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Mortality Profiles of Hunter-Gatherer Societies: A Case Study from the Eastern Pampa–Patagonia Transition (Argentina) During the Final Late Holocene

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ABSTRACT The objectives of this work are to present a set of methodological procedures to analyse commingled bone assemblages (e.g. secondary burials), in order to build the mortality profile of the Paso Alsina 1 site and discuss the obtained age at death distribution in a context of hunter-gatherer populations that inhabited the eastern Pampa–Patagonia transition (Argentina) during the Final Late Holocene. The Paso Alsina 1 site is a formal disposal area of inhumations composed by multiple secondary burials dated at ca. 500 ^{14}C years BP. The site is comprised of a minimum number of 77 individuals, represented by both sexes and all age categories. The mortality profile is characterized by a bimodal pattern with a peak of greater representation of individuals younger than 3 years and another comprising the range between 20 and 34.9 years old. These results are discussed in relation to the paleopathological information available for the site, indicating that individuals suffered mainly disruptions in growth and development by systemic stress. The mortality profile obtained suggests that this skeletal series would not have formed as a result of a catastrophic event. On the contrary, it is an atricional mortality profile, consisting of individuals who died at different times and places and for varied reasons. Later, skeletal remains were grouped into secondary bundles and simultaneously buried at the site. Body manipulation and secondary burials are common in the context of a social reorganization that occurred in the area and in neighbouring regions during the Final Late Holocene.

Key words: commingled bone assemblage; eastern Pampa–Patagonia transition; hunter-gatherer; Final Late Holocene; mortality profile; Paso Alsina 1 site

Introduction

The construction of mortality profiles based on osteological samples from hunter-gatherer groups and associated with different chronologies has been achieved from different cultural contexts around the world (Johnston & Snow, 1961; Mensforth, 1990; Weber *et al.*, 2002; Bernal *et al.*, 2004; Luna, 2008, among others). This kind of information is necessary in order to discuss paleodemographical, paleopathological and paleoepidemiological issues, as well as population dynamics, mobility patterns, interactions between groups, competition and interpersonal violence, wars, among other issues (Weber *et al.*, 2002; Chamberlain, 2006; Hill *et al.*, 2007).

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In Argentina, archaeological research in the Pampas and northeastern Patagonia indicates major changes and reorganization of cultural systems towards the Final Late Holocene (ca. 1000–250 ^{14}C years BP). It has been proposed that these changes encompassed diverse socio—economic and demographic phenomena such as population growth, population expansions, inter-ethnic contacts, social interaction networks at different spatial scales (local, regional and extra-regional), territoriality, spatial circumscription, demographic packing and, possibly, regionalization (Barrientos & Perez, 2004; Mazzanti, 2006; Berón, 2007; Gómez Otero, 2007; Martínez, 2008–2009; Politis, 2008; Prates, 2008; Favier Dubois *et al.*, 2009). Along with this new socio-economic scenario, the appearance of formal disposal areas and cemeteries emerged. In the Pampas and northeastern Patagonia, there are several mortuary contexts corresponding to hunter-gatherer groups of the Final Late Holocene that

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have a large number of individuals, both arranged in secondary and primary burials (e.g. La Petrona, Los Chilenos 1, Chenque I, Médano Petroquímica, Cima de los Huesos, Cementerio de los Indios and Laguna del Juncal, among many others; see references in Martínez *et al.*, 2012; Figure 1). Despite this, few contexts have been analysed in order to build mortality profiles (see examples in the Chenque I and Lago Salitroso sites at the Dry Pampa and northwest–southern Patagonia, respectively; Bernal *et al.*, 2004, García Guráieb, 2010; Luna, 2010).

The Paso Alsina 1 site is located in the lower basin of the Colorado River, in the eastern Pampa–Patagonia transition (Figure 1). It is an exclusive inhumation area composed by multiple secondary burials (see characteristics in the succeeding texts) with a chronology of ca. 500 ^{14}C years BP, being one of the sites in Pampa–Patagonia with the highest number of buried individuals. The objectives of this paper are to present a set of methodological procedures to analyse commingled bone assemblage (e.g. secondary burials) in order to build the mortality profile and to discuss the pattern of the age at death distribution in a context of hunter-gatherer populations during the Final Late Holocene. The results are discussed in relation with the paleopathological information available for the site and with the socio-historical context that characterizes the hunter-gatherer groups that inhabited the study area.

