

Health at the time of Native-European contact in Southern Patagonia. First steps, results, and prospects

Ricardo Aníbal Guichón⁺, Jorge Alejandro Suby, Romina Casali, Martín Horacio Fugassa

Laboratorio de Ecología Evolutiva Humana (Quequén), Departamento de Arqueología, Facultad de Ciencias Sociales, Universidad Nacional del Centro de la Provincia de Buenos Aires, Calle 508 n° 881 (e/517 y 521), (7631) Quequén, Provincia de Buenos Aires, Argentina and Departamento de Biología, Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Mar del Plata, Argentina

The objective of this paper is to present the first steps into the study of health in southern Patagonia during pre and post Native-European contact. Thus, our work has a double purpose. First, to discuss characteristics and relevance of human bone records of southern Patagonia, in order to study health in a population context. Second, to show some new lines of information, which include paleoparasitology, nutritional paleopathologies, and the study of lifestyles from human remains. In this context, we have started working on the first Spanish settlement "Nombre de Jesus", founded in 1584, and with historical documentation of "La Candelaria" Mission in Rio Grande (1896-1931).

Key words: paleopathology - archaeology - southern Patagonia

Knowing about the health of human populations is important to understand their history and lifestyle. In general terms, the recognition of epidemiological changes requires actualistic models, as well as the exploration of the variation in health levels over time and space in order to understand the adaptation processes involved (Wood et al. 1992, Mendonça 2003, Armelagos et al. 2005). The presence of illnesses is mostly the product of the imbalance between individuals and numerous environmental components. Evolutionary ecology turns information about health into an indicator of many diverse aspects of human societies.

The objective of this paper is to present the first steps into the study of health in Southern Patagonia during pre and post Native-European contact. Southern Patagonia can be arbitrarily defined as the region including the provinces of Santa Cruz and Tierra del Fuego in Argentina, and the Magellan region in Chile. Thus, our work has a double aim. First, to discuss characteristics and relevance of human bone records of Southern Patagonia, in order to study health in a population context. Second, to show some new lines of information, which include paleoparasitology, nutritional paleopathologies, and the study of lifestyles from human remains, taking into account the diverse archaeological contexts and historical documentation.

Paleopathological analyses are recent in Southern Patagonia. Most works from 1990 to the present (Perez-Perez & Lalueza 1992, García Moro et al. 1993, Guichón 1995, Aspillaga & Ocampo 1996, Hernández et al. 1998, Aspillaga et al. 1999) have studied oral pathologies and stress indicators in human bones related to high latitude adaptation, using conglomerates of materials poorly defined in terms of space and time. In 1986 we criticized the temporal allocation of the samples to ethnographic groups (Cocilovo & Guichón 1985-86). Given the complexity and antiquity of these human occupations and the characteristics of the records we suggest: (a) the use of a geographical assignation; (b) a more adjusted analysis of the samples; and (c) other complementary lines of information (Guichón 2002).

Moreover, since the archaeological assemblages differ from the original population, the osteological record requires a careful description before the making of paleoepidemiological models. In this sense, a more detailed analysis of bone collections will allow us to discuss the integrity and reliability of the human record (Wood et al. 1992, Mendonça et al. 2003, Borrero 2004). Our knowledge of ancient ecosystems and organisms is partly controlled by our understanding of preservation and taphonomic factors, which include post-mortem changes as well as deposit conditions (Behrensmeyer & Hook 1992). Therefore, taphonomy and paleoecology¹ are strongly interrelated (Behrensmeyer et al. 2000). Although in the last few decades other types of evidence have been explored, the human osteological record are still the most abundant source of information about environment, organisms, and ecosystems from the past (Cutler et al 1999). However, are

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⁺Corresponding author: guichon@infovia.com.ar

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¹ Following Wing et al. (1992:2) we understand by paleoecology ...the study of associations among species and ecological attributes through time...

adaptation processes, short-term population distribution, change in food resources and paleoepidemiological changes detectable in human fossil records in Southern Patagonia? The answer to this question is complex and involves the recognition of taphonomic and preservation issues of human fossil records (Wood et al. 1992) as well as an interpretation within their context (Steckel et al. 2002).

