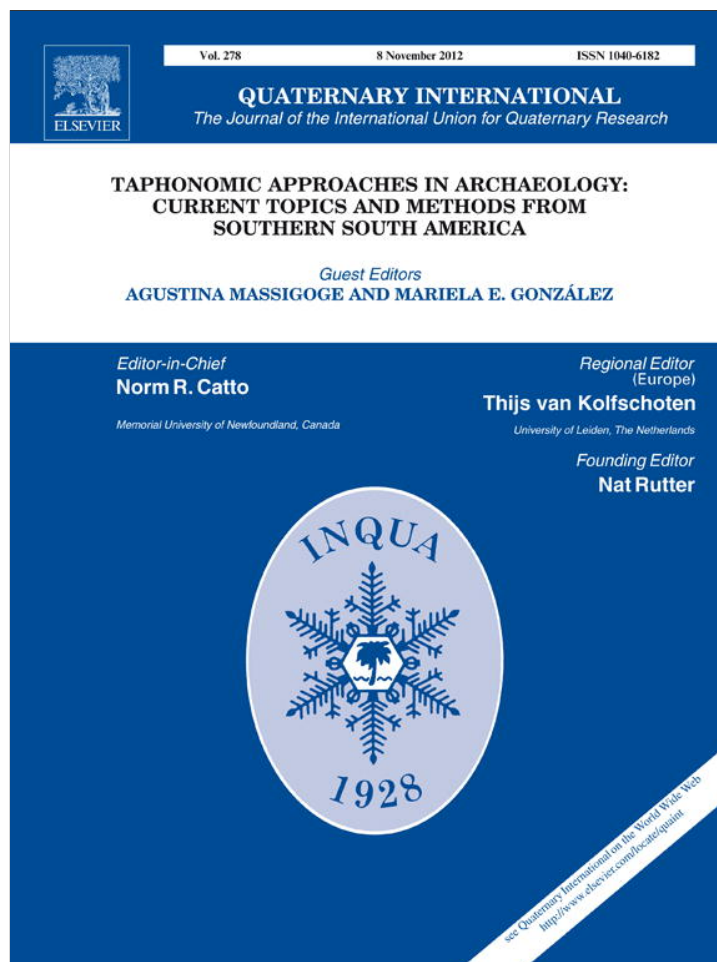


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Leather funerary packages: Mortuary practices and differential preservation in a Late Holocene prehispanic cemetery (Pampean region, Argentina)

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ABSTRACT

The ethnohistorical and archaeological bibliography on mortuary practices of the indigenous societies of Pampa and Patagonia refers extensively to the use of the envelope of bodies, for different purposes. One has been to facilitate the transport of the deceased until their final place of burial. This practice has been registered on the Chenque I site, a hunters- and-gatherers cemetery located in the Parque Nacional Lihué Calel, La Pampa, Argentina, used during the last part of late Holocene. It was applied both for primary as to secondary burials, being single and multiple. Some burials surrounded by a whitish doughy substance, where shell beads are imbricated, were recovered during the excavations carried out in various areas of the site.

The purpose of this paper is to communicate the results of the verification methods applied to the aforementioned substance to corroborate that it is the product of the taphonomic degradation of leather. These methods allowed an approach to the identification of the species employed, possibly Rheididae. Secondly, the state of preservation of enveloped burials was compared with others without it, in order to inquire whether this mortuary practice had an effective role in protecting the human remains.

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1. Introduction

The recovery and analysis of material evidence associated with human interments, as remnants of textiles, vegetable substances, leather and elements of decoration or funerary offerings is very important for archaeological interpretation of the circumstances that framed the events of burial. Identification and contextualization helps to draw the postmortem destination of the remains, including a possible transport or redeposition, thus contributing to better understanding of specific funerary rites.

However, the correct identification can be masked by the processes and agents that have operated during the period elapsed between burial and analysis time. That is why it is necessary to recognize these processes, especially differential degradation of assorted materials. Substances such as leather may be vulnerable to the processes of decomposition of the soft tissues of the body, specific characteristics of the surrounding sediment and other taphonomic agents. Therefore, they would degrade at differential rates with respect to other materials such as metals or malacological ornaments, considering archaeological time scale and context of deposition (Janaway, 2002).

The ethnohistorical and archaeological references on mortuary practices of the indigenous societies of Pampa and Patagonia refers extensively to the use of wrapping the dead bodies for different purposes. One has been to facilitate the transport of the deceased towards their final place of burial (Moreno, 1879; Latcham, 1915; Outes, 1915; Vignati, 1930). The skin of some species of the local fauna, of great importance in the system of subsistence of populations of Pampa-Patagonia, such as guanaco (*Lama guanicoe*) and Rhea in its two subspecies (*Rhea americana* and *Pterocnemia pennata*), in its natural state or submitted to tanning processes, is the organic element with more chances of survival to taphonomic agents due to its composition and resistance.

It is common that this practice is associated with secondary burials, but in some cases it is also related to primary ones, as is the case in the Chenque I site, a cemetery of hunter-gatherers located in Parque Nacional Lihué Calel, La Pampa, Argentina. Fragments of leather painted with red ochre, as well as burials surrounded by a whitish doughy substance where malacological beads are imbricated, were recovered during the excavations carried out in various areas of the site. Also, the presence of a piece of leather painted in red ochre and with mussel shell beads joined with a cordage, forming a regular and sequential design has been recorded in the collections of the Ethnographic Museum "Juan B. Ambrosetti", Facultad de Filosofía y Letras, Universidad de Buenos Aires.

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This paper deals two purposes: the first is to describe the chemical analyses carried out to verify, from the taphonomic and cultural points of view, the evidence already existing in the presence of leather or animal skin as a material used for packaging, transport and burial of some individuals (Berón, 2004; Berón and Luna, 2007). The second is to guess whether the role of this material was intentionally considered, or eventually was favorable, for an eventual differential preservation of the bodies thus treated. This could be an additional advantage of the practice of bodies wrapping generally related to ritual practices and/or used for pragmatic purposes, to facilitate transport to their place of burial. Therefore the recovery and subsequent observation in the laboratory of the aforementioned substance generated a series of questions: ones related to the patterns of social behavior and particular mortuary practices; the others aimed to the identification of different processes and agents involved in the degradation and/or differential preservation along taphonomic lapse, both regarding the bioarchaeological remains, as much as the pasty substance that covered some of the burials.

2. Site Chenque I characterization

Chenque I site, is a prehispanic cemetery located in the Parque Nacional Lihué Calel, in the western Pampean region ($38^{\circ}00'S$,

$65^{\circ}38'W$, Fig. 1A). The area comprises a group of hills that emerge amid the Pampean plain, a geomorphological and biological island. The geomorphology of Lihué Calel enables the establishment of a more favorable and moist microclimate than the semiarid adjacent areas. The mountain relief helps to retain water from the scarce rainfall and moderate summer temperatures, leading to the existence of numerous waterholes, some standing permanently in the area. This makes possible the existence of a varied flora and fauna. The surrounding area has a semiarid climate, with limited resources. Hunter–gatherer societies made use of this site for mortuary purposes during the end of the Late Holocene, between 1050 and 290 BP (Berón et al., 2007). More than 200 individuals (children and adults of different ages and gender) were recovered in the excavated area (49 m^2 , about 23% of the total area, Fig. 2). Several hundred bodies have been buried in the total area. It is superficially marked with the alignment of rocks in a subcircular structure of 210 square meters area (Fig. 1B). Two stratigraphic units were defined, having very different properties. The Superior Unit (0–30 cm depth) contains thousands of bony and dental remains with different degrees of fragmentation, comminglement, arrangement and anatomic association, due to a systematic reuse of the site. In the Inferior Unit (below 30 cm), 43 burial structures were detected, many of them in association with stone arrangements over, under and/or around the body. The Inferior Unit is