Study area and characteristics of the Paso Alsina 1 site

The lower course of the Colorado River is enclosed in the so-called Diagonal Árida (Abraham de Vázquez *et al.*, 2000). The study area is located in the Pampa–northeastern Patagonia transition, considered as an ecotone in which vegetation and animal communities

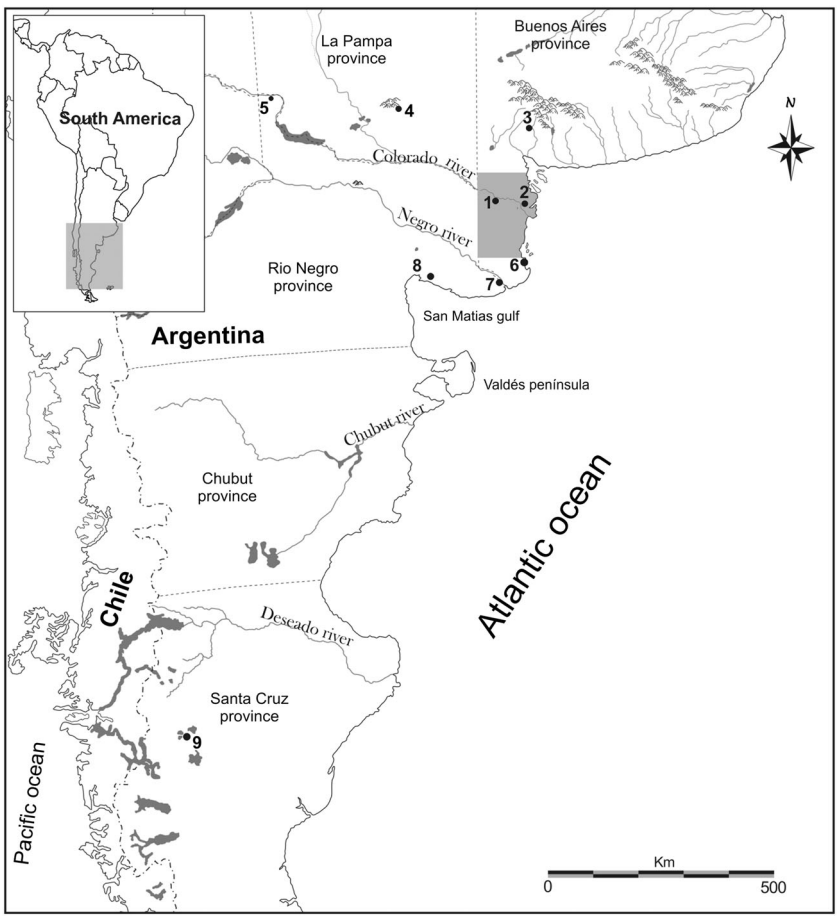

Figure 1. Paso Alsina 1 site and other formal disposal areas, cemeteries and 'chenques' at Pampa and Patagonia regions: (1) Paso Alsina 1, (2) La Petrona, (3) Los Chilenos 1, (4) Chenque I, (5) Médano Petroquímica, (6) Cementerio de los Indios, (7) Laguna del Juncal; (8) Cima de los Huesos and (9) Lago Salitroso.

from different geographic provinces are recorded (see Martínez *et al.*, 2009 and references therein). Archaeological investigations have established that hunter-gatherer groups that inhabited the area were characterized by specific adaptations to riverine arid–semiarid environments, whose earliest settlements yielded a chronology of ca. 5000 ^{14}C years BP. Nevertheless, most of the archaeological occupations are related to the Late Holocene (3000–250 ^{14}C years BP), for which an archaeological and behavioural model has been proposed (Martínez, 2008–2009).

