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Biological Anthropology of Latin America Historical Development and Recent Advances

Edited by
Douglas H. Ubelaker and Sonia E. Colantonio

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ABSTRACT

Ubelaker, Douglas H., and Sonia E. Colantonio, editors. *Biological Anthropology of Latin America: Historical Development and Recent Advances*. *Smithsonian Contributions to Anthropology*, number 51, xiv + 385 pages, 24 figures, 67 tables, 2019. — Despite significant positive developments within topics of biological anthropology, archaeology, and related academic areas in Latin America, we noted a lack of coordination and communication among them. Available publications provide syntheses within different areas of biological anthropology, yet few have attempted integration of the distinct subfields. We decided to address the development and current issues of most major areas of Latin American biological anthropology in a single volume with chapters by distinguished, experienced scholars who live and work in Latin America, are knowledgeable about the topics, have published extensively on them, and who were recommended by specialists within six geographical regions of interest: Brazil and northeastern South America, Mexico, Central America, the Caribbean, northwestern South America, and southern South America. Six subdisciplines within biological anthropology were defined for academic coverage: (1) biodemography and epidemiology; (2) bioarchaeology and skeletal biology; (3) paleopathology; (4) forensic anthropology; (5) population genetics; and (6) growth, development, health, and nutrition. Though these six subdisciplines overlap to an extent, each offers a distinct history of development and presents unique issues to address. Chapters generally cover topics of history, the state of knowledge, methodological perspective, and areas in need of additional research. Although the text is in English, abstracts in English, Spanish, and Portuguese are included.

Cover image: Houses in the Caxiunã National Forest. Courtesy Hilton Silva.

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Paleopathology in Southern South America: Recent Advances and Future Challenges

Jorge A. Suby^{1} and Leandro H. Luna²*

ABSTRACT. Despite disparities among countries, paleopathology experienced a remarkable development in South America in recent years, including current theoretical approaches and new methodological procedures. More specialists in bone and dental paleopathology offered relevant information in local, regional, and international journals and conferences. Some southern South American countries, particularly Chile and Argentina, are leaders in the recent progress of paleopathology in the Americas. This paper summarizes the recent past and present of paleopathological research in southern South America and offers additional considerations about the challenges that need to be confronted in the near future.

RESUMEN. A pesar de una serie de diferencias existentes entre países, la paleopatología tuvo un notable desarrollo en Sudamérica durante los últimos años, incluyendo la incorporación de enfoques teóricos modernos y la aplicación de nuevas metodologías. Una mayor cantidad de especialistas en paleopatología ósea y dental han ofrecido información relevante, presentada en revistas y conferencias locales, regionales e internacionales. Algunos países del sur de Sudamérica, en especial Chile y Argentina, tienen una influencia fundamental en el reciente progreso de la paleopatología en América. En este trabajo analizamos el pasado reciente y presente de las investigaciones paleopatológicas en el sur de Sudamérica y ofrecemos consideraciones adicionales acerca de los retos que deben ser enfrentados en el futuro próximo.

RESUMO. Apesar das diferenças existentes entre os vários países, a paleopatologia teve nos últimos anos um notável desenvolvimento na América do Sul, tanto pela incorporação de abordagens teóricas atuais como pela aplicação de novas metodologias. O aumento do número de especialistas em paleopatologia óssea e dentária teve como consequência a produção de informações relevantes, apresentadas em revistas e conferências, locais, regionais e internacionais. Em especial o Chile e a Argentina tiveram uma influência fundamental no recente progresso da Paleopatologia na América do Sul. Este capítulo sintetiza o passado recente e o presente da pesquisa paleopatológica no sul da América do Sul, fornecendo considerações adicionais sobre os desafios que devem ser enfrentados no futuro próximo.