The human bone record

The process of human exploration and colonization in Patagonia was probably slow, with a discontinuous settlement in time and space. The environmental instability in the Pleistocene-Holocene transition aid to explain the lack of early archaeological records and the slowness of the process of colonization (Borrero 1996, 2005).

We still do not have a thorough knowledge about the remains of the Patagonian native population, which are dispersed in museums in Chile, Argentina, United States, and several European countries. The most important collection lies at the Instituto de la Patagonia in Punta Arenas, Chile. Within the last five years many new findings have been incorporated in that collection. From the catalogues of the museums mentioned above, 562 individuals could be identified (Fig. 1). The degree of completeness is varied; little more than 60% of the samples have postcranial bones, and only 59% of the individuals can be geographically located. It is possible to observe that most bones appeared near the coast of Tierra del Fuego. Archeological visibility may be connected to this. Moreover, stable isotope information has been obtained from 69 individuals; DNA studies have been done on 48 samples; and chronological information has been obtained from 25 individuals.

The information available for the older archeological sites in Southern Patagonia shows a terrestrial adaptation (Borrero et al. 2001). As for the Middle Holocene, on the basis of stable isotope works, we have found evidence of strategies based on marine and terrestrial resources. It is worth pointing out that these new studies

(Guichón et al. 2001, Borrero et al. 2001, Barberena 2002) were carried out on some of the same individuals to whom Lalueza (1995) had obtained DNA data. From these analyses, we can see both genetic variability (C and D haplogroup) and dietary variability (marine, mixed, and terrestrial) both in Middle and Late Holocene (Table I, Fig. 2).

Biogeographical characteristics must also be considered. The mountain range of the Andes can be seen as a more or less translucent filter for the genetic flow among populations (Guichón 2000). Moreover, as suggested by Borrero, the Magellan tundra has been characterized by a low current capacity that probably limited the initial size

TABLE I
Genetic and dietary variability for the Middle and Late Holocene

	Dietary	Haplogroup	Chronology
Middle Holocene			
1 Lago Sofia	Terrestrial	C	3900BP
2 Marazzi	Terrestrial	D	5570 ± 400 BP
3 Punta Santa Ana	Sea	-	6800 BP
Late Holocene			
4 Cerro Johnny (B.N.)	Terrestrial	D	4000 BP
5 C. Estrecho Trinidad	Sea	D	XIX-XX c (contextual)
6 Posesión Olimpia I	Terrestrial	D	XIX-XX c (contextual)
7 Puerto Natales	Mixed	D	XIX-XX c (contextual)
8 Bahía Santiago	Mixed	C	No dating Late Holocene
9 Punta Satélite (P. Delgada)	Mixed	C	No dating Late Holocene

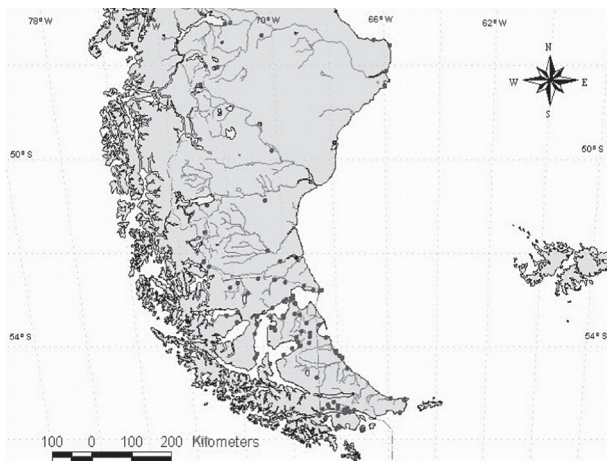


Fig. 1: map of Southern Patagonian human bone collections with geographical reference (N = 331).