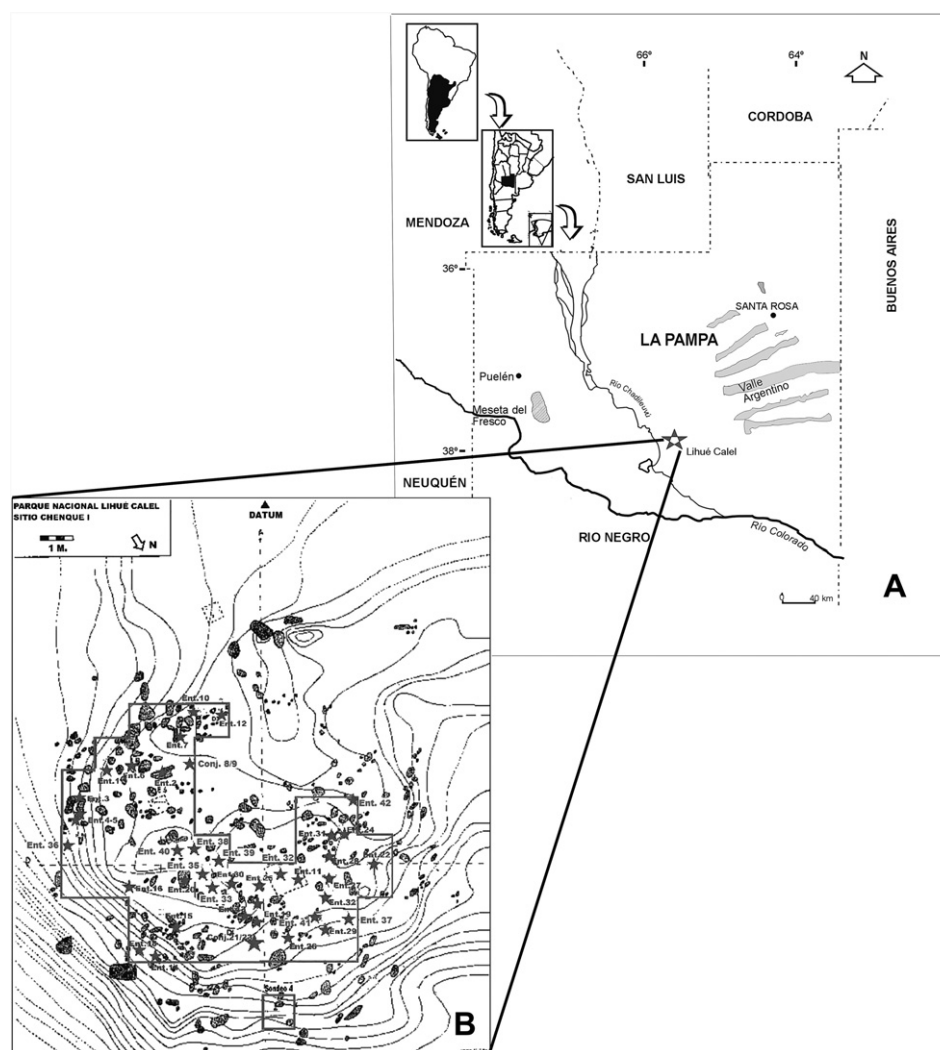


Fig. 1. A – Location of site Chenque I, La Pampa province, Argentina. B – Hypsometric plane with general location of burials.

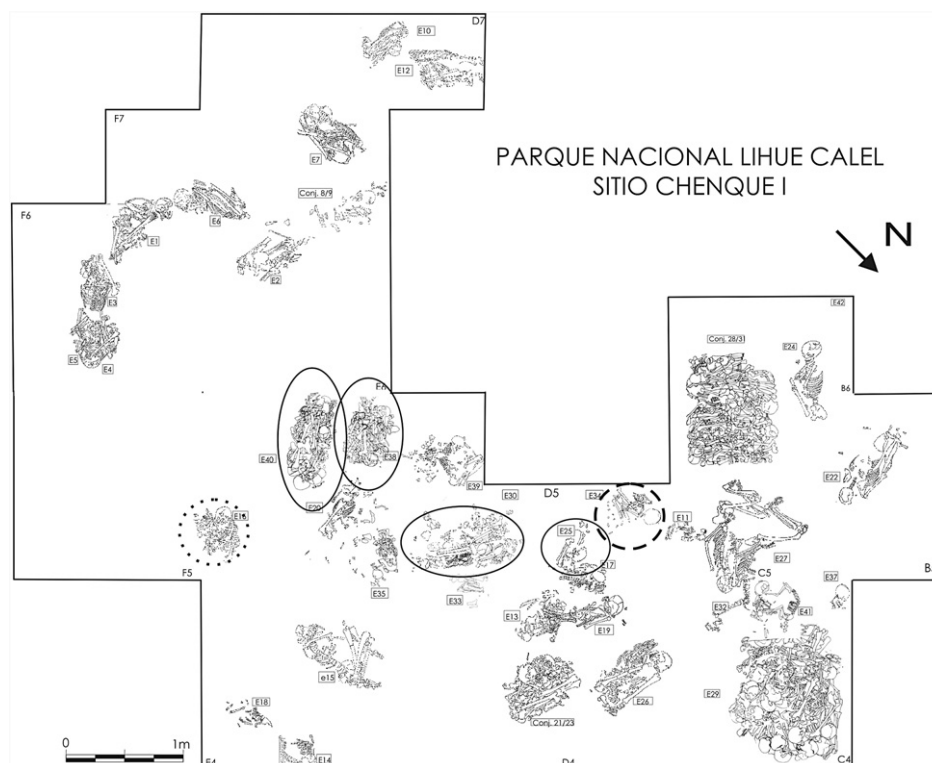


Fig. 2. Spatial location of burials with the pasty substance. Burial 34: primary simple burial 25, (circulated with short lines): simple available; Burial 30: secondary multiple; Burial 38: supporting multiple and burial 40: secondary multiple (circulated with full line); Burial 16 (circulated with dotted line).

divided in two sections, named top and base. The Base Inferior Unit (BIU) corresponds to a pattern of deeper burials for whose interment it was necessary to practice digging structures in the limestone matrix and to add loessic sediments after the final internment of the bodies. The other pattern of burials, which corresponds to the Top Inferior Unit, is represented by burials deposited in the sedimentary matrix, considerably above the basement. This produced a differential preservation of individuals buried in the BIU, as the carbonated matrix in which they were deposited minimized taphonomic deterioration factors (Berón and Luna, 2007; Berón et al., in press a).

A great variability of inhumation modalities was recorded: primary, secondary, simple, multiple burials as well as a variant not previously registered in Argentina, called disposition. It is the situation in which anatomical structure of the body is *postmortem* altered by human agents, close to time of death, and with a clearly intentional order. It occurs previous to the skeletization process, with soft tissues still present. Different skeletal parts of the body (skull, trunk, different parts of the appendicular skeleton) were disarticulated and re-ordered forming a funerary package, with definite limits (Fig. 3C and D). This modality may be considered a variant of secondary burials (Berón and Luna, 2007). Secondary burial in South America shows more variability than the original definition of this modality established, both in its formal characterization as well in the span time of its practice (Scabuzzo and Politis, 2010). Recent synthesis on secondary burials in the Pampean region demonstrates that this practice was present from the early Holocene to the Late Holocene, beyond situations that motivated it. So this mode of burial was practiced in the Pampean region from 7600 BP until final Late Holocene, time at which there has been a significant increase in secondary burials (Scabuzzo and Politis, 2010). This practice has been recorded in many sites of the Pampean and Patagonian regions: Arroyo Seco 2 (Scabuzzo and

Politis, 2010), El Guanaco (Mazzia et al., 2004), Túmulo de Malacara (Vignati, 1960; Politis et al., 2010), Los Chilenos (Barrientos et al., 2002), Campo Brochetto (Barrientos et al., 1997), La Petrona (Martínez and Figuerero Torres, 2000), Paso Alsina 1 (Martínez et al., 2007), Napostá (Barrientos, 1997), Paso Mayor 1-2 (Bayón et al., 2010) and Chenque I (Berón and Luna, 2007) and in different parts of South America, from early chronologies (Scabuzzo and Politis, 2010). In Chenque I, the practice of secondary burials and its variant, “disposition” is related to the transportation of corpses from different distances, during final Late Holocene, as this cemetery was a place of reference for final destiny of ancestors, as we have proposed previously, in a context of strong interrelated populations in a wide spatial region (Berón, 2003, 2004).