The Paso Alsina 1 archaeological site is an inhumation area that was fully excavated. It contains 10 multiple secondary burials; the distance between them is very narrow, and in some cases, burials are placed side by side and/or juxtaposed (Figure 2). The burials were arranged in an ordered and structured way within an area of ~6 m^2 (Martínez *et al.*, 2012). On the basis of the recurring spatial arrangement of certain diagnostic anatomical units, a "basic structure" for the funerary bundles was defined: one to three skulls at the ends, bones of the pelvic and shoulder girdle associated with the skulls, long bones in the lateral sectors and ribs grouped symmetrically aligned to each other, located on the burials and their borders (Martínez *et al.*, 2012: figure 5). Thirteen radiocarbon dates were obtained from all burials (Table 1), and the values showed no statistically significant differences, which allowed calculating a weighted mean of 483 ± 20 years BP (see discussion in Martínez *et al.*, 2007). An outstanding feature of the mortuary context is that most of the bones were intensely painted with red pigments on their surfaces (Martínez *et al.*, 2012). The presence of cut marks related to defleshing, scraping and cutting activities in both adult and adolescent individuals were also observed on the anatomical units (González, 2012). Given the context of the site and the burial mode, it was inferred that the anthropic traces indicate the removal of soft tissue during the skeletonization of the body. The contextual information allowed defining the site as an exclusive inhumation area of secondary burials that were simultaneously buried in a single episode (Martínez *et al.*, 2012).

Given the aforementioned structure, it is possible that the time of death of the individuals who are represented in the burials are different but very close to each other, at least when considering a time scale of only a few years. Furthermore, the skeletal parts of the same individuals may be present in different funerary bundles. It was proposed that the development of secondary burials was part of a communal funeral scheme of hunter-gatherer groups, which would have involved the collection of skeletal remains from different bodies with different times of death and possibly from different landscape sectors. Anatomical units would have been put together, ordered and arranged in secondary burials that were transported throughout the landscape (Martínez *et al.*, 2012). Chronicles and travellers' records described this corpse treatment for the time of European–Aboriginal contact (Falkner, [1774] 1911). Taking into account this characteristic of the sample, a series of methodological steps were applied to build the

Figure 2. Distribution of the funerary bundles (FB) at Paso Alsina 1 site (modified from Martínez et al., 2009).

Table 1. Chronology, minimum number of elements, minimum number of individuals, sex and age at death estimations by funerary bundles at the Paso Alsina 1 site

				Age					Sex		
Funerary bundle	^{14}C years BP	MNE	MNI	Adult	Adolescent	Child	Infant	Perinate	Male	Female	Undetermined
1	497 ± 43	217	8	6	1	—	1	—	1	4	3
2	452 ± 35 471 ± 43	399	15	11	1	1	1	1	7	4	4
3	570 ± 44	289	11	7	1	2	1	—	3	3	5
4	516 ± 44	342	10	6	—	3	1	—	3	2	5
5	465 ± 43	195	8	6	—	1	—	1	4	1	3
6	448 ± 43 476 ± 43	375	10	6	1	1	1	1	4	3	3
7	485 ± 43	269	8	5	1	—	1	1	2	1	5
8	465 ± 41	263	16	11	1	1	2	1	4	7	5
9	446 ± 42	319	15	6	—	—	4	5	2	4	9
10	504 ± 34 483 ± 34	657	18	10	4	3	1	—	6	2	10
Superficial	—	201	11	5	3	1	1	1	1	0	10
Total	—	3526	130	79	13	13	14	11	37	31	62

MNE, minimum number of elements; MNI, minimum number of individuals.

mortalityprofile with the osteological sample of the Paso Alsina 1 site.

Materials and methods

Each secondary burial consists of bone elements with no anatomical relationship, as they belong to several individuals of both sexes and different age categories. Consequently, because there is no skeletal integrity (e.g. individuals anatomically articulated), studies were carried out by considering the bone and dental element as the unit of analysis for the site. Each anatomical unit was identified and laterality was determined for paired skeletal parts. Different quantitative units were calculated such as minimum number of individuals (MNI) and minimum number of elements (Lyman, 1994). This analysis included complete bones, bone fragments and also dental elements in order to achieve a more precise quantification of the sample (Ubelaker, 1974; Hoppa & Gruspier, 1996).