INTRODUCTION

As in other regions in the world, paleopathology has seen considerable development in South America since the second half of the twentieth century. New theoretical and methodological approaches have been introduced to the study of social, cultural, and

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biological influences on the health of past societies both before and during the colonial period. Primary results of this progress in paleopathological research include a greater number of specialists in interpreting evidence of past health; more scientific studies being undertaken at local, regional, and worldwide levels and more numerous international collaborations, which usually result in a higher quality of resources, broader knowledge and more broadly accepted interpretations.

South America is a large and heterogeneous continent with marked differences in economic and educational status between countries. In the past, the continent was inhabited by numerous human societies with profound biological and cultural differences, from highly stratified societies like the Incan Empire in the Andes, to small bands of hunter-gatherers like Selk'nam in Tierra del Fuego (Steward, 1963; Poole, 2008). This variability means that research in paleopathology is also amply diverse, depending on available resources and focusing on different aspects of past populations according to local and academic interests.

In this chapter, we describe and analyze the current status of paleopathology in Chile, Bolivia, Paraguay, Uruguay, and Argentina, the southernmost countries of South America. As is usual in this kind of review, it is a great task to gather all the published results from every country. For that reason, we opted to include only the most relevant investigations, particularly those reported during the last three decades, although in some cases previous research is included considering its importance in later local developments. It is not our intention to summarize the history of paleopathology in these countries, since this approach was partially or fully conducted in the recent past (for example, Castro and Aspillaga, 2004; Guillén, 2012; Mendonça de Souza and Guichón, 2012). On the contrary, we offer an integrated interpretation of recent investigations and, in our opinion, the most important challenges that paleopathology will deal with in this part of the world in the near future.

PALEOPATHOLOGY IN CHILE

Chilean paleopathology is one of the most developed in southern South America. Past populations from northern Chile received extraordinary attention, stimulating the current paleopathological perspective (Verano and Lombardi, 1999). This is probably because stratified and unequal Andean societies developed in this region over the course of about two millennia, and its climate promotes preservation of a great number of mummified and skeletal remains (Verano, 1997). A considerable number of studies were also performed on the remains recovered from southern Patagonia, including current Chilean and Argentinian territories. Regrettably, populations from other Chilean regions received less attention (Castro and Aspillaga, 2004). Some reviews of the most relevant results were presented by Munizaga (1974), Allison (1984), Moreno et al. (1993), Castro et al. (1997), Verano (1997), Castro and Aspillaga (2004), and Rothhammer and Llop (2004).

The studies in northern Chile were mainly centered on skeletal and mummified remains from the Arica and Tarapacá regions. As in other South American countries, like Peru or Ecuador, paleopathological research was initially led by foreign physicians and physical anthropologists, such as Aleš Hrdlička, Marvin Allison, Enrique Gerszten and Arthur Aufderheide, who stimulated the study of several collections of skeletons and mummies, offering much relevant information about cultural and biological aspects related to human health in pre- and post-Hispanic times. Most of these investigations continued with modern approaches by local or foreign researchers (Verano and Lombardi, 1999).

The studies of health mainly focused on evidence of several infectious diseases in northern Chilean populations. The detection of remains with signs of tuberculosis (Arriaza et al., 1995) was extremely important to explain its presence in pre-Columbian Andean populations. Chagas disease (Guhl et al., 1997, 1999, 2000; Ferreira et al., 2000; Aufderheide et al., 2004; Orellana-Halkyer and Arriaza, 2010), treponematosi (Allison et al., 1982; Standen and Arriaza, 2000a), leishmaniasis (Costa-Junqueira et al., 2009; Marsteller et al., 2011; Costa-Junqueira and Llagostera, 2014), pulmonary diseases like pneumonia (Aufderheide et al., 2002; Aufderheide et al., 2008), and non-specific infectious diseases (Kelley and Lytle, 1995; Aspillaga et al., 2006; Varela et al., 2006; Tótora Da-Glória et al., 2011) were also reported in several archaeological contexts. Paleoparasitological studies of internal and external parasites were also conducted in the last several decades (Ferreira et al., 1984; Goncalves et al., 2003; Reinhard and Urban, 2003; Arriaza et al., 2010a, 2012, 2013, 2014; Araújo et al., 2011; Rodríguez et al., 2011).

