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# Current status and perspectives of the development of dental research in biological anthropology of Argentina: Introduction and conclusions of the symposium<sup>☆</sup>

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### ABSTRACT

This paper describes and discusses the research in the field of dental anthropology in Argentina. It has been presented at the symposium entitled “The development of dental research in Argentine Biological Anthropology: current status and perspectives”, coordinated by the authors at the IX National Meeting of Biological Anthropology of Argentina, Puerto Madryn, 20th–23rd October 2009. The aim of the symposium was to present new results and future prospects of this discipline in the country and to create a forum for discussion of current research within this field.

Six contributions that focused on the study of teeth from different perspectives and analysed bioarchaeological samples from different areas of Argentina (Central Highlands, Pampa and Patagonia) were presented. After the presentations, a discussion about the state of the art of dental research in the country was generated, in which the need for the generation of methodological consensus on the criteria for the evaluation of the variables considered was stated, so that research conducted in different areas can be compared. In short, the contributions of this symposium provide insights into the diversity of dental anthropology in contemporary Argentina and the potential of these types of studies to gain important information about biological and cultural aspects of the native populations in the country.

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## R E S U M E N

En este trabajo se describen y discuten las investigaciones expuestas en el marco del simposio “El desarrollo de las investigaciones dentales en la Antropología Biológica Argentina: estado actual y perspectivas”, coordinado por los autores en las Novenas Jornadas Nacionales de Antropología Biológica (Puerto Madryn, Argentina) en octubre de 2009. El propósito del simposio fue presentar resultados y perspectivas futuras dentro de esta disciplina en Argentina y generar un espacio de discusión acerca de las investigaciones actuales sobre la temática.

Se presentaron seis contribuciones que analizaron muestras bioarqueológicas de diferentes áreas del país (Sierras Centrales, Pampa y Patagonia) y focalizaron en el estudio de la dentición desde diferentes perspectivas. Posteriormente, se generó una fluida discusión acerca del estado de avance de las investigaciones dentales en el país y se planteó la necesidad de generar consensos en los criterios para la evaluación de las variables consideradas de manera que las investigaciones desarrolladas en diferentes áreas puedan ser comparadas. En definitiva, las contribuciones de este simposio permitieron conocer la diversidad temática de la antropología dental contemporánea en Argentina, la cual provee información importante sobre aspectos biológicos y culturales de las sociedades nativas del país.

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## Introduction

The aim of this paper is to summarise the contributions in the field of dental anthropology presented at the symposium entitled “The development of dental research in Argentine Biological Anthropology: current status and perspectives” (El desarrollo de las investigaciones dentales en la Antropología Biológica Argentina: estado actual y perspectivas), organised by the authors as part of the IX National Meeting of Biological Anthropology of Argentina (IX Jornadas Nacionales de Antropología Biológica, Puerto Madryn, Argentina, 20th–23rd October 2009). This symposium represented the first forum of discussion in the history of Argentine archaeology and biological anthropology, dedicated exclusively to dental studies, in the context of scientific meetings. The symposium brought together a large number of participants interested in dental anthropology, both established researchers and graduate students in archaeology, biological anthropology and biology, thus reflecting the significant increase in dental studies observed in the past decade (Bernal and Luna, 2011).

In the last 10 years, a significant increase in research involving dental evidence has occurred in the country. To the previously established lines of studies, new issues have been added, exploring diverse problems such as sex determination, adult age estimation, the assessment of metabolic stress through the evaluation of tooth size and, the analysis of biological distances and migration processes at different geographic scales. Currently, the scope of dental information obtained through the diverse theoretical and methodological approaches contributes to the discussion of old problems, but also allows the development of new studies, that improve our knowledge about the biological and sociocultural characteristics of native populations in Argentina.

Two lines of research deserve special attention. On the one hand, dentition has become systematically used as evidence for the study of evolutionary relationships among native populations through statistical analysis of metric and discrete dental traits (e.g. Bernal, 2008; Bollini, 2004; Bollini et al., 2008; Luna, 2008; Luna and Bernal, 2005). On the other hand, various studies have been initiated in order to evaluate the potential of dentition as an alternative tool for adult sex determination in those cases in which the anatomical units commonly used to obtain that information (ossa coxae and skulls) are not well preserved.