In Chenque I site, females and males of all ages were buried and beside their bodies there were also found offerings as beads of necklaces or other kind of ornaments, made of different raw materials, prehispanic metallic ornaments as a copper earring and a silver brooch (usually called *tupu* in *mapundungun* language), mollusks and rock tools. Post-hispanic elements were not found, providing a complementary criterion for the temporal position of the assemblage. Furthermore, in some of the skeletons there were found embedded projectile points that in several cases were the cause of death of the individual (Berón, 2010a, in press). Moreover, multiple inhumations, cases of cremation of bones, and ochre application, were identified.

To date, 25 radiocarbon dates and 70 isotopic values of $\delta^{13}\text{C}_{\text{COL}}$, $\delta^{15}\text{N}$, $\delta^{13}\text{C}_{\text{AP}}$ and $\delta^{18}\text{O}_{\text{AP}}$ have been obtained, from which have been assessed time trends regarding mortuary patterns, paleodiet and geographical origin from the individuals (Berón et al., 2007, 2009, in press b). It is possible to distinguish two periods of use of the cemetery. The first extends between 1050 and 700 BP. The second intensive range goes from 435 to 290 BP. A gap in use between 700

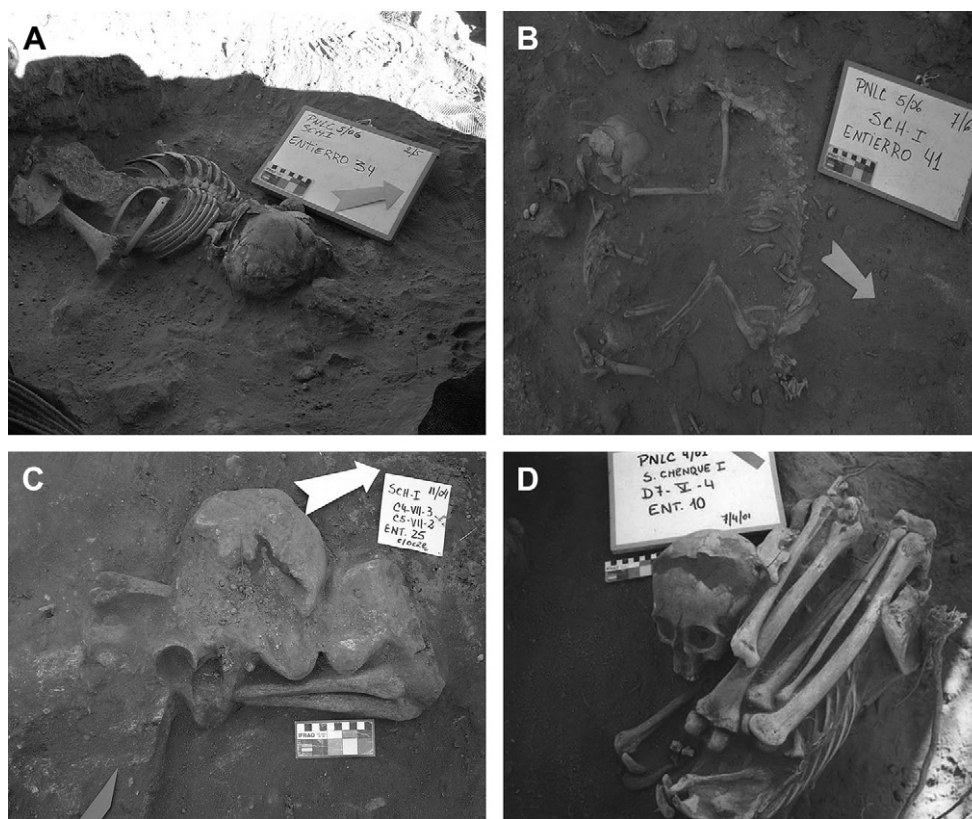


Fig. 3. Burial modalities analysed: A and B, Primary subadult burials, n° 34 and 41 respectively. C and D, secondary type – disposition – burials, n° 25 and n° 10 respectively. Comparison of burial preservation.

and 400 BP was identified, that coincides with a period of intensification of aridity, and that could be correlated with an abandonment of the territory by the people who used this cemetery, perhaps moving to other areas. In neighboring areas but on the margins of permanent water resources were located during this period other burial structures such as Paso Alsina 1 and La Petrona, near the Colorado River and Laguna de Los Chilenos 1, which partially cover the gap chronologies recorded in Chenque I (500–450 BP, 770–250 BP and 476 ± 80 BP respectively) (Barrientos et al., 1997; Martínez et al., 2006; Flensburg et al., 2011). During the last period of use of the cemetery, between 435 and 290 BP, the group of burials that focus on this chronological period shows particularities that are worth mentioning. All burial structures of this period are multiple. Three (Burials 21/23, 27 and 29) show abundant signs of violence, as projectile points inserted in bones or tissues which, in most cases, were the cause of death of individuals (Berón and Bossio, 2008).

Given that the societies that generated this cemetery had a hunter-gatherer organization and an elevated logistic mobility, this provides an impressive case in terms of the redundancy of use of this place for mortuary activities (Berón et al., 2002, 2007; Berón, 2004; Berón and Luna, 2007; Luna, 2008). All around the cemetery there are habitation sites, most of them identified as superficial ones, without chronology data. The best known base camp is Tapera Moreira, a multicomponent site used from Middle to Late Holocene, about 100 km south of Chenque I ($38^{\circ}33'S$, $65^{\circ}33'W$). The third component is dated about the same span time as this cemetery (Berón, 2004). Considering the several kinds of bio-archaeological evidences and the great amount of information obtained, Chenque I site is probably one of the most important hunter-gatherer mortuary sites in South America.

3. Packaging and transport of bodies: ethnohistorical references

The variability of methods of burial recorded in the research area would be responding to differences of space–time between the moment of death and the time of burial of individuals (Baffi and Berón, 2001; Berón, 2004). Therefore it is expected that the greater the distance from the cemetery at the time of death, more complex becomes the mode of burial.

The practice of burial procedures that alter the anatomical structure of the body (secondary and disposition), implying a complex treatment of the bodies, with a consequent investment of time, technology and effort as well as a delay between the time of the death and the final fate of the individual, would be related to the group membership of the individual, according to some authors (Goldstein, 1995; Berón and Luna, 2007). However, others suggest that its implementation may be due to circumstantial factors as for example that death occurred in a place away from the cemetery, as well as representing an increase in the levels of social complexity (Carr, 1995). This requires strategies that facilitate the transfer of the bodies to the cemetery of reference, such as packages and mummies. It has also been raised that this cemetery would have acted, in a macroregional scale, as a referential place towards which the dead and their relatives moved from different backgrounds and varying distances (Berón, 2004; Berón et al., 2007, 2009; Berón, 2010a). This was observed by Latcham between the Mapuche: “La tierra de los muertos varía entre los araucanos según la localidad que habitan. Para las tribus sub-andinas está ubicada allende la cordillera; pero para las tribus costinas es al otro lado del océano.” “The land of the dead varies between the Mapuche according to the village they inhabit. For sub-andean tribes it is located beyond the

Andean mountain range; but for tribes of the coast it is on the other side of the ocean" (translation by the author, [Latcham, 1915: 20](#)).