As in other stratified and highly populated societies, trauma was frequently evaluated in populations from northern Chile, where evidence of accidental, ritual-based, and violent injuries were studied, mostly from a paleoepidemiological and biocultural approach (Costa-Junqueira et al., 1998; Standen and Arriaza, 2000b; Lessa and Mendonça de Souza, 2004, 2006, 2007; Rosado and Vernacchio-Wilson, 2006; Torres-Rouff and Costa Junqueira, 2006; Varela et al., 2006; Standen et al., 2010; Torres-Rouff, 2011; Castelleti Dellepiane et al., 2014; Lessa, 2014; Lessa and Gaspar, 2014; Pacheco and Retamal, 2014). These papers show a process of increasing violence in certain strategically located areas of the landscape (such as the Atacama desert during the Middle Horizon [600–950 A.D.] and Late Intermediate Period [950–1400 A.D.], Lessa and Mendonça de Souza, 2004, 2006; Torres-Rouff and Costa Junqueira, 2006; Standen et al., 2010; Torres Rouff, 2011, Lessa, 2014), which affected individuals differently by sex, age, and social hierarchy, with traumatic lesions being more prevalent in young and middle adult males.

The effects of arsenic poisoning on the health of past human populations from Atacama was first suggested three decades ago, in studies showing teratogenic consequences on skeletal and mummified remains (Figueroa et al., 1988; Silva-Pinto et al., 2010; Boston and Arriaza, 2009; Arriaza et al., 2010b; Byrne et al., 2010). Other studies with important consequences analyzed

the impact of diseases related to activity patterns in northern Chilean populations, including auditory exostosis (Standen et al., 1995, 1997; Ponce, 2010), osteochondritis dissecans (Kothari et al., 2009; Ponce, 2010), and osteoarthritis (Silva-Pinto et al., 2013). Pathological conditions such as neoplastic (Sawyer et al., 1988, 1990; Gerszten and Allison, 1991), neurological (Gerszten and Martínez, 1995; Appenzeller et al., 2000; Gerszten et al., 2001; Carod-Artal and Vázquez-Cabrera, 2004), and oral diseases (Linossier et al., 1988; Rosado, 1998; Costa-Junqueira et al., 2004; Meller et al., 2009; Hubbe et al., 2012; Watson et al., 2013), as well as related paleodemographic analyses (Arriaza et al., 1988; Quevedo et al., 2000, 2003), also were documented and offered very valuable contributions to the comprehension of the variability of human adaptations.

In contrast, studies of health in past populations from southern Chile were less thoroughly analyzed, mostly with bioarchaeological or physical anthropological approaches. A review of this kind of information in southern Chile and Argentina, reported during the last three decades, was recently published by Suby (2014a). In general, due to the absence of cemeteries in pre-historical times and areas of inhumation with low numbers of individuals, mostly one per site, many researchers have studied skeletal collections from different archaeological sites, with or without chronological and geographical information. In contrast to the studies conducted in the north of the country, these analyses were mainly focused on the general health status of human populations. Pérez-Pérez and Lalueza Fox (1992), Guichón (1994), Aspillaga et al. (1999, 2006), Morano and Bucarey (2009), and Castro and Aspillaga (1991) described or quantified metabolic, oral, and articular diseases in human collections from southern Chile. Moreover, Constantinescu (1999, 1997) presented descriptive analyses of enthesal changes and articular disease in a skeletal collection from the insular and continental portions of the Magellan region. Paleopathological analyses of anemia (Suby, 2014b) and vertebral joint disease (Suby, 2014c) were carried out in skeletons recovered in the southern territories of both Chile and Argentina.