In this context of continuous progress of research in dental anthropology, the purpose of the symposium was to present current results and future prospects through the analysis of these topics, and to create a forum for discussion about the status of ongoing investigations based on analysis of human dentition. We invited the presentation of papers that focus on the application of new methodological strategies and/or that offer interesting results for the different issues that are currently being considered in the scope of both the biological anthropology and the bioarchaeology of Argentina. Priority was given to papers using interdisciplinary research and analytical innovations, with different spatial and temporal scales.

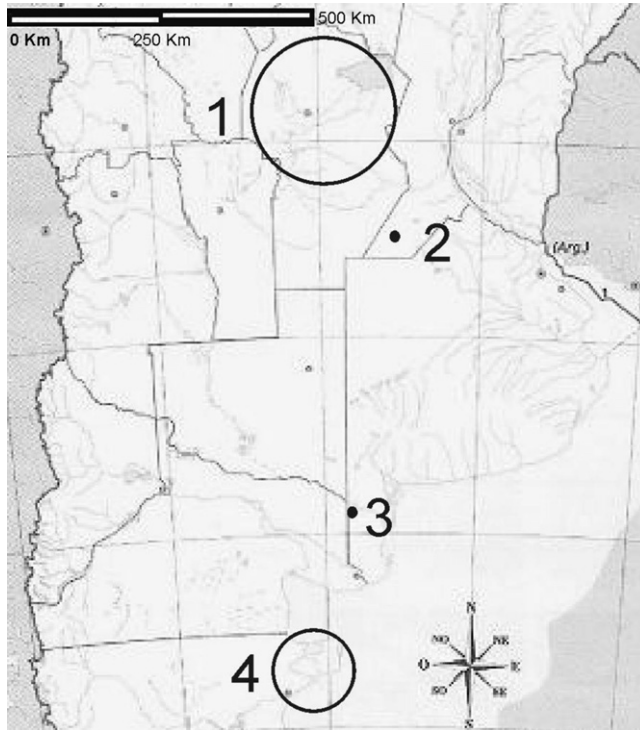
### Symposium papers

Six contributions were presented, which analyse bioarchaeological samples from different areas of Argentina and focus on the study of teeth from different perspectives (some of these papers will be published in *HOMO*, *Journal of Comparative Human Biology*). Bernal and Luna (2011) presented a historical analysis of bioarchaeological dental investigations in Argentina and discussed the current state of the discipline and prospects for future research. The first investigations in this country, guided by evolutionary ideas, were developed to establish the taxonomic position of humans by means of the description and comparison of morphologic and morphometric aspects of the dental crown and root. Later, the studies focused on the classification of intentional dental modifications and dental wear within the framework of historical-cultural approaches. These analyses were not conducted under systematic protocols of investigation and were early abandoned. In the recent past, a significant change has taken place in dental studies, mainly as a result of the interest in evaluating adaptive aspects of human populations in the framework of a biocultural approach. The principal line has been oriented toward the analysis of indicators of health and metabolic stress, such as enamel hypoplasiae, caries and dental wear, both in hunter-gatherers and farmers. Human dental remains have also been used in our country for estimating the age at death of subadults and in estimations of the minimum number of individuals in archaeological sites with multiple burials. In this way, a large corpus of data was accumulated for the characterisation of demographic profiles in bioarchaeological samples of different origins, and for the development of research focused on indicators of metabolic and functional stress, and diet. More recently, biodistances based on dental metric and non-metric traits have been studied, with the aim of contributing to the knowledge of the evolution of the South American populations. Finally, Bernal and Luna (2011) highlighted the fact that consolidation of the current studies will contribute to the knowledge of diverse aspects of the adaptation and evolution of the human populations in Argentina and in bordering countries.