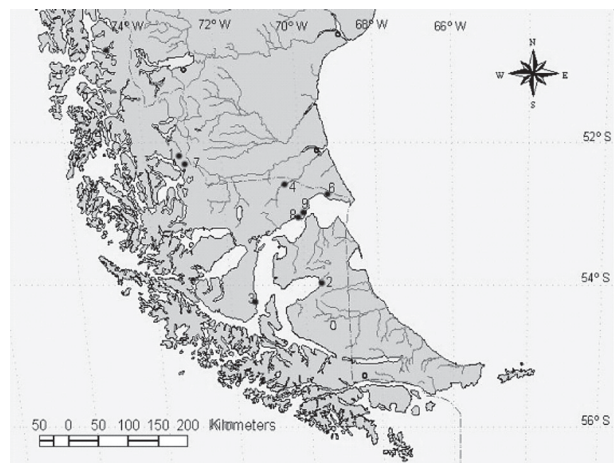


Fig. 2: map of genetic and dietary variability for the Middle and Late Holocene.

TABLE II
Events in the history of Southern Patagonia

Chronology	Events
11000 BP	First settlers of Southern Patagonia
8000 BP	Opening of the Strait of Magellan
1520	Discovery of the Strait of Magellan
1584	Attempt to settle in the Strait (Campaign by Sarmiento de Gamboa)
1781	Foundation of Floridablanca, Santa Cruz, Argentina
1852	Foundation of Punta Arenas, Chile
1868	Beginning of the hunting of sea-wolves
1870	Foundation of Anglican Mission, Ushuaia, Tierra del Fuego
1885	Foundation of Río Gallegos, Santa Cruz, Argentina
1893	Foundation of Mission “La Candelaria”, Tierra del Fuego

The Native-European contact in Southern Patagonia can be understood as a complex process of interaction that took several hundreds of years. The first contact occurred on the coast (Fugassa & Guichón 2004) and it was many years later that the Europeans moved inland (Amador 1990). Table II summarizes some important events in the history of the region.

One of the presumptions about the first Native-European encounter could be connected to the role of the indirect contact as suggested by Dobyns (1993). Thus Borrero (1992) speculates that the size of the population at pre-contact time in Tierra del Fuego might have declined. Nevertheless, considering the number of inhabitants, the dynamics of these hunter-gatherer populations, and the climatic conditions in the area (mainly strong westerly winds) our expectations for the dispersion of infectious diseases transmitted by air (such as tuberculosis, influenzavirus, measles, and adenovirus) are low (Fugassa & Guichón 2005). If our speculations were confirmed, the population size observed by the first explorers would not have been modified by the arrival of the European people.

The other scenario in this process is the direct contact between the native people and the European colonizers. This type of contact started in 1850, when the Anglicans came into the Beagle Channel to establish their mission, which was finally founded in Ushuaia. The daily lifestyle of the natives was altered. The dispersion of diseases was one of the contributory factors in the changes initiated with the interethnic contact among natives, missionaries, sailors, whale hunters, and the first Chilean colonizers. The historical works and ethnographic sources (Bridges T 1891a, b, 1893, Braun Menéndez 1939, Emperaire 1963, Belza 1975, Bridges E 1975, Canclini 1986) reveal the exposure of Beagle Channel native populations to a di-

versity of diseases, with a predominance of measles and tuberculosis. Other diseases, like syphilis, might also have been transmitted to native people.

The last quarter of the XIX century produced significant changes in the Native's health, due to both colonization and the development of animal husbandry (particularly the expansion of sheep according to the demand of the international market). The extinction of Fueguin populations was then irreversible, and the role of disease was important. Death due to infectious diseases was a fundamental part of this change (Gallardo 1910, Braun Menéndez 1939, Gusinde 1951, 1982, Canclini 1986, Martinic 1990, García Moro 1992, García Moro et al. 1997). Direct reasons, such as native massacres in the hands of gold hunters, could be mentioned, but indirect modes were central too. The alteration of material and spiritual lifestyle of these populations was a manifold process, including social organization, diet, territory, and culture. Therefore more detailed and integrated historical and bio-archeological studies are necessary.

Cases of study

In 2005, we started doing fieldwork in two sites: “Nombre de Jesus”, the first Spanish settlement founded by Sarmiento de Gamboa in the Strait of Magellan in 1584²; and “La Candelaria” Mission in Río Grande founded in 1896.