Sex determination was made by macroscopic observations on different qualitative and/or morphological features in bone elements corresponding to individuals older than 15 years. The more diagnostic bone elements were analysed (e.g. skull, os coxae and sacrum) using conventional methods (Buikstra & Ubelaker, 1994). Features of the skull, such us the development, size and robusticity of the nuchal crest, frontal sinus, glabella, mastoid processes and supraorbital margin, as well as the characteristics of the mandible, were analysed (Buikstra & Ubelaker, 1994). In the case of os coxae, features and morphology of the greater sciatic notch and of the subpubic region (e.g. subpubic concavity, medial surface and ventral arch) were taken into account. Finally, for the sacrum, the morphology (width and length) of the auricular surface and the curvature of the bone were considered (Flander, 1978). In individuals younger than 15 years, sex was not determined because of the low frequency of anatomical units considered as diagnostic for this kind of analysis (e.g. os coxae) and because there is a low accuracy in the results provided by the available methods (Lewis, 2006). For sex estimation, the categories proposed by Buikstra & Ubelaker (1994) for female, male and undetermined were used.

To estimate the probable skeletal age at death of adults, several methodological criteria that take into account changes in the morphology of the skull, pelvis and sacrum were considered (Buikstra & Ubelaker, 1994; Osborne *et al.*, 2004; see Aykroyd *et al.*, 1999). In the case of the crania, a criterion such as the stage of craneal suture closure (Buikstra & Ubelaker, 1994) was employed. For the os coxae, features of the auricular surface (Lovejoy *et al.*, 1985; Meindl & Lovejoy, 1989; Osborne *et al.*, 2004; ver Aykroyd *et al.*, 1999) and the pubic symphysis were observed (Brooks & Suchey, 1990; Suchey & Katz, 1998; see Buikstra & Ubelaker, 1994). For the sacrum, criteria such as the appearance and fusion of the vertebrae were used (Krogman & Iscan, 1986). The rest of the anatomical units were analysed following the stages of epiphysial union as suggested by Buikstra & Ubelaker (1994). For subadults, both macroscopic and osteometrical methods and techniques were considered (Scheuer & Black, 2000). The stage and development of ossification centers (Scheuer & Black, 2000; Kahana *et al.*, 2003), the stage of epiphysial union for long bones (Johnston & Zimmer, 1989) and the

stage of obliteration of craneal sutures (e.g. spheno-occipital; Kahana *et al.*, 2003) were considered. In the case of teeth, the formation, calcification and dental eruption processes were taken into account (Buikstra & Ubelaker, 1994). In the case of subadults whose age is younger than 12 years, standards that considered the length of the long bones (Scheuer & Black, 2000) were used. The following age categories were taken into account: fetal (before birth), perinate (36–44 weeks), infant (1 month–3 years), child (3–12 years), adolescent (13–20 years), young adult (20–35 years), middle adult (35–50 years) and old adult (older than 50 years) (Buikstra y Ubelaker, 1994). When it was not possible to estimate an age, individuals were classified into two broad categories: subadult and adult. To plot the results in a mortality curve, 5 year intervals to subadult individuals (<20 years) were used. Adult individuals were grouped into age intervals as suggested by Buikstra & Ubelaker (1994). The choice of different intervals for subadult and adult individuals is due to the different sensitivity of the age determination techniques.

The MNI was calculated for each funerary bundle with the purpose of obtaining information on the composition of the skeletal sample and the internal variability at the site. Nevertheless, as indicated previously, anatomical units of a single individual may be distributed between different funerary bundles. In this case, in order to build an appropriate sex–age profile for the site and to avoid overestimating the MNI, a series of procedures to apply a minimum distinction approach (sensu Grayson, 1978:60) was performed. Once determination for each bone and dental item based on the criteria listed previously was completed, the obtained information was grouped and combined in order to discriminate the MNI. For example, the elements corresponding to subadult individuals were grouped by age ranges. Then, each bone assemblage corresponding to these age ranges was analysed in order to achieve two types of refitting: mechanical and anatomical. The latter type was made on the basis of bilateral and intermembral skeletal segment identification (Todd & Frison, 1992). This activity was carried out macroscopically, considering non-metric and metric attributes. In the first case, the bilateral symmetry between elements and the tightness of joint articulation were observed. In the second case, measurements were obtained by using a digital calipper with a resolution of 0.01 mm and an accuracy of 0.03 mm. In the case of anatomical units corresponding to adults, the same procedure was followed, including information on sex. In addition, an analysis of multiple paired elements was performed in adults in order to estimate the most probable number of individuals (Adams & Konigsberg, 2004). This task was done by considering the femur, because it is the most represented bone element in the sample (Figure 3). In the case of teeth, the MNI was calculated from the tooth more represented in the sample, considering its laterality and alveolar location (in this case, the upper right first molar). For the statistical treatment of the data, with the purpose of analysing the differences between sex and age of death, a chi-s test was performed ($p = 0.05$) using the software package PAST (version 2.08) (Hammer *et al*. 2001).