Four of the papers presented at the symposium offered unpublished data on dental analysis of hunter-gatherers in Argentina. One of these is published in the present issue. It focuses on the evaluation of the oral health of the individuals excavated in Paso Alsina 1 (Partido de Patagones, southern Buenos Aires, Argentina; Fig. 1) (Flensburg, 2011). This archaeological site is an exclusive burial area where 10 secondary multiple burials, containing a minimum of fifty-six individuals, were inhumated by hunter-gatherer groups during the final late Holocene. Pathological lesions such as caries, abscesses, dental enamel hypoplasiae, antemortem tooth loss, dental calculus and periodontitis were studied, and all of these characteristics were found in low percentages. These results correspond to the expected values for exclusively hunter-gatherer societies, and are consistent with information provided by other lines of archaeological research developed in this area (Flensburg, 2009).

Two other papers discussed the oral health of the societies that inhabited the Argentine Central Highlands, Sierras Centrales (Fabra and González, 2009) and Pampas (Piccoli and Barboza, 2009) during the Holocene, through the evaluation of numerous indicators. The samples used were taken from regions of Argentina, which have recently begun to be explored from a bioarchaeological perspective.

The first paper focused on dental studies in order to evaluate the subsistence strategies of the inhabitants in the southern region of the Central Highlands (center of Argentina; Fig. 1). The authors discussed the changes that might have occurred as a consequence of the incorporation of pottery production and products of agriculture around 1500 years BP, in a mainly hunter-gatherer context. These changes led to a lifestyle change among these populations, who turned toward a mixed economy. Several oral health indicators, such as dental enamel hypoplasia, dental caries, abscesses, antemortem



**Fig. 1.** Location of the archaeological sites: (1) several sites in Sierras Centrales, Córdoba (Fabra and González); (2) Laguna El Doce site, Santa Fe province (Piccoli and Barboza); (3) Paso Alsina 1 site, southern Buenos Aires (Flensburg, 2011); (4) Several sites in central-northern coast of Patagonia and the Chubut River Lower Valley (Novellino and Gómez Otero, 2009).

tooth loss and calculus, were analysed in bioarchaeological samples from this area. The results are in concordance with isotopic, archaeological and ethnohistorical evidence, which suggest that climatic, social and demographic pressures might have affected the lifestyle of these populations, modifying and diversifying their subsistence strategies through the incorporation of agricultural products since the mid-late Holocene. It should be noted that these data are the first gathered through systematic multidisciplinary investigations, and are welcomed as an additional way of explaining the population dynamics of this area.

Piccoli and Barboza (2009) presented a detailed analysis of the oral health of individuals recovered from the Laguna El Doce site (General López, SW of Santa Fé Province; Fig. 1), who belong to Late Holocene hunter-gatherers. The sample is composed of a large amount of human remains that were buried at the coast and redeposited by the action of the lagoon. For that reason, this sample had to be studied as if it were an ossuary, without a possibility of making comparisons between individuals. Tooth wear and the presence and prevalence of caries, abscesses, antemortem tooth loss and calculus, were analysed. Overall, the results are consistent with the bioarchaeological profile related to hunter-gatherer populations, without significant agricultural inputs. This is in contrast to the previous case (Fabra and González, 2009), although both samples are not so distant (approximately 300 km.). Differences in the distribution of dental lesions were observed between the two samples (abscesses and antemortem tooth loss among adults, caries and dental calculus in subadults). Abscesses and antemortem tooth loss were associated with a high degree of tooth wear in those cases, in which there was no indication of periodontal disease, calculus or caries. In spite of the characteristics of the sample (ossuary), the detailed methodological approach generated valuable information that aids the drawing of explanations about the health status of the inhabitants of the area.