Nombre de Jesus (XVI c)

The aim of the Spanish expedition was to establish two settlements in the Strait of Magellan to block the passage of English corsairs. In 1581, 16 ships and 2408 people onboard (among these men, women, and a few children) set sail from Spain. The following year, 2225 people arrived at Rio de Janeiro, Brazil. Despite their attempt to continue with the voyage, the expedition stayed in the country for over a year. The expedition then suffered a process of disintegration characterized by disagreement, desertions, and theft. Consequently, six vessels departed from Brazil on the 1 December 1583. Only 400 people arrived at the Strait and founded “Nombre de Jesus” in 1584. Three years later, in January 1587, the English pirate Thomas Cavendish found 18 survivors, although decided to rescue only one of them (Fernandez 1990).

Sarmiento de Gamboa and the colonist rescued by Cavendish constitute the only source of information that helps us understand what happened at the two settlements, “Nombre de Jesus” and “Rey Felipe”. Both survivors' statements agree about the scarcity of food. For this reason, some researchers (Martinic 1983) speculate that these people may have starved to death, while others (Fernandez 1990) sustain that the environmental resources could have been sufficient to supply both “Nombre de Jesus” and “Rey Felipe”.

Until now, the location of the first settlement has been unknown. The recent finding of four skeleton burials may

² Dr Senatore began to work in “Nombre de Jesus” in 2004 and invited us to join one year later.

TABLE III

Height estimated for young adult skeleton found in Nombre de Jesus (Trotter & Glesser 1958, 1977)

Height	Femur	Femur + Tibia	Humero
Skeleton 2	168,3 ± 3,27	170 ± 2,99	168,9 ± 4,05
Skeleton 3	165 ± 3,72	166,8 ± 3,55	173,1 ± 4,55
Skeleton 4	182 ± 3,27	182,4 ± 2,99	175,9 ± 4,05

indicate that we have found “Nombre de Jesus”. The cultural position of the skeletons, the C¹⁴ information of skeleton NJ-1 (Ua-22946: 475 ± 45 BP), and the presence of Spanish mortuary elements support this idea. In Fig. 4 we can see the four skeletons recovered, all of them aligned with their heads pointing eastwards. In a first analysis of age and sex, we have determined that three of them could be young adults at the time of death (two male and one female NJ-3), and one skeleton NJ-1 of a child (10 to 14 years old). The height of the three adult skeletons has been calculated (Table III) according to Trotter and Glesser (apud Borgognini Tarli & Pacciani 1993).

Considering the aid letters written by Sarmiento de Gamboa to King Felipe II, one of our hypothesis is that the inhabitants of “Nombre de Jesus” suffered some kind of nutritional stress. We are still working on the assessment of the observational signs of the bones. Although we have not found porotic hyperostosis or cribra orbitalia, the skeletons number two (NJ-2), three (NJ-3), and four (NJ-4) present femoral hyperostosis (Perez Martín et al. 1999) which has been questioned as a nutritional stress indicator. In relation to functional pathologies, only skeleton three (NJ-3) shows lumbar scoliosis.

Moreover, skeleton NJ-1 presents incisives morphology similar to “shovel” tooth frequently found in Mon-

goloid populations (Brothwell 1993). In Fig. 5 the incisives of the four individuals can be observed. Future DNA studies of NJ-1 and new radiocarbon data of the other skeletons could help us to reject or accept the idea of both Spanish and Natives burials in the same graveyard. The radiocarbon information for NJ-1, the same orientation and depth of graves, and the cultural material associated to NJ-4 (ceramic and metal elements) could support the contemporaneity of the burials (Senatore et al 2005).