Results

The Paso Alsina 1 site consists of 3526 bone elements and 887 teeth from different individuals of all age categories and sexes. As seen in Table 1, there is a differential representation of the amount of bone elements and the MNI by funerary bundle. Adding the MNI calculated for each secondary burial as well as surface findings, a total of 130 individuals were determined at the site. However, as mentioned previously, some

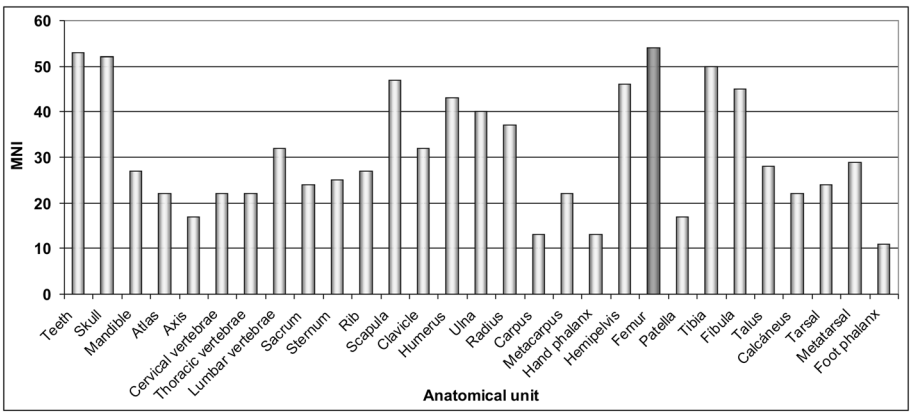

Figure 3. Minimum number of individuals (MNI) calculated by anatomical units in adults from the Paso Alsina 1 site.

anatomical units of the same individual could potentially be allocated in different funerary bundles, so, following the procedures detailed in the former section, the MNI was recalculated to avoid overestimating the final quantification. As a result in the broad category of subadults, it was possible to quantify 419 anatomical units that represent individuals with ages ranging from birth to adolescence stages. Although in Table 1 there are 51 subadults the task of grouping anatomical units from the different burials by age categories (e.g. perinate) allowed adjusting the MNI to 23 (Table 2). Regarding the adults, 3107 anatomical units of different age groups and both sexes were recovered. Table 1 shows the presence of 79 adults considering the whole burials. However, according to the most abundant anatomical unit (left femora; Table 2 and Figure 3), the MNI for the site was adjusted to 54 adults. Calculation of the most probable number of individuals for this age category yielded the same figures. In sum, the most conservative MNI obtained for the site is 77, including adults and subadults (Table 2).

The results show that within the perinate category, there are 99 anatomical units of which 53 (53.5%) could be assigned to a particular age range. On the basis of this information, a MNI of five individuals of undetermined sex were determined (Table 2). In the infant category, out of the 104 quantified bone elements, 83 (79.8%) could be assigned to an estimated skeletal age of death. The presence of six individuals of undetermined sex and different ages was recorded (Table 2). In the child category, all elements ($n = 86$) were assigned to a specific age range. The presence of three individuals of undetermined sex and different ages was estimated (Table 2). In the adolescent category, all elements were attributed to a specific age range ($n = 100$), and nine individuals were identified

Table 2. Minimum number of elements, minimum number of individuals and sex determination according to age category at the Paso Alsina 1 site