The ethnohistorical literature abounds in references to such practices, loaded both from a functional sense (convenience of transport), as ritual (preparation of the package, manufacture of ornaments, ochre employ). In this sense [Latcham \(1915\)](#) compiled various references in different places in Chile, with regard to the existence of cemeteries used recurrently, over centuries, as it is the case of the Chenque I site: "Entre muchas tribus era costumbre tener cementerios fijos, donde sepultaban sus muertos, generación tras generación. Parece que cada familia tenía sepulturas especiales en estos cementerios, donde enterraban los muertos uno tras otro, hasta que el hacinamiento de restos era tan grande que la tierra se llenaba de huesos y éstos quedaban esparcidos al contorno con cada nuevo entierro. A causa de esto el estudio sistemático del contenido de las sepulturas se hace muy dificultoso, porque los restos humanos y los objetos enterrados con ellos, pertenecientes a una época, se revolían con los de las siguientes, sin que se pueda distinguir los unos de los otros.". "Among many tribes it was customary to have fixed cemeteries, where buried their dead, generation after generation. It seems that every family had special graves in these cemeteries, where the dead were buried one after another, until that overcrowding of remains was so large that the ground was full of bones and they were scattered to the boundary with each new burial. Because of this the systematic study of the contents of the graves is very difficult, because human remains and objects buried with them, belonging to a time were commingled with the ones of the following, being impossible to distinguish ones from the others" (translation by the author, [Latcham, 1915: 147](#)).

He also refers to the transportation of the deceased through long distances in pampas and Patagonia: "Cada vez que se cambiaba el lugar de sepultura de los restos, se solía mudar completamente los vestidos y envoltorios de los muertos y generalmente se hacía gran acopio de pieles, ponchos, etc., en anticipación de estas grandes fiestas. Encontramos una costumbre parecida entre las antiguas tribus de las pampas argentinas y de la Patagonia. Todos los años llevaban los despojos de sus difuntos a los sepulcros ancestrales, situados casi siempre en el litoral; y a veces tenían que emprender largos viajes con este propósito". "Every time they changed the place of burial of the remains, they used to move completely dresses and wrapping of the dead and generally made large collection of skins, ponchos, etc., in anticipation of these great feasts. We find a similar custom among ancient tribes of the Argentine pampas and Patagonia. Every year the spoils of their deceased were carried the ancestral tombs, almost always located on the coast; and sometimes they had to undertake long journeys for this purpose" (translation by the author, [Latcham, 1915: 164](#)).

There are also references to mortuary modalities, the treatment of the bodies and the preparation of packages: "La manera de formar el atado mortuorio variaba de una parte a otra. Esto dependía en parte del modo de colocar el cadáver, y en parte a otros factores. Muchas tribus exponían o sepultaban sus difuntos en posición tendida, otras adoptaban la postura sentada o encogida y a veces descoyuntaban o quebraban los huesos del muerto para darle la forma de ovillo que consideraban conveniente. En los entierros secundarios de los huesos, también prevalecían diferentes métodos. A veces se esmeraba en dar a cada hueso su ubicación correspondiente, ligándolos con tiritas de cuero en el caso de haberse desprendido de los cartílagos; en otras ocasiones formaban un atado sin orden ninguno, solo preocupándose de que estuvieran entera la osamenta". "The way of forming the mortuary wrap varied from one part to another. This depended in part on how to place the corpse, and partly due to other factors. Many tribes exposed or buried their dead in lying position, others took the sitting posture or shrunken and sometimes broke or disjoint the bones of the dead to shape it like a ball that they

considered appropriate. In secondary burials of the bones, different methods prevailed. Sometimes it worried to give each bone its corresponding location, linking them with strips of leather in the case of being freed from the cartilage; at other times they formed a bundle without any order, just worrying that the skeletons were whole" (translation by the author, [Latcham, 1915: 165](#)).

"Con el tiempo el temor a las ánimas desterró estos sentimientos hospitalarios y aún cuando guardábanse toda clase de consideraciones y respeto a las supuestas necesidades del difunto, sin embargo, se tomaban todas las precauciones posibles para asegurar su permanencia en la sepultura, o por lo menor para impedir que su alma volviera a la tierra de los vivos. Con este objeto inventaron varios métodos de asegurar el cadáver. A veces lo amarraban fuertemente con sogas, o bien lo envolvían en muchas fajas o mantas y aun lo cosían dentro de bolsas de cuero. Hacían sepulturas hondas, las que cubrían con montones de tierra o de piedras; (...)". "Over time, the fear of the spirits banished these kind feelings and even when they maintained every consideration and respect to the supposed needs of the deceased, however, took all possible precautions to ensure their stay in the grave, or at least to prevent his soul back to the land of the living." To this end they invented several methods of securing the corpse. Sometimes it was strongly tied with ropes, or wrap it in many bands or blankets and even sewn it in leather bags. They dug deep graves that were covered with piles of earth or stones; (...): (translation by the author, [Latcham, 1915: 103](#)).

In reference to the mapuche people [Guevara in 1925](#) wrote: "Con anterioridad a la conquista española, los cadáveres no recibían propiamente sepultura sino que eran colocados sobre el suelo i cubiertos de tierra i piedras hasta formar una especie de túmulo. Envolvíanlos en cuero o corteza de árboles. A esta costumbre sucedió la de sepultar los muertos en hoyos muy superficiales, sobre los cuales se agregaba el montículo". "Before the spanish conquest, the bodies were not actually buried but were placed on the ground and covered with earth and rocks until a kind of mound was formed. The dead were wrapped in leather or tree bark. This custom was followed by that of burying the dead in very shallow graves, over which a mound was built" (translation by the author, [Guevara, 1925: 47–48](#), cited in [Dillehay, 2007: 149](#)).

[Latcham](#) also refers to the custom of giving the dead a secondary burial, which implied a complex treatment of the body: "Cuando muere un indio, una de las mujeres más distinguida es elegida para convertir el cuerpo en esqueleto. Esto se hace, abriendo el cuerpo y sacando las entrañas, que se queman. En seguida se quita la carne de los huesos, los cuales se dejan tan limpios como es posible. Después son sepultados hasta que los restos de carne se pudren completamente, o hasta que son removidos a las sepulturas de sus antepasados (lo debe hacerse dentro del año; pero que a veces no demora ni dos meses).

Esta costumbre se observa estrictamente entre los moluches (araucanos argentinos), los taluhets y diuihets (indios pampas); pero los cbechehets (puelches) y los tehuelhets (tehuelches) o patagones colocan en alto los huesos, sobre cañas o ramadas, para secarse y emblanquecerse al sol o intemperie". "When an indian dies, one of the most distinguished women is chosen to make the body turn to a skeleton. This is done by opening the body and removing the entrails, which are burn. Then the meat from the bones is removed, leaving them as clean as possible. They are then buried until the remains of meat are completely rotten, or until they are removed to the graves of their ancestors (which must be made within the year, but sometimes there is not even two months of delay).

This custom is strictly observed among moluches (Argentine araucanians), the taluhets and diuihets (Pampas), but the chechehets (puelches) and tehuelhets (Tehuelches) or patagones placed the bones high on poles or ramadas, to be removed and whiten in the sun or weather" (translation by the author, [Latcham, 1915: 144](#)).