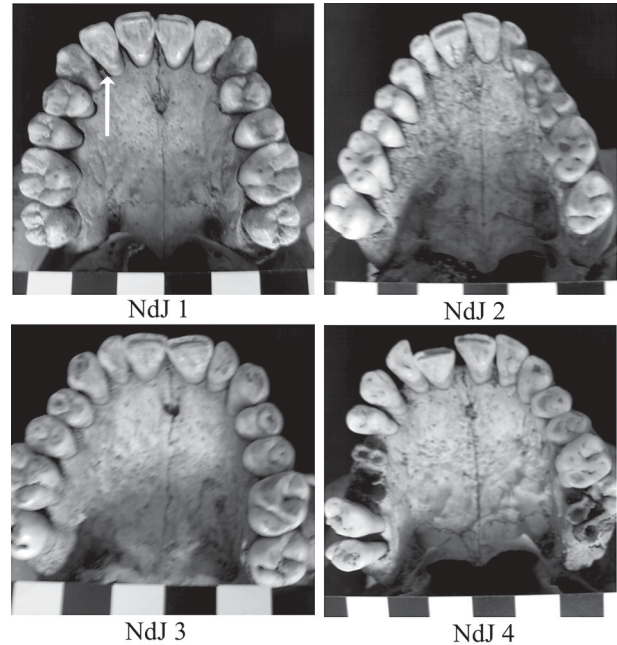


Fig. 5: incisives of the four individuals (NJ-1, NJ-2, NJ-3, NJ-4).

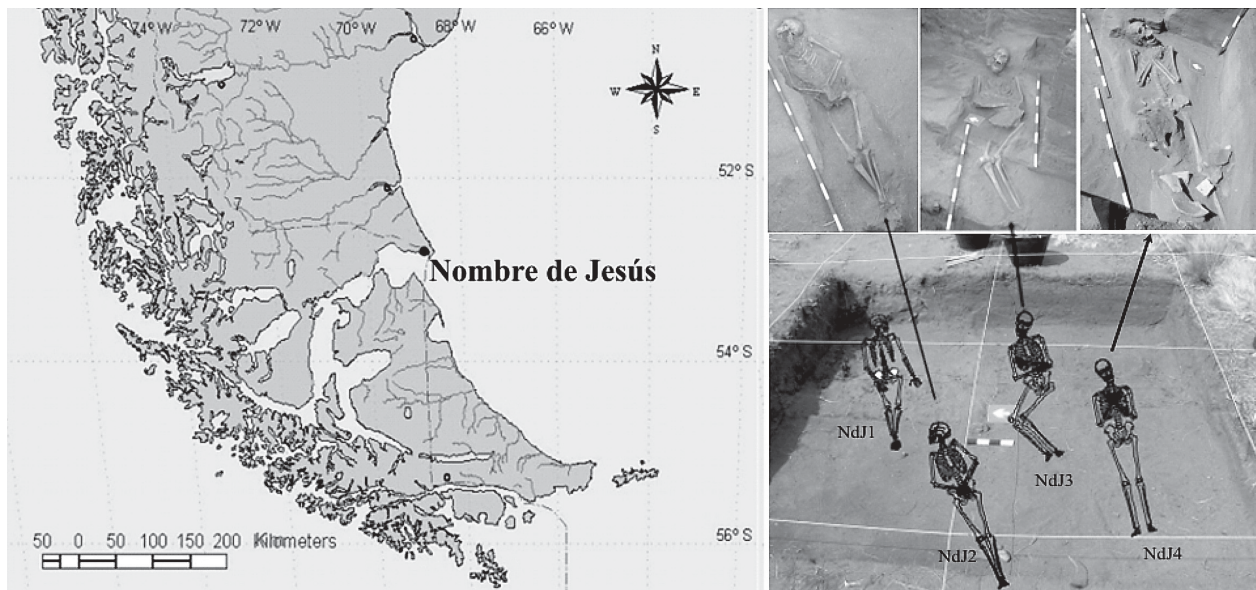


Fig. 4: first Spanish settlement in the Strait of Magellan, 1584-1587, Sarmiento de Gamboa, “Nombre de Jesus”, Cabo Virgenes.

In the case of long bones, some epiphyses show incomplete fusion. Considering the ages at death estimated for these young adult individuals, the epiphysal fusion seems retarded, fundamentally in the legs. Moreover, the long bones of legs present bilateral periostitis, with reddish stains. Through forensic methods, our next step is to work on the detection of human hemoglobin on these bone surfaces. Dental characteristics, such as pre-mortem dental loss and alveolar retraction, may also add to future discussion about the presence of scurvy as already mentioned in the historical documentation available (Sarmiento de Gamboa 1950).