Age category	Age ranges	MNE	MNI	F	M	Undetermined
Perinate	Undetermined	46	—	—	—	—
	36–38 weeks	15	2	—	—	2
	39–40 weeks	19	1	—	—	1
	40–41 weeks	12	1	—	—	1
	43–44 weeks	7	1	—	—	1
Subtotal perinate		**99**	**5**	—	—	**5**
Infant	Undetermined	21	—	—	—	—
	1–3 months	11	1	—	—	1
	3–4 months	17	2	—	—	2
	1.3–1.6 years	16	1	—	—	1
	1.5–2 years	14	1	—	—	1
	2–2.5 years	25	1	—	—	1
Subtotal infant		**104**	**6**	—	—	**6**
Child	5–6 years	5	1	—	—	1
	6–9 years	15	1	—	—	1
	10–12 years	66	1	—	—	1
Subtotal child		**86**	**3**	—	—	**3**
Adolescent	12–14 years	32	2	—	—	2
	14–16 years	16	2	—	1	1
	17–19 years	52	5	2	2	1
Subtotal adolescent		**100**	**9**	**2**	**3**	**4**
Subadult	Undetermined	**30**	—	—	—	—
Subtotal subadult		**419**	**23**	**2**	**3**	**18**
Adult	Undetermined	3007	3	—	—	3
	20–30 years	24	18	4	8	6
	25–35 years	29	13	4	6	3
	30–40 years	27	10	5	5	—
	35–45 years	19	9	4	5	—
	40–50 years	1	1	1	—	—
Subtotal adult		**3107**	**54**	**18**	**24**	**12**
Total		**3526**	**77**	**20**	**27**	**30**

MNE, minimum number of elements; MNI, minimum number of individuals; F, female; M, male.
Values in bold emphasis indicate the subtotals by age category and the final total for the site.

Table 3. Comparison of age categories at the Paso Alsina 1 site (p-values for the χ^2 statistic test)

Age category	Perinate	Infant	Child	Adolescent	Young adult	Middle adult
Perinate	—					
Infant	0.754	—				
Child	0.467	0.302	—			
Adolescent	0.26	0.414	0.071	—		
Young adult	>0.001*	>0.001*	>0.001*	>0.001*	—	
Middle adult	0.001*	0.002*	0.0001*	0.023*	0.059	—

*$p \geq 0.05$.

(Table 2). In the adult category, 3107 bone elements were recovered, of which only 100 could be assigned to an estimated age of death (3.2%). Fifty-four individuals of both sexes were identified (Table 2).

Regarding sex, results indicate similar frequencies among female (25.97%; 20/77) and male (35.07%; 27/77), which are indistinguishable in terms of statistics ($\chi^2 = 1.50$; $p = 0.22$). A higher percentage is in the undetermined category (38.96%; 30/77) as a result of a moderate amount of subadult individuals. With regard to the age of death, there is a clear predominance of adult (70.12%; 54/77) in relation to the subadult (29.88%; 23/77) individuals, which were statistically significant ($\chi^2 = 21.189$; $p > 0.001$). When comparing age categories between adult and subadult, also, statistical differences are observed (Table 3). Instead, these statistical differences are not recorded when comparing among subadult and adult age categories (Table 3).

The mortality profile obtained for the site shows a bimodal pattern (Figure 4). Figure 4 shows a peak in the representation of individuals younger than 5 years (14.3%; 11/77) and another one between the age interval of 20–34.9 years (40.2%; 31/77; Figure 4). Among the subadult age categories, the individuals between birth and the first 3 years of life (Table 2) are the most represented, with no individuals between 3 and 4.9 years. Then, the frequency decreases toward the 5–9.9 age interval (2.6%; 2/77), slightly rising again for the 10–14.9 (5.4%; 4/77) and 15–19.9 (7.8%; 6/77) age intervals. This mortality profile shows that ~30% (23/77) of the identified individuals did not reach adulthood. Regarding adults, between 20 and 49.9 years, the frequency of individuals rise up to 70% but with a higher percentage in the 20–34.9 age interval. In older ages, the number of individuals begins to decrease (35–49.9 age interval), and individuals older than 50 years were not recorded (Figure 4).