This custom continued in the region yet in equestrian times: “Cuando remueven los restos de los difuntos, los empaquetan en un cuero, y los colocan en uno de los caballos favoritos del fallecido, que han guardado para este propósito y que adornan de la mejor manera posible con mantas, plumas, etc., y viajan de este modo, aunque sea una distancia de trescientas leguas; hasta que llegan a su propio cementerio donde offician la última ceremonia”. “When they remove the remains of the dead, package them in a leather, and place them in one of the favorite horses of the deceased, which have kept for this purpose and which adorn in the best way possible with blankets, feathers, etc., and travel in this way, even if it is a distance of three hundred leagues; until they come to their own cemetery where to officiate the final ceremony.” (translation by the author, [Latcham, 1915:145](#)).

More specifically, for the case dealt within this work, Moreno pointed out the following find in Santa Cruz province: “Tengo la felicidad de extraer en el fondo de la cueva un cuerpo humano, bastante bien conservado, que fue inhumado envuelto en cuero de avestruz y cubierto luego con pasto y tierra sobre la cual recojo dos cuchillos de piedra y una punta de flecha de la misma materia. El cuerpo está pintado de rojo. La pierna derecha ha sido replegada sobre el cuerpo de una manera tan forzada que poco ha faltado para que la cabeza del fémur abandonara la cavidad cotilóidea. Entre este brazo y el cuerpo encuentro cruzada una bella pluma negra de cóndor. El plumoso sudario con el que ha sido envuelto y del cual solo quedan restos, también ha sido pintado de rojo. Junto con los cuchillos recojo huesos de guanaco, tallados; son los alimentos con que los vivientes han querido alimentar al muerto”. “I have the happiness to extract from the bottom of the cave a human body, quite well preserved, that was buried wrapped in ostrich leather and covered with grass and earth on which I pick up two stone knives and a tip of arrow of the same material. The body is painted in red. The right leg has been wrapped on the body in such a forced manner so that it has little failed for the head of the femur to abandon the acetabulum. Between this arm and the body, I find crossed a beautiful

black condor feather. The feathery shroud in which the body has been wrapped and of which there are only remnants, has also been painted in red. Together with the knives I pick up bones of guanaco, carved; they are the foods with which the livings have wanted feed the dead” (translation by the author, [Moreno, 1879: 369–370](#)).

All these references agree to refer to the importance of the final burial of the ancestors and the significant investment of energy in its sacredness.

4. Archaeological correlates

Chemical and taphonomic analysis were prompted by the presence in several burials, both primary modality – burial 34- as secondary or disposition ones – burials 25, 30, 38, 40, of traces of a possible wrapping, consisting of a whitish pasty substance, unidentifiable at first glance, because of its state of degradation ([Fig. 4 A](#), burial 34; [4 B](#), burial 38, [4 C](#), burial 40, [4 D](#), burial 30). These cases were found in a striking contiguity spatial location ([Fig. 2](#)). The examination of the aforementioned pasty and whitish substance, found in some cases with shell beads imbricated among it, generated a series of questions, some aimed to identify patterns of social behavior and mortuary practices, and others focused on the processes of degradation/preservation suffered by both, the whole human bioarchaeological assemblage, and the material that covered some of them.

A relevant evidence is the finding in the Chenque I site of fragments of leather painted in red ochre and of sets of abundant shell beads reddish painted ([Fig. 5](#), left). It was previously proposed that in some cases, especially those in which burial structure presents quite defined boundaries and an ordering of bones of the type called disposition, it is possible that bodies were contained in leather wrapper painted with ochre and eventually ornate with valve beads, (burials 1, 3, 7, 10, and 16, [Berón, 2004](#)). It is likely that red ochre present in some of the bones, skulls and ornaments be the result of the transfer of this substance from the wrapper to the skeletal

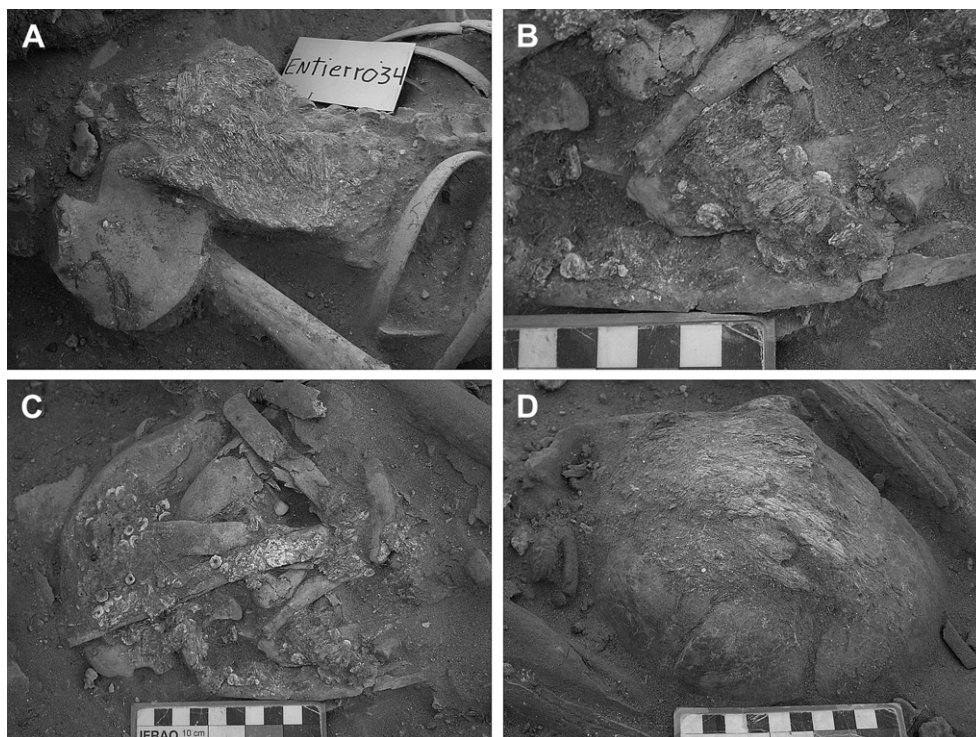


Fig. 4. Burials with pasty and whitish substance on bones: A – Burial 34, B – Burial 38, C – Burial 40, D – Burial 30.

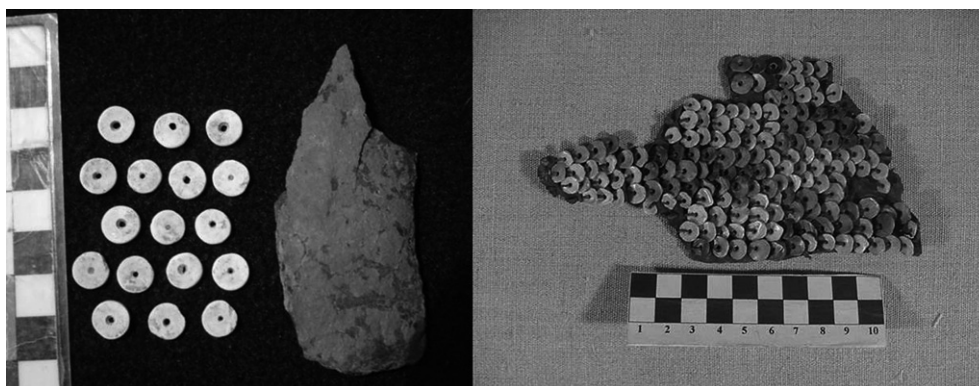


Fig. 5. Left: fragments of leather covered with red ochre and symmetric shell beads, also painted with red ochre, recovered in Chenque I site. Right: fragment of leather painted with red ochre and shell beads sewed on it, recovered in Chubut province and published by Vignati (1930). Photographs taken by M. Berón.

elements, once produced the skeletonization of the body. So it was suggested that these painted leather fragments were remnants of the wrapper which formed the funeral packages used to facilitate the transportation of the bodies so treated. Other indicators lead to reaffirm this possibility. Burial 16 consists of 5 overlapping subadults and a male adult placed laterally, in disposition modality. The more superficial skull of a subadult was covered with abundant ochre. On the other hand, at the base of burial was detected a layer of beads made up of shell that extends over the entire surface occupied by the funeral package and part of the sides. The total of beads recovered in association with this burial is 245, most of which have equal morphology, size and presence of ochre in one of their faces. It is possible that these beads were sewn to leather, which in turn was stained with red ochre. This process would, have caused the staining of both the skull of the subadult and the beads (Fig. 2, burial circled with points, Berón, 2004: 369–370).