Several descriptive and quantitative analyses of oral health, metabolic disease, trauma, and osteoarthritis in human remains were published during the last decade, such as the studies of the skeletons recovered in Cabo Nose (Alfonso-Durruty et al., 2011), Cañadón Leona 5 (L'Heureux and Amorosi, 2009), and Cerro Sota (L'Heureux and Amorosi, 2010), located in the Magellan region of Chile. Regarding infectious diseases, Saez (2008) documented possible cases of tuberculosis in native populations from Chiloé as a result of contact with European settlers during the colonial period and suggested that this disease was a primary cause of morbidity and death.

PALEOPATHOLOGY IN BOLIVIA

Paleopathological research in Bolivia is much less developed. A review of the most important paleopathological analyses

was summarized by Rio Dalenz and Vincenty (2007). As with others from southern Peru and northern Chile, remains from western Bolivia were initially studied by foreign scientists in the nineteenth century. Bandelier (1904) recovered and anthropologically studied trephined skulls from Aymará sites, which were sent to the American Museum of Natural History (New York) and were later studied by Aleš Hrdlička. Most current paleopathological studies continue to focus on human remains from the Aymara populations, mainly through studies of mummies. For example, Suarez Morales (1967) reported serologic analyses of 10 mummies housed in the National Museum of Archaeology in La Paz, all corresponding to blood group 0, which is similar to other findings in Latin America. More recently, Mendonça de Souza et al. (2008) studied a mummified body of a seven-year-old child, with the possibility of perimortem trauma and tuberculosis. Moreover, Vincenty (2004) offered descriptive macroscopic, radiological, and histological results of five pre-Inca mummies from Potosí and Oruro, and identified cases of thyroid goiter, congenital anomalies (probable atrophy), infant hydrocephaly with trepanation, scoliosis, fibroma, and a sharp trauma with hemorrhage. Virus HTLV-1—responsible for leukemia and lymphoma in adults and for tropical spastic paraparesia—was molecularly identified in bone marrow of mummies of ca. 1500 BP housed in the Archaeological Museum R. P. Gustavo Le Paige of San Pedro de Atacama (Li et al., 1999).

Céspedes and Villegas (1976) visually and radiographically studied 418 pre-Columbian non-adult and adult skulls housed in the National Museum of Archaeology of La Paz, Regional Archaeological Museum of Tiwanaku, and Anthropological Museum Eduardo López Rivas of Oruro, in order to identify dental and cranial pathologies. The authors described and quantified several types of dental anomalies, such as transpositions, supernumerary teeth, teeth displaying gigantism and dwarfism, retentions, caries, dental calculus, granulomas, antemortem tooth loss, and attrition. They also described trepanations and the frequencies of wormian bones.

The study of infectious diseases was also explored in Bolivian remains. Paleoparasitological studies mention that Chagas disease—an infectious illness with great implications for sanitation in South America even today—originated in the Bolivian highlands as a consequence of the adoption of sedentary habits by prehistoric human groups (Araújo et al., 2013). Moreover, a study performed by a German-Bolivian team on 123 pre-Hispanic skeletons from the Loma Salvatierra site in the northern lowlands (Prümers et al., 2012) showed a high degree of degenerative joint disease, absence of evidence of violence, frequent indicators of anemia (i.e., cribra orbitalia and porotic hyperostosis) and signs of bone infections. Two of those skeletons showed sabre-shin tibiae and signs of Hutchinson's disease in the incisors, which was interpreted as being caused by a treponemal disease, possibly venereal syphilis, based on morphological and molecular results (Prümers et al., 2012). Ponce Sanjinés (1982) interpreted humped figures of ceramic iconography from the Americas as cases of vertebral tuberculosis. Finally,

some paleopathological analyses of camelid and bovine remains recovered from colonial sites in Potosí showed degenerative changes to phalanges, vertebrae, tarsals, limb elements, and ribs (Defrance, 2008). Most of the scarce paleopathological research in the country is primarily descriptive in nature, although this trend is starting to be reversed through the development of more integrative and interpretative research.