Discussion

In the bioarchaeological literature, it is common to find references indicating that the subadult skeletal remains are underrepresented in osteological assemblages because of taphonomic processes that significantly affect their preservation (see discussion in Lewis, 2006). In this case, a low frequency of subadult bone elements in the sample was observed (11.9%), although this represented a significant number of individuals (MNI = 23). Considering the recovery of small bones or bone portions with low bone mineral density (e.g. vertebral neural arch, thin bones such as cranial vault and ribs), with a good preservation state, and also considering that they belong

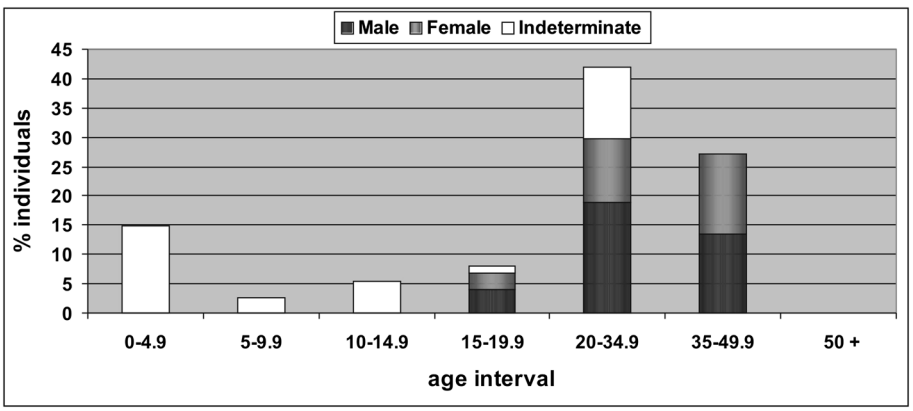

Figure 4. Mortality profile from the Paso Alsina 1 site.

to individuals of different ages (e.g. perinate and adolescent), it is possible to argue that postdepositional processes have played a slight role in the preservation of these elements at the site. The possibility that different taphonomic processes acting in the primary contexts of burials and affecting the integrity of anatomical units prior to their collection for making bundles is not excluded. However, the recovery of bones in these contexts was mediated by cultural choices, regardless of the state of preservation. In this sense, despite this strong body manipulation and transport of bones throughout the landscape, both sexes and all age ranges are represented. It is remarkable that there is homogeneity in the representation of skeletal parts, because bones in all age categories of the hand, foot, vertebrae, ribs, long bones and some of its unfused epiphysis are present (Flensborg, 2012). Taphonomic analyses at the site indicate that the mortuary context suffered postdepositional disturbance mainly induced by processes that operate *in situ*. The evidences that support this statement are the complete absence of carnivore action and the low frequency of bones affected by rodents (~3%), weathering (~0.5%) and chemical deterioration (~1%) (Flensborg, 2012; González, 2012). The presence of abundant root etching (~90%) on bone surfaces supports the idea of depositional stability (González, 2012).

A homogeneous mortuary treatment of individuals, regardless of sex and age categories, was observed at the Paso Alsina 1 site. As seen in Table 1, all funerary bundles are represented by a wide variety of individuals of different ages. The placement of anatomical units in each burial is similar, allowing the characterization of the pattern mentioned in the aforementioned section (see 'basic structure' in Section Study area and characteristics of the Paso Alsina 1 site). There were no grave goods and/or personal belongings in the burials that would lead to differentiate individuals by their social condition, status and so on (Martínez *et al.*, 2012). In short, there is no evidence to propose differences in the treatment of individuals (for a different case, see the characteristics of the Chenque I site; Luna, 2008 and references therein).

The aforementioned characteristics of the skeletal series, together with the high number of individuals recovered in a bounded spatial (~6 m^2) and temporal scale (at ca. 500 years BP) from the Paso Alsina 1 site, offer appropriate conditions to build a mortality profile. Figure 4 shows the age of death distribution in a U-shaped line, which is typical of an attritional profile. It is generally argued that the mortality profiles that characterize hunter-gatherer groups show a very high infant mortality between birth and 5 years, with an increment during the first year of life. Afterwards, an abrupt decrease in mortality is observed until the beginning of adolescence, when it increases again during early adulthood. It is usual that the mortality during subadult stage reaches 40% (Johnston & Snow, 1961; Angel, 1969; Lovejoy *et al.*, 1977; Owsley & Bass, 1979; Ubelaker, 1982; Mensforth, 1990). The mortality profile described in the former section coincides, in general terms, with this model. In the analysed skeletal series, the subadult category represents 30%, thus being within the expected parameters in this type of profile. This result shows that almost one third of the skeletal series did not reach adulthood. If individuals are distinguished by age categories, the highest percentage of deaths occurred during 0–3 years (Table 2), suggesting that individuals would have been suffering some kind of stress, possibly related to metabolic–nutritional disorders (Flensborg, 2012; see below).