The reference of Vignati (1930) is of particular interest, who documented the discovery of a tchenque in the province of Chubut, to the north of the Gulf of San Jorge and Lake Colhué Huapi (ca. 800 km south of Chenque I site). The buried individual was carrying a “especie de túnica de cuero con aplicaciones de pequeños discos de valvas de moluscos” “a kind of tunic of leather with applications of small discs of mollusk valves” of which only some fragments survived (translation by the authors, Vignati, 1930:11). Leather “no fue previamente curtido, pero fue pintado de color rojo granate mediante una capa de ocre, que ha quedado adherida, bien por la propia grasitud del cuero, bien por la acción de algún mordiente orgánico. Sobre el cuero se han cosido, a modo de lentejuelas, los pequeños discos de nácar de valva de molusco, mostrando la cara interna” “was not previously tanned, but was painted in red garnet with a layer of ochre, which has fixed, either by the own leather fatty, or by the action of some organic mordant. On the leather, small discs of nacre from mollusk shell were sewn, by way of sequins, showing the inside face” (translation by the author, Fig. 5 right, Vignati, 1930: 13–14, Museo Etnográfico, inventory n° 37.721).

5. Skin and leather processing

The animal skin is made up of labile organic substances easily attacked by microorganisms, environmental and climatic factors. Collagen is the main component of skin, in types I and III. Each one of its fibers is an aggregation of several fibrils aligned parallel to each other. These fibrils are in turn composed of molecules with triple helical morphology formed by polypeptide chains rich in hydroxyproline and glycine. A cross section of the dermis observed at the electron microscope reveals that collagen fibrils have a characteristic cross pattern, which differs in each species. This cross gives strength

and stress to the fibers (Alberts et al., 2002). In addition to collagen, it is composed of elastin, a protein that forms an elastic network that gives not strength but flexibility. One of its main components is also hydroxyproline, an amino acid that plays a key role in the structure of the triple helix of type I collagen of the skin (Alberts et al., 2002).

Tanning is the process by which the skin is converted into leather. The difference between skin and leather is the greatest resistance presented by the latter and hydrothermal stability (Thomson, 2006). The tanning process, in its different methods and variations, stabilizes the leather substrate in order that the action of bacteria is inhibited. There are many ways to perform this process, from the most ancient – like the traditional manual operating method of tanning oil as an active ingredient that harnesses the natural fat left on the skin – through vegetable substances based on tannin, extracted from species such as quebracho (*Schinopsis* sp.), *acacia* and *mimosa*, among others, to the most modern and refined, based on minerals as chrome, aluminum and titanium. Ancestral processes are still in use today.

The use of Sodium Chloride (NaCl) – either spread on the surface or in the form of brine where the skin is immersed – or the application of ash is a resource to keep skin in good condition to proceed to the tanning of it. Field observations carried out by the staff of the CITEC (Centro de Investigación y Desarrollo del Cuero, INTI –Instituto Nacional de Tecnología Industrial) and the CIC (Comité de Investigación Científica de la provincia de Buenos Aires) in regions such as the Argentine northwest, found the use of a layer of ash as an inhibitor of all types of bacteria, especially halophytes (*Salinari Pseudomonas*, *Micrococcus* sp, among others), which resist high salinity conditions contributing to the degradation of organic matter preserved by salty improperly. The ash, strongly alkaline, prevents bacterial growth. On the other hand, when salt (NaCl) is also used, the halophytic bacteria can contaminate the skin, degrading and blocking to get good quality leather. An actualistic research is being carried out from several months ago in the CITEC, on cattle leather, in order to prove the efficiency of this process.

6. Materials and methods

On the basis of these materials and the set of references, ideas and background aforementioned were carried out the analysis and the search for references about the characteristics of faunal animal leather and skin and their possible transformations. Regarding the first goal, to determine if the pasty element is degraded leather or not, the appropriate chemical analyses were carried out at the start, which allowed the identification of the substance from samples correspondent to burials 25 and 34. These analyses were carried out in the CITEC by an interdisciplinary team.

Every step of the processes developed is described below. The purpose of the analysis is focused on the effective detection of statistically significant levels of hydroxyproline, an aminoacid component of skin collagen type I, at a rate estimated between 10 and 13% of bovine witness. The hydroxyproline is very rarely found in other proteins, so it is used to identify the effective presence of collagen in a sample, or to determine the collagen content of the same (Haines, 2006). Step 1: the sample was submitted to digestion in an acid medium at a temperature of 100 °C for a period of 24 h to ensure hydrolysis of the material.

Step 2: following test protocols, aliquots were taken from the supernatant liquid, which was filtered and then lyophilized to concentrate its components. Then, after several experiments, it was decided to work directly on the powder to be submitted to the action of specific reagents. The latter process leads to recognition of evidence of hydroxyproline in the form of traces.

Regarding the second objective, to analyze the possible differential preservation of burials, four cases were evaluated and compared, two with signals of possible leather envelope, burials 34 and 25 (Fig. 3A and C) and the others without it, burial 41 and 10 (Fig. 3B and D). The purpose of this taphonomic approach was to inquire whether this mortuary practice had an effective role in the preservation of bones. Burial 34 is primary, simple; the individual is a subadult, female, 10–14 years old. It was compared with burial 41, also primary, simple, the individual is a subadult, male, 2–3 years old, buried close to a specimen of *Canis familiaris* (Berón, 2010b). The other two compared cases are dispositions: burials 10, simple disposition, female individual, 30–39 years old and burial 25, simple disposition, female individual, 27–30 years old. Each pair in comparison share similar characteristics in terms of age range, radiocarbon age and depth of burial but differ respect to the presence of pasty substance (Tables 1 and 2). Forensic and medico-legal investigations have shown that some form of garments or wraps slow physical degradation processes, and constitute a barrier against the action of some predators (Haglund and Sorg, 1997; Roksandik, 2002).

It was analyzed the degree of skeletal completeness of each individual, following the standards proposed by Buikstra and Ubelaker (1994): Grade 1 (0–25%), Grade 2 (25–50%), Grade 3 (50–75%), Grade 4 (75–100%). With regard to the degree of general preservation of each skeletal element, its structural integrity, observed macroscopically, was taken as reference, and it was separated into three levels: good to very good, when the integrity of the bone macrostructure has been preserved without alteration; regular, when partial loss of cortical and trabecular tissue was recorded, but with little change in its structure; and bad, when this loss is significant and compromises the integrity of the bone, even turning difficult its identification.

7. Results

7.1. Animal skin structure

As regards to the first objective of this work, the process of chemical analysis detailed above, showed traces of hydroxyproline

Table 1
Primary burial. Compared variables.

Burial N°.	34	41
Modality	Simple primary	Simple primary
Age group	Subadult	Subadult
Radiocarbon age	1050 ± 30 BP	930 ± 30 BP
Completeness degree	4	4
Integrity and preservation	Good	Good to very good
Depth of burial	2.70 m	2.71 m
Whitish substance	Present	Absent

Table 2
Secondary/dispositions burials. Compared variables.