Novellino and Gómez Otero (2009) presented an analysis of diet, nutritional status and oral health among hunter-gatherers from the central-northern coast of Patagonia and the lower valley of the Chubut River (see Gómez Otero and Novellino, *in press*). They assessed oral health by analysing observations of caries, abscesses, tooth wear, pulp cavity exposure and antemortem tooth loss. They also assessed the nutritional status based on the prevalences of enamel hypoplasiae, porotic hyperostosis and *cribra orbitalia*. The results showed high inter-site variability and changes over time, especially during the late Holocene. No evidence of nutritional stress or iron deficiency was found, suggesting favorable nutritional conditions during life, that would have resulted from a mixed diet, which included carbohydrate-rich food as well as marine and terrestrial proteins. The percentages of caries showed a progressive increase during the final late Holocene (1000 years BP onward), while the frequencies of abscesses and antemortem tooth loss and the degree of dental wear showed a decrease during the same period. These tendencies are interpreted by the authors as a result of the increase in the consumption of processed foods by the hunter-gatherers from this region.

Bollini (2009) discussed the importance of the information based on metric and non-metric dental traits in human population studies. The author briefly characterised Argentinean aboriginal biological relations, and suggested some guidelines for the analysis of samples from various regions of Argentina. The author stressed the importance of establishing coherent standards in order that different researchers could generate comparable data, and offer coherent and reliable explanations of the identified biological processes. He focused on five different areas of research (continuous and discontinuous traits analysis, dental pathologies studies, micro-wear analysis and intentional dental modifications), that are mutually linked and that, if analysed using an holistic perspective, can provide useful information about the aboriginal populations that inhabited southern South America in prehistoric times.

## Conclusions

After the presentations, some specific issues emerged that summarise the state of art of Argentine dental anthropology and offer new ways to delineate future research in this field. First, assessment of the association between the presence of caries and tooth wear rates on the one hand, and both the frequency of antemortem tooth loss and levels of prevalence of abscesses on the other, emerged as an issue that deserves further attention. While caries and tooth wear are recurrently defined as potential causes of tooth loss and abscesses, it remains to be specified what is the precise causal relationship in the context of different systems of human subsistence. For example, the presence of periapical abscesses in archaeological human remains can be identified alternately in association with high rates of attrition, periodontitis, caries or dental calculus (or a combination of these variables), which significantly change the explanations on the types of foods consumed and the cultural aspect of use of the masticatory system in different populations. For this reason, the development of recent studies (mainly ethnoarchaeological) to create baseline information in order to strengthen the suggested inferences, would be welcomed. An interdisciplinary approach involving specialists in areas such as archaeology, biological anthropology, dentistry, biology, and medicine would be also desirable.

Another issue repeatedly mentioned throughout this symposium was the need to standardise the criteria for the evaluation of different variables considered as useful by researchers in different areas. This should involve clarification of the definitions of the variables and existing categorisations (scales used), so that data can be compared by researchers in different areas with confidence, and inter-sample variations recognised. For example, when analysing dental enamel hypoplasiae, it should be clearly stated which sort of lesions are included (e.g. lines, pitting, planes, etc.), the tooth type analysed, the degree of dental wear accepted for incorporation of elements into the analysis, the procedure chosen for the inclusion of contralateral information, etc. (Dobney and Goodman, 1991; Hillson, 1996, 2000; Hillson and Bond, 1997; Luna, 2008; Luna and Aranda, 2010; Ogden et al., 2007).

At the same time, the evaluation of metric characteristics of the tooth crown and neck for sex determination is an important aspect that needs much more research. Variations between populations in dental sexual dimorphism are recognised worldwide (Kondo and Townsend, 2004; Ling and Wong,

2007; Saunders et al., 2007; Schwartz and Dean, 2005). Some local samples also show significant differences in the size of permanent elements according to sex (Luna, 2008). This aspect offers a powerful way to gather demographic data from secondary, fragmented or relocated burials, as well as for subadult individuals.

Finally, there was a discussion about the implications of assessing differences in laterality, observed in antemortem tooth loss and in the degree of tooth wear, as an additional variable to analyse cultural aspects of use of the dentition and changes in food chewing habits.

In conclusion, this symposium demonstrated the current state of dental anthropology in Argentina. The contributions underlined some of the main problems that researchers in this field are dealing with. The dynamics of the research at the national level promises to generate an increasing flow of information in the near future, thereby contributing to the development of world archaeology by providing additional data and explanations from this southern American country.

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