Some structural characteristics of bones, principally BMD and cortical area index, are good indicators of nutritional stress (Larsen 1997, 2002, Ruff 2000, Ruff & Larsen 2001). To evaluate architectural bone alterations, we are doing bone photon-densitometry, whose preliminary results have shown compatible values with osteopenia or

osteoporosis in all skeletons. Furthermore, peripheral Quantitative Computed Tomography (pQCT) has contributed to the evaluation of the cross-sectional structure of long bones, through cortical area and second moments of inertia. So far, we have found that all skeletons have endocortical alterations, with a significant reduction of the cortical area in tibia and radius (Fig. 6). Moreover, some cortical alterations have been observed in long bones through tomographical slices and digital X-ray. This last technique revealed Harris lines in the tibias of skeleton NJ-1. Finally, we are working on paleoparasitological studies of archaeological sediments found at “Nombre de Jesus” (see Fugassa et al. in this issue).

La Candelaria (XIX c.)

As part of the strategy of colonization, the Salesian Mission “La Candelaria” (Fig. 7) was settled near present-day Rio Grande City, Tierra del Fuego, in 1893. The pres-

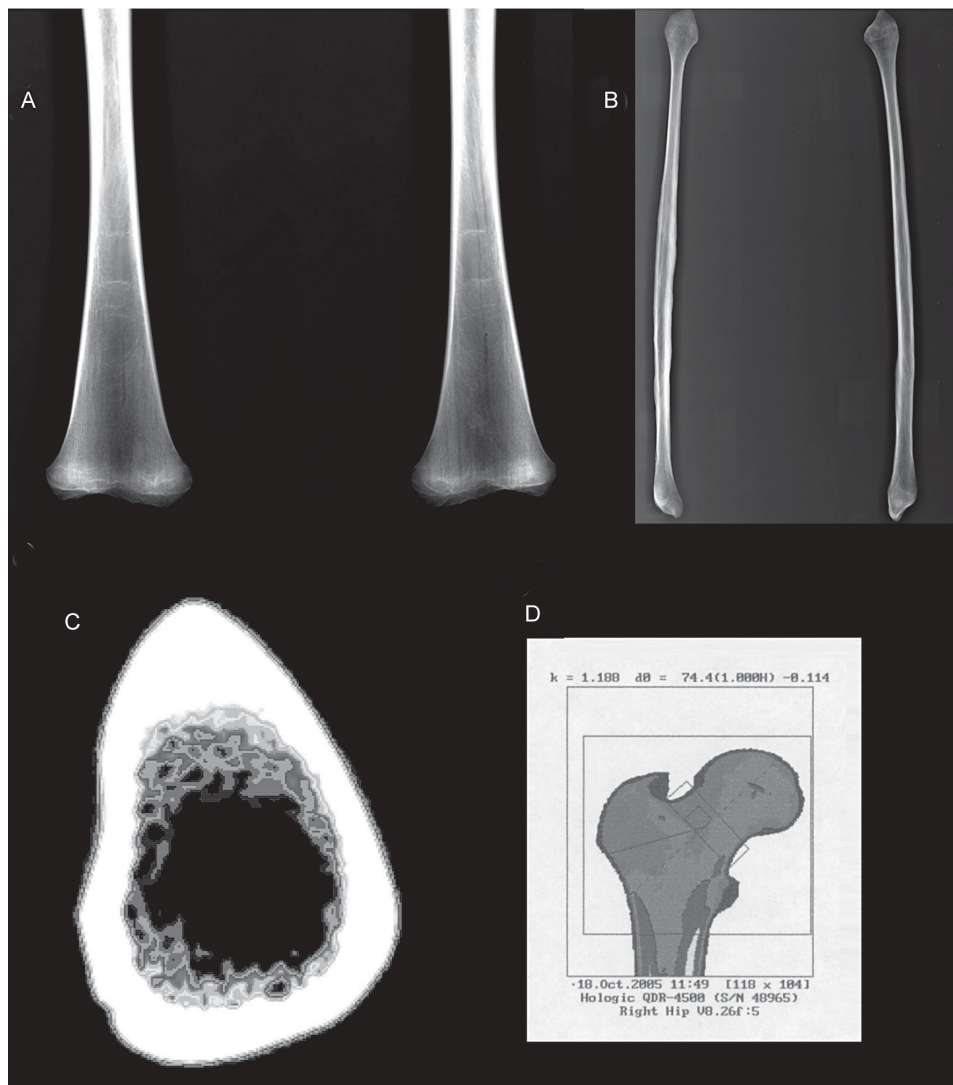


Fig. 6: paleopathological bone analyses from “Nombre de Jesus”. A: Harris lines in both femoral of skeleton 1; B: bilateral periostitis in skeleton 4 ulna; C: pQCT images showed reduction of cortical area; D: analysis of BMD with photodensitometry, showed osteoporotic values in femoral neck of skeleton NJ-2.