PALEOPATHOLOGY IN PARAGUAY

Despite the many anthropological studies on populations of the Aché and other related ethnic groups (e.g. Hill et al., 1984, 1985, 1987, 1997, 2007; Bribiescas, 2001; Gurven et al., 2001; Hurtado et al., 2003; Tsuneto et al., 2003; Walker and Hill, 2003; Dornelles et al., 2004; Schmitt et al., 2004), very little paleopathological data are available for indigenous groups from Paraguay. Among the most important is that of a postcranial skeleton of a 15-year-old girl known as “Damiana,” who was kidnapped after the assassination of her family in 1896 and died of tuberculosis. In 2010, the Natural Science Museum of La Plata, Argentina, returned her remains to the Aché community. Later, the skull of this skeleton was identified in the anatomical collection of Charité, in Berlin (Koel-Abt and Winkelmann, 2013). Paleopathological analyses were conducted, showing signs of stress-like cribra orbitalia and dental enamel hypoplasia, as well as endocranial impressions that were interpreted as the result of tuberculous meningitis (Koel-Abt and Winkelmann, 2013).

PALEOPATHOLOGY IN URUGUAY

Anthropological disciplines, including paleopathology, are quite recent in Uruguay (Figueiro, 2014). The main focus of skeletal research comprises mortuary practices, age and sex estimation, diet and molecular analyses for studying biological distance among populations, and in some cases, descriptive references of bone and dental pathologies (for example, see Sans et al., 1997, 2012; Moreno et al., 2014; chapters in López Mazz and Sans, 1999). However, systematic paleopathological studies, as in Paraguay and Bolivia, are still uncommon.

The studies produced in the last twenty years were mainly concerned with establishing the health status of past populations. Most studies used samples from east and west regions of the country, analyzing oral stress indicators (e.g., caries and linear enamel hypoplasia), signs of non-specific bone infections, anemia (cribra orbitalia and porotic hyperostosis), Harris lines, and muscular stress markers (Portas and Sans, 1995; Sans et al., 1997; Sans, 1999; Calabria, 2001). Some studies on osteoarthritis, Schmorl's nodes (Sans, 1999) and trauma (Pintos and Bracco, 1999; Gascue, 2009; Gianotti and López Mazz, 2009; Cabrera et al., 2014) were also reported, most of which are mainly descriptive because of small sample size. However, efforts for systematization appeared in recent years (for example see Figueiro, 2014).

The general trends identified show few differences between sexes, with an increase in mechanic and oral pathologies with age and trauma through time (Gianotti and López Mazz, 2009; Cabrera et al., 2014). Some exceptions are highlighted considering oral health for late pre-Hispanic societies, with variations inferred in diet composition between males and females, and among different individuals buried in the same site (Sans, 1999). Finally, a recent contribution from forensic anthropology about rights violations also adds relevant information about perimortem lesions (López Mazz et al., 2014).

PALEOPATHOLOGY IN ARGENTINA

As in Chile, paleopathological studies of past populations from Argentina have seen remarkable progress since 1980, especially during the last two decades. In contrast to research developed in northern Chile, research in Argentina is strongly influenced by the North American bioarchaeological approach (e.g., Buikstra, 1977; Buikstra and Cook, 1980; Buikstra and Beck, 2006; Cook and Powell, 2006), probably due to the development of important and numerous long-term archaeological programs, as well as the number of grants awarded in Argentina. In fact, most of the students working in paleopathology in the country are archaeologists. For that reason, taphonomical and mortuary issues are constantly included as part of paleopathological studies (Aranda and Luna, 2012; see chapters in Luna et al., 2014a).