Burial N°.	25	10
Modality	Simple secondary	Simple secondary (disposición)
Age group	Adult	Adult
Radiocarbon age	435 ± 40 BP	790 ± 25 BP
Completeness degree	3	4
Integrity and preservation	Regular	Regular
Depth of burial	2.03 m	2.05 m
Whitish substance	Present	Absent

which, although in a percentage less of 10%, could be considered statistically significant. This determined that the substance tested is compatible with skin animal, probably not submitted to a tanning process, but to a cursory preparation (salty, fatty or impregnation with mineral substances), without reaching the consistency of leather, which facilitated further degradation into the aforementioned pasty substance.

Observation of portions of the sample with better integrity in the microscope detected traces of parallel cross-linking of collagen fibers that could guide a preliminary diagnosis most likely to the species Rheidae than to guanaco or other mammal, which commonly show crossing angles. However, the analysis continued, with the application of more complex methods, in order to arrive to a definitive diagnosis.

7.2. Characteristics of Rheidae skin structure

The greater rhea or ñandú moro (*Rhea americana*) integrates, along with the lesser rhea or overo (*P. pennata*) form the Rheidae family. It is native to the South American continent and extends over a wide part of its territory (Argentina, Brazil, Chile, Bolivia, Paraguay and Uruguay). Integrated with ostrich (*Struthio camelus*), emu (*Dromaius novaehollandiae*), cassowary (*Casuaris Casuaris*) and kiwi (*Apteryx australis*), the group of flightless birds is called *Ratites* (C-394 TEEA Bariloche, INTA 2001). Histological examination of the structure of the skin of *Ratites* reveals that its surface consists of a thin epidermis, located between two or three cell layers covered with keratin, the *Stratum Corneum*. The dermis is composed primarily of collagen, in the form of a thin top layer and of an extensive corium (Menon and Menon, 2000; Lunam and Weir, 2006).

Fibers of collagen in the skin of the Rheidae lines, predominantly parallel to the surface, with few fibers which can occasionally be arranged perpendicular or tangential to the epidermis (Menon and Menon, 2000; Lunam and Weir, 2006). This structure, observed under the electron microscope, can be seen in Fig. 6 A (from Lunam and Weir, 2006: 29). This same pattern of fiber organization has been detected in the microscopic observation during the analysis carried out to archeological samples from burials 25 and 34, which could lead to the presumption that it would be skin remains of Rheidae, probably not tanned (Fig. 6B), what exposed to further degradation by taphonomic processes during the period of formation of the archaeological record. The skin of Rheidae has a poorer fibrous structure than that of mammals such as cattle or camels, and also a smaller thickness (1 mm vs. 2 mm in cattle). Therefore it has less resistance conditions and higher relative fragility.

7.3. Taphonomic factors that influence the degradation of the skin

The main factors acting on taphonomic degradation of the skin and leather are:

Humidity: In archaeological context both the untreated animal skins as much as tanned leather preserve its integrity in extreme

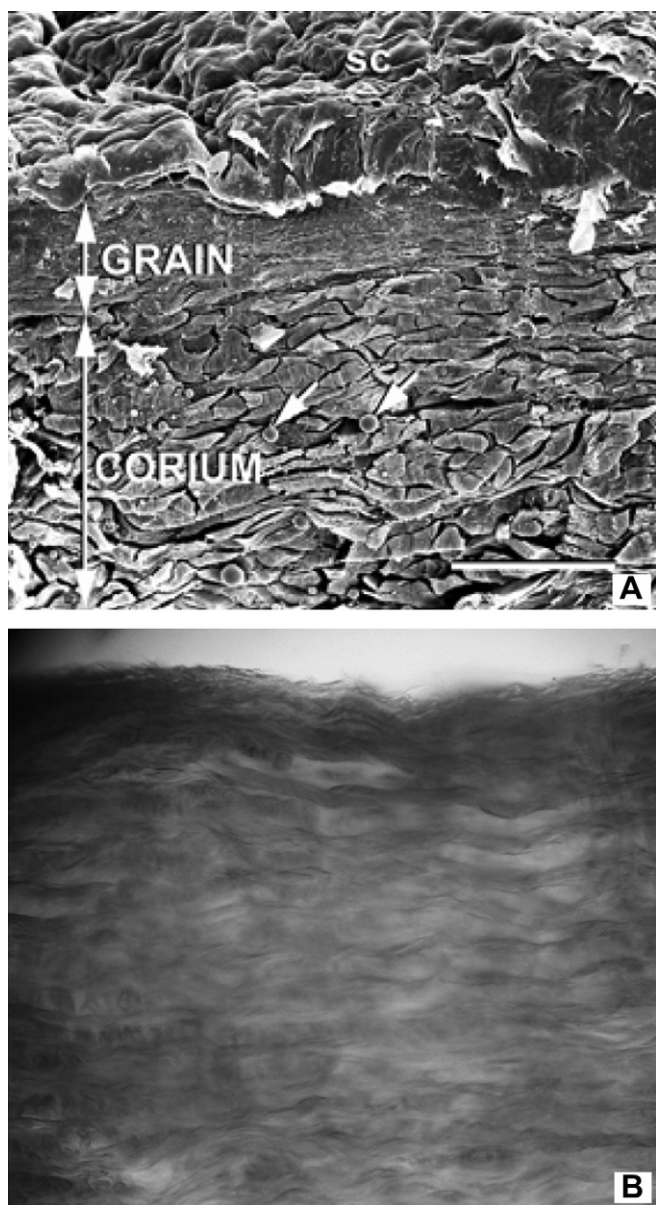


Fig. 6. Microscope Rhea leather structure, A – Image taken from Lunam and Weir 2006:29, B – Image record from CITEC, INTI Image Bases.

conditions of desiccation or conversely, flooding, even at large temporal scales. The raw skin is hygroscopic, and therefore susceptible to changes in environment relative humidity (Doyal and Kite, 2006). Fluctuations in the rates of humidity of the surrounding sediment significantly influence the degradation of the collagen protein fibers (Janaway, 2002).

Bacterial action: Rough skin is subject to a relatively rapid degradation by bacterial action which attacks by proteolytic enzymes. If the skin has been subjected to some type of treatment (cured with salt, dried, soaked in fat or minerals, ash etc.), there is a pseudo-tanning, which grants a temporary protection against the attack of microorganisms (Doyal and Kite, 2006).

Hydrolysis and oxidation: These two important factors for skin break down or leather treated with vegetable substances consist of reactions strongly influenced by the environmental context. In the case of the samples here analyzed, filtration of water by percolation, alkaline Ph sediment and transference of sulfur and nitrogen dioxide, by close contact with the bodies, would have acted on

amino acids and peptides of collagen, altering their chemical structure internally. Also organic acids produced by the decomposition of the buried body lipids (autoxidation) are important disturbance factors (Florian, 2006).

In the case of the Chenque I site, it has been verified the presence of water leaks by percolation in the form of precipitation of calcium carbonate and dioxide of manganese on several skeletal elements. On the other hand the pH of soils associated with most of the burials is markedly alkaline (\bar{X} pH 8.00). The decomposition of organic matter necessarily involves the action of bacteria that break down the body's soft tissues, especially in its early stages.

Regarding the second objective, a comparison was made between two primary burials and two dispositions. In the case of the two primary burials compared (Table 1), the degree of skeletal completeness is similar (grade 4, following Buikstra and Ubelaker, 1994). However, in the case of burial 34 a higher proportion of carpal elements (16), phalanges of the hand (9), tarsus (15) and phalanges of the foot (4) have been preserved compared with burial 41, from which have been recovered 4 carpal elements, 6 phalanges of the hand, 3 carpal elements and 1 phalanx of the foot (Fig. 7 A, B). The packaging, in the case of burial 34, may have fulfilled the function of a container, which due to the small size of these skeletal elements, tend to be more susceptible to vertical or horizontal displacement, or suffer a greater dispersion, and therefore be less represented in the archaeological record (Mays, 1999).