Adult individuals are the most represented in the mortality profile, which indicates that a high percentage of the population reached a reproductive age. The higher frequency was identified between 20 and 35 years, with a gradual decrease in subsequent age categories. This is similar to what is reported in other case studies for the Pampas and Patagonia, as well as worldwide (Johnston & Snow, 1961; Angel, 1969; Clake, 1977; Lovejoy *et al.*, 1977; Owsley & Bass, 1979; Mensforth, 1990; Luna, 2008; García Guráieb, 2010). The age category 20–35 years corresponds to life stages during which individuals fully develop active social roles in the group (e.g. activities of subsistence, confrontation and interpersonal violence), which puts them at a higher risk of suffering various types of long-term stress (Hill & Hurtado, 1996; Hurtado *et al.*, 2003). Older age ranges show lower frequencies of individuals, which may be partly influenced by a lower life expectancy in hunter-gatherer groups and/or the problems and biases of the available methods for age at death estimation (see comments and references in Chamberlain, 2006).

Paleopathological evidence suggests low frequencies of traumatic processes all in adults (~1.4%), most of them due to accidents and, to a lesser extent, interpersonal violence (Flensborg, 2012). Moreover, infectious processes were not recorded in the bone sample (Flensborg, 2012). The interrelation of these results with the characteristics of the mortality profile indicates that there is no evidence of catastrophic events due to epidemics affecting all age groups of the population or conflict scenarios expressed by interpersonal violence and/or wars. Indicators of metabolic and nutritional stress were observed at high frequencies at the level of individuals (~48%), homogeneously affecting both sexes. The presence of dental enamel hypoplasia (~20%), porotic hyperostosis (~48%) and cribra orbitalia (~21%)

suggests a series of stressful events during the early stages of the life of individuals that produced acquired anemia (Flensborg, 2012). Such stressful events could partly explain the death of some infants. However, systemic stress indicators were recorded in adults, thus arguing that they could overcome the different stress episodes that could have existed in the earlier stages of growth and development. Infanticide as an explanation is not feasible for the moment because there are a small number of individuals in this cohort, especially if we take into account the number of individuals identified during the first weeks of birth (6.5%, 5/77). In addition, there is no evidence of trauma that could be associated with these cultural practices. From the perspective of the osteological paradox (Wood *et al.*, 1992), the low frequency of pathological markers, especially infectious processes, could indicate that individuals would have died from severe diseases that left no traces in skeletal tissue. However, taking into account the mortality profile in which few infant individuals with no signs of stress are represented and that there were no high frequencies of pathological disorders, it can be argued that individuals could have overcome potential diseases, thus reaching adulthood (Flensborg, 2012).

Conclusion

Archaeological contexts of disarticulated and commingled skeletal human remains are difficult case studies to deal with. The study of the Paso Alsina 1 site led to a series of methodological decisions and adjustments that resulted in valuable and more confident data. Sex and age at death estimation based on multiple secondary burials generally offers a lower degree of reliability and accuracy compared with primary burials. Nevertheless, as shown in this paper, exploring and integrating different methodologies allowed improving age and sex determination. Overall, the methodological criteria adopted for the reconstruction of the MNI were appropriate to calculate a more reliable and conservative final number. Also, the interpretation of the mortality profile was performed in combination with paleopathological evidence available for the skeletal series. Results indicated that the mortality profile is an attritional one consisting of individuals who have died at different times and places and for varied reasons. Skeletal series such as the Paso Alsina 1 site are prone to be found in social contexts where there is a special treatment of death under specific social organizations. In this sense, the burial structure of the Paso Alsina 1 site was performed as part of a social process that operated at a regional level (Pampas and North Patagonia) during the Final Late Holocene. Higher demographic density, lower residential mobility, spatial circumscription, demographic packing and territorial behaviours, among others (see Introduction section), were accompanied by profound changes in funerary behaviours, including intense body manipulation and formal disposal areas or cemeteries. These contexts seem to be the adequate ones for conducting paleodemographical research. In this sense, the Paso Alsina 1 site offers one of the best case studies to address aspects related with paleodemography of prehistoric hunter-gatherer populations.

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