Mendonça de Souza and Guichón (2012) offer a review of the history of paleopathology in Brazil and Argentina. Also, the most recent advances of bioarchaeological studies of past human populations from Argentina were recently summarized (Aranda and Luna, 2012; Luna and Suby, 2014). As described in those articles, paleopathological research received increasing attention during the last two decades as part of bioarchaeological studies, focusing on the health of past populations from a biocultural approach in all regions of Argentina. Many of them include modern methodological and analytical procedures, together with regional and anthropological approximations. The investigations are very prolific, so the articles mentioned in this section are only a small part of the whole body of paleopathological research in the country. In the last two decades, Argentinean research in paleopathology reached international scientific standards, and, as a consequence of that, it began to gain recognition in the rest of the world. As an example of this process, many studies were published in international journals, encompassing the analysis of multiple lines of evidence, including those from the northwest (Arrieta et al., 2014; Seldes and Botta, 2014; Luna et al., 2015; Gheggi, 2016), the center of the country (Fabra and González, 2015; Fabra and Salega, 2016), the western center (Bernal et al., 2007; Gómez Otero and Novellino, 2011; Ponce and Novellino, 2014), the Pampa (Luna et al., 2008; Luna and Aranda, 2014; Scabuzzo, 2012), northern Patagonia (Flensburg, 2011a; Flensburg, et al., 2013; Gordon, 2015), the central coast of Patagonia (Gomez Otero and Novellino, 2011), and southern Patagonia

(Suby and Guichón, 2009; Suby et al., 2009, 2017; Suby, 2014b, 2014c). Paleopathological studies in all these regions were usually oriented to the study of the health status of past human populations through metabolic and oral diseases, in some cases considering current theoretical and methodological approaches and integrating different variables on a comparative perspective (García Guraieb, 2006; Seldes, 2006; Luna, 2008; Suby et al., 2013; Suby, 2014b; González Baroni, 2014).

In addition, some studies were aimed at specific diseases. Tuberculosis was suggested in pre-Columbian remains from the northwest and south of Argentina (Arrieta et al., 2011, 2014; García Guraieb 2006; Guichón et al. 2015) and treponematosi in southern Patagonia (García Guraieb et al., 2009; Castro et al., 2008), as well as cases of osteomyelitis (Flensburg et al., 2013). Degenerative joint disease of the vertebrae was specifically studied in the center of the country (Fabra et al., 2014) and in Patagonia (Suby, 2014b). Oral pathologies were frequently studied in different areas of the country, including analyses of oral pathologies such as caries, periodontal disease, abscesses, calculus, antemortem tooth loss, dental wear (L'Heureux, 2002; Novellino, 2002; Novellino et al., 2004; Bernal et al., 2007; Menéndez, 2010; Bernal and Luna, 2011; Flensburg, 2011a; Gómez Otero and Novellino, 2011; Luna and Bernal, 2011; Gheggi, 2012; Miranda, 2012; García Guraieb and Maldonado, 2014; Luna and Aranda, 2014; Miranda and Fuchs, 2014) and physiological stress (enamel hypoplasia; e.g., Novellino and Gil, 2004; Luna and Aranda, 2010). In general terms, the results are compatible with trends identified in other regions of the world:

hunter-gatherer societies show high wear rates, periodontic reactions, calculus, antemortem tooth loss, and low prevalence of caries; on the other hand, individuals from agricultural societies exhibit lower dental wear and a higher frequency of caries. In both types of societies, differences between sexes are minimal.

In recent years, systematic research about violence patterns from a paleopathological perspective were fulfilled in different regions of Argentina (Barrientos and Gordon, 2004; García Guraieb et al., 2007; Flensburg, 2011b; Gheggi and Seldes, 2012; González Baroni, 2013; Berón, 2014; Gordón, 2015; Politis et al., 2014). Finally, analyses about neoplastic (Luna et al., 2008, 2015; Figure 1) and congenital diseases (Fabra and Salega, 2016) are very scarce but have been recently published. The comparative results usually show striking differences between hunter-gatherer and agricultural societies, as expected, but also a high variability within them, related to sex and age variation in some of the variables considered, mainly degenerative joint disease and oral health. Some divergent trends were identified related to the second line of analysis (e.g., Miranda, 2012; Fabra et al., 2014; Luna and Aranda, 2014), which offer support for the high diversity of each mode of subsistence. In this sense, more integrative paleopathological research is needed in order to better comprehend the different pathways covered by the pre-Columbian societies in various temporal and spatial settings.

