarbon dates shows no hiatuses that can be linked with population extinctions and/or replacements.

For the Late Holocene, the archaeological signal becomes much more intense. As it has been stated by some authors (Holdaway et al., 2005; Surovell et al., 2009), there is a higher possibility to find more recent settlements, so this trend may increase the archaeological signal when compared with older periods. Although this could be seen as one of the causes of this trend, some authors suggest a Late Holocene human population growth (Martínez, 1999; Politis and Madrid, 2001; Berón, 2004; González, 2005; Mazzanti, 2006; Politis, 2008). Thus, that the distribution of radiocarbon dates and the archaeological signal for the Late Holocene could be the result of this population growth process, especially from ca. 1000 BP.

The radiocarbon tendencies for the intensity of human occupation and peopling of the Pampean region will surely undergo changes with the incorporation of new data. Nevertheless, it is necessary to explore other lines of evidence (e.g., technological and stylistic changes through time) that go beyond the probability distributions of radiocarbon dates in order to better explore the issues previously discussed.

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