In the case of the dispositions (Table 2), the results of the comparison between burial 25 vs. burial 10 (Fig. 7C, D), do not show significant differences in the preservation of the bone macrostructure of the two individuals. So it is interpreted that the purpose of using skin, possibly Rheidae, as wrapper, was not a product of a pattern of behavior directed to special preservation of the bodies so treated, nor has it acted naturally in this regard.

8. Discussion and final considerations

The skin of animals has been used by human populations for various purposes during thousands of years. Different methods of preparation thereof have generally followed cultural traditions, influenced by the availability of animal species and the type of local subsistence economy. Pampean hunter–gatherers groups have based much of their subsistence system in several animal species, mainly the guanaco (*L. guanicoe*), from which extracted for millennia equally proteins and fats for food, as much as artifacts, clothing and shelter, the latter manufactured with their leather, obtained from the already mentioned ancient tanning processes.

The role of Rheidae in the subsistence system of hunter–gatherers has been frequently cited in the ethnographic chronicles (Moreno, 1879; Musters, 1997; Salemme and Frontini, 2011), as a resource exploited by indigenous peoples and also in the archaeological literature, which mentions material evidence in the form of skeletal elements (generally scarce), artifacts and mainly fragments of egg shells (Salemme and Miotti, 1998; Quintana and Mazzanti, 2001; Belardi and Carballo, 2003; Salemme and Berón, 2003; Stoessel, 2007; Bonomo et al., 2008; Prates, 2008; Quintana, 2008; Martin et al., 2009; among others). However, there is no previous evidence in the archaeological record of the region of the likely use of their skin, which due to its flexibility may have been used for various purposes. Prates (2009) summarizes valuable ethnohistorical information from Patagonia on the use of different parts of rheids, including meat and eggs for food consumption but also the gut, nerves, feathers, tendons, fat, bones and blood for various purposes. The author mentions that the skin of the neck was used to make bags to contain of salt or fat and to transport liquids and to make blankets (Prates, 2009: 204, 207, see original citations). Nevertheless, the use of rheids skin in sacred burials

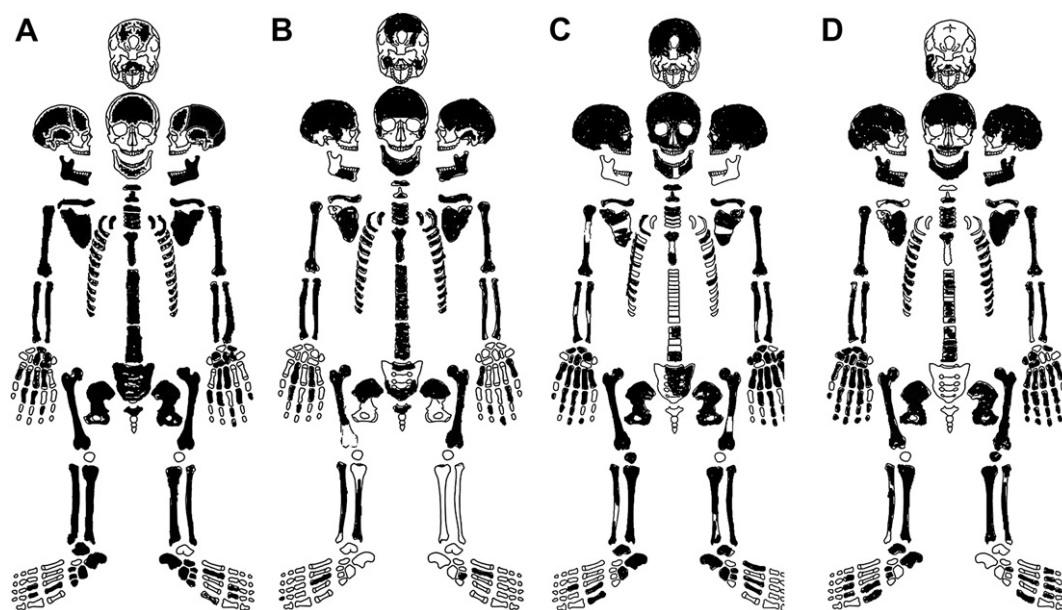


Fig. 7. Completeness degrees: A, burial 34, B, burial 41, C, burial 25, D, burial 10.

activities as possibly shown in Chenque I site, is an interesting fact as it suggests that these species, undervalued in terms of subsistence, in comparison with mammals as guanaco (well represented in the archaeological record), have played an important role in sacred and symbolic spheres.

The state of extreme degradation of the sample from Chenque I suggests that it was used a skin with little prior treatment, through techniques such as salting, drying or impregnation in fat. Poor tanning may have made it more susceptible to attack by post-depositional taphonomic agents.

The processes previously cited of environmental origin: fluctuations in the relative rate of moisture, the composition of the sedimentary matrix, and the action of bacteria, did not allow the preservation of the original material, but this material fulfilled the role of efficient packaging for the transport of the deceased until final destiny of burial. It follows from this that those funeral packages were not significant in terms of protecting the human remains from and post-depositional processes, but on each of the analyzed individuals both intrinsic and extrinsic factors acted synergetically during its taphonomic history.

The excellent preservation and integrity of the structure of the skeletal elements of analyzed primary modality individuals (burials 34 and 41), is attributed to a rapid burial offered by indicators such as preservation of anatomical position, absence of compatible bone weathering alterations, and absence of entomological evidence to suggest a period of surface exhibition (Di Donato, 2007). The carbonated sedimentary context would have also especially influenced, as well as the depth of burial (between 1.51 and 1.71 m below surface), which could combine to prevent the destructive action of big roots and predators as dermestids, rodents and carnivores (Di Donato, 2010). Individuals of secondary modality and disposition (burials 25 and 10) did not show important differences attributable to the presence or absence of the analyzed substance.

The emergence of formal burial areas reflects the generation of social limits of inclusion/exclusion and processes of handling of mortuary practices to achieve political and social objectives. The content and context of burial structures are not merely a manifestation of the socio-political organization, but they are an active

element in human relationships that can be used to create, reflect, conceal or manipulate social relations (Dillehay, 1995; Brown, 1995a, 1995b). In the case of the Chenque I site, the generation of this formal burial area may have contributed to strengthening behaviors of inclusion among groups, motivated not only by economic issues, but also by situations of movement, control, and exchange of persons, goods, information, ritual knowledge and power. In a context characterized by a desert environment, the maintenance of social relations ensures access to resources and alternative knowledge that allow reduction of the risks inherent in the unpredictability of these areas. In the cemetery were buried populations of different ethnic origin and of varied geographical origins, according to data of the material record accompanying tombs and different bioarchaeological variables. Stable isotope analysis obtained from humans remains from Chenque I shows very poor values for $\delta^{18}\text{O}$ ($< -8\text{‰}$) that correspond to individuals with no local residence but corresponding to environments characterized by rainfall probably impoverished such as the Andean areas, either the Atlantic or Pacific sides, contrasting with the local signal, which is located in a range from -4 to -1.7‰ (Berón, 2004, 2007; Luna, 2008; Berón et al., in press a). This required strategies that would allow the transport of the bodies, both from distant places and in different situations with regard to the time of the death of individuals. The significant amount of malacological ornaments (beads, snails), which were attached to the preserved fibers of the substance, constituted part of complex ceremonies that included the wrapper of the bodies with animal skins as has been evaluated in this work.

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