In contrast to studies of skeletonized remains, mummified remains were much less frequently analyzed (Fernandez et al., 1999; Previgliano et al., 2003; Wilson et al., 2007, 2013; Cortals et al., 2012), contrasting with the long-standing tradition



FIGURE 1. Left os coxae lateral view of a middle adult male from the Pukara de la Cueva site, Jujuy province, northern Argentina, showing nodular and irregular bone outgrowth probably corresponding to metastatic prostate cancer (see Luna et al., 2015). Photo: Leandro Luna.

of mummy studies from Peru and Chile. Identified modern skeletal collections, such as those of Chacarita (Bosio et al., 2012) and Lambre (Salceda et al., 2009, 2012), are being formed with individuals who died during the twentieth century and offer relevant results to the study of bone pathologies (Plischuk and Salceda, 2011; Plischuk, 2012; Plischuk et al., 2014), sex and age-at-death methods (García Mancuso, 2013; Desántolo, 2013), and differential preservation (Luna et al., 2012).

Directly related to paleopathology, forensic anthropology, working on the documentation of human rights violations, has had an outstanding development in Argentina since the 1980s as a result of the need to identify skeletal remains of individuals assassinated during the last military government of 1976–1983. The Argentine Forensic Anthropology Team (Equipo Argentino de Antropología Forense [EAAF]) is recognized worldwide as one of the pioneers and leaders in this field, also contributing to the identification of skeletal pathologies (EAAF, 1990, 2009; Olmo and Salado Puerto, 2008).

THE PRESENT STATE AND FUTURE CHALLENGES IN SOUTHERN SOUTH AMERICAN PALEOPATHOLOGY

Paleopathological studies of southern South American populations made significant progress during the last century, with a great potential to continue contributing important data to the understanding of ancient diseases. Changes in theoretical approximations led to tremendous improvements in social and biological explanations from a bioarchaeological perspective since the 1980s. The examination of stratified and non-stratified societies from different historical contexts of the sub-continent offers invaluable insights about the evolution of many diseases that affect humankind and its relationship with social and biological factors in the present. Some evidence of that can be found in the important discoveries about tuberculosis during the 1970s and 1980s in South American remains, which forced reconsideration of the spread of this complex disease through time. In the same way, the information provided by the studies of mummies from Chile and Peru were, and still are, central to understanding some diseases only present in such remains.

As in other regions of the world, paleopathology had a promising beginning in the late nineteenth century. However, in some countries, studies were performed by foreign scholars, with or without local professional participation, and sometimes with relatively little involvement in the social problems of the working areas. In many cases, research was not sustained during the majority of the twentieth century. More constant and valuable data derived from fully scientific approaches began to emerge only in the last three or four decades. As a result, some countries show scarce paleopathological production, especially within the international literature.

The bright side is that the twenty-first century offers new opportunities to increase paleopathological research in South

America. In the first place, advances in internet communication allow bridges to be built between distant researchers much more easily than before. As a consequence, information travels and is shared faster with anyone with enough interest, and collaborative research projects among researchers of different countries from South America and all around the world is now a more affordable possibility. Travel is not always necessary, and academic efforts can be integrated with economic resources. This is a major issue for southern South American countries, whose economic resources are usually lower in comparison to North American and European countries.