Fig. 7: the Salesian Mission La Candelaria, Río Grande, Tierra del Fuego.

ence of European people on the island brought about the movement of human groups altering their territoriality, and provoking new intertribal wars and the aggravation of previous conflicts (Gallardo 1910, Gusinde 1951, 1982, García Moro 1992).

Moreover, the sheep started competing and displacing the guanaco (*Lama guanicoe*) for grazing. As the guanaco constituted a basic resource for the Selk'nam (Onas), the Natives hunted sheep as a new nutritional source. In this context the European people started capturing and murdering the Selk'nam. Therefore, the "legal authority", the new land owners and missionaries, implemented the strategy of taking the natives to the Missions. Considering this new scenario some authors sustain that the decrease in Native population size is related to the inclusion of the Natives into the Mission and the subsequent dispersion of infectious diseases (Gallardo 1910, Braun Menéndez 1939, Gusinde 1951, 1982, Canclini 1986, Martinic 1990, García Moro 1992).

It has been suggested that the high mortality, fundamentally due to infectious diseases, was the most direct cause of the Selk'nam "extinction" (García Moro 1992). The historical documentation will certainly provide other aspects of the interethnic contact and its effect on health. One of our aims is to evaluate and discuss death caused by infectious diseases in the Selk'nam population of "La Candelaria" Mission, and the subsequent native disappearance. To study evidence in an interdisciplinary framework is our immediate challenge.

An examination of the period 1896-1931 has already been carried out through the Diary of the Mission (Book 1, 1896-1902), the Baptism Book (1896-1913), and the Book number II of Demises (1902-1931). According to these books, Native deaths in the mission amounted to 223 individuals. Most of them were Selk'nam, with similar percentages for both sexes, and certain predominance of 4 to 12 year-old children. Since specific information about the causes of decease for the period 1897-1902 does not exist, the death profile (age, sex, seasonally of decease, etc.) has been compared with the period 1902-1931, for which there is specific data. Moreover, diverse ethnographical and secondary sources have been analyzed in order to provide a context to the obtained information.

Prospects

We have presented the general framework and briefly mentioned our new findings ("Nombre de Jesus" - XVI c) and some recent results. As has been commented above, we are working a long different lines of information (human taphonomy, bone paleopathology, paleoparasitology, and historical documents) from several archaeological sites and bone collections of the region. In this context, the future perspectives for our work imply a schedule oriented to: (a) continue the study of the human bone record, as a necessary source of information to make inferences about changes in health and lifestyle; (b) revise the standards that have been used up to the present in order to develop comparative studies that consider a wider regional scale, such as suggested by Steckel and Rose (Steckel et al. 2002); (c) identify, among the osteological collections, material that could provide information about possible changes in health attributed to Native-European contact; (d) conclude our fieldwork at "Nombre de Jesus" archaeological site. The studies on recovered materials started through non-destructive techniques (CT, pQCT, DEXA, and Rx) showing nutritional stress. At the same time, it is necessary to evaluate the probable presence of scurvy. Moreover, we hope that DNA analyses and radiocarbon data support the hypothesis of a Native-European mixed graveyard on the Magellan Strait in 1584. Stable isotopes information may offer a first approximation to the diet of the recovered individuals; (e) work with historical research, adding other sources of information related to "La Candelaria" Mission and Salesian Mission of Dawson Island (Chile); (f) continue the paleoparasitological studies, analysing pre and post-contact materials.

In the last years, it has been suggested that the comprehension of the health status of the past populations is the result of a complex system of cultural and environmental variables, which should be included for a better interpretation (Steckel et al. 2002). Our comprehension of the changes in the health of Southern Patagonian populations requires research into the complex process (before, during, and after) of Native-European contact. This implies a challenge that we expect to answer with the help of those colleagues who may be interested in the extreme Southern Hemisphere.

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