During the last decade, new discussion forums were created. The Paleopathology Association Meetings in South America (PAMinSA) started in 2005 in Rio de Janeiro, Brazil, and provided a great opportunity not only to show the regional scientific research to foreign scholars, but also to spread paleopathological resources from more developed regions to others that need encouragement for their emerging efforts. The participation of internationally recognized specialists in paleopathology and bioarchaeology surely provide significant help to promote these meetings, and will probably be important to sustain them in the future. Chile and Argentina were hosted these meetings in 2007 and 2009 respectively. They returned to Argentina in 2015 and were held again in Chile in October 2017 and in Brazil in 2019. In between, Peru (2011) and Colombia (2013) hosted PAMinSA (www.quequen.unicen.edu.ar/paminsa/).

Disparity in production is not only regional, but also topic-related. In some cases, as in northern Chile, paleopathological studies are centered on specific diseases and cases. An exception is trauma analysis, which has been a very prolific focus of attention. In contrast, in southern Chile, Argentina, and Uruguay, energy was focused on the study of multiple stress markers to understand changes in the health status of human groups. Primarily, changes in health indicator prevalence in a spatial and temporal perspective were explored, in relation to the exploration and colonization of new ecosystems, demographic changes, dietary patterns (e.g., introduction of agricultural practices and new resources as result of the European conquest), and socio-cultural variations (e.g., those produced by the contact between natives and Europeans). Many of these results are published in international journals, while others are communicated in indexed local or regional publications, in many cases with free access by scholar networks such as www.scielo.org, which gathers the information of a great number of scientific journals from Latin America, Portugal, and Spain.

Pre-Hispanic populations from South America were culturally and socially very diverse, varying from very stratified and unequal societies to low-density hunter-gatherers adapted to very different ecological settings. The stratified societies exhibited high demography dynamics, overcrowding, high prevalence of infectious diseases, interpersonal violence, and human sacrifices, while the hunter-gatherers demonstrated varying frequencies of non-specific stress indicators such as enamel hypoplasia, cribra orbitalia (Figure 2), porotic hyperostosis and Harris lines.



FIGURE 2. Active *cribra orbitalia* in a skull from Tierra del Fuego island, Argentina. Photo: Jorge Suby.

Because of this variability, bioarchaeological records of past societies are dissimilar in many regions of South America. While in some places hundreds of skeletons could be studied, in others, only a couple dozen are available, which forces the adjustment of aims, methods and perspectives. But even in those cases, valuable information has been reported and is enthusiastically welcomed in international meetings and journals.

New challenges will emerge in the coming years. High level and original scientific production is being created in some southern South American countries, such as Chile and Argentina, with increasingly higher international impact, although this goal still needs to be deepened and spread to the other countries in the region. In many cases, the most recent theoretical and methodological advances are systematically incorporated into bioarchaeological and paleopathological research, providing rigorous results. Interdisciplinary interaction in paleopathological studies needs to be deepened, although this is not exclusively a regional problem (Mays, 2012). In this matter, research groups completely oriented to paleopathological studies that include multiple kinds of data (archaeological, biological, medical, among others), are not yet common in southern South America and need to be addressed in the near future. More participation of South American scholars in international forums, such as the Paleopathology Association (PPA) meetings of North America and Europe, is another aspect required in order to create new collaborative bonds and to promote regional results and discussions, which in some cases are so isolated that they do not register on the international scene. Economic constraints of South American countries are an omnipresent obstacle to this aspect. Finally, another important issue to be highlighted is the need for

the creation of methodological consensus regarding the criteria for the evaluation of variables, in order to ensure that the results generated by different researchers are comparable (Luna et al., 2014b).

In conclusion, paleopathology in southern South America shows significant scientific dynamics, especially in countries like Argentina and Chile, and an accelerated development is expected in the coming years, with high-quality articles. In the remaining countries, research potential is remarkable, since they offer adequate samples, and the main goal is to achieve the formation of local specialized resources on the academic and societal levels that address paleopathological problems from a population perspective.

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