

Introduction to the special issue **Actualistic Taphonomy in Argentina: Current Status of the Research and Future Perspectives**

Daniela Alunni*

*Centro Austral de Investigaciones Científicas (CADIC-CONICET)
Bernardo Houssay 200, Ushuaia, Tierra del Fuego, Argentina*

María Clara Álvarez

*Investigaciones Arqueológicas y Paleontológicas del Cuaternario Pampeano
(INCUAPA-CONICET), Facultad de Ciencias Sociales
Universidad Nacional del Centro de la Provincia de Buenos Aires (FACSO-UNICEN)
Del Valle 5737, Olavarría, Buenos Aires, Argentina*

Journal of Taphonomy 15 (1-3) (2017), 1-9.

Introduction

One of the aims of zooarchaeology is to recreate the relationships between humans and animals in the past. Most of the time, such interactions are inferred from “complex patterns of multiple agents *signatures* in bone assemblages” (Gifford-González, 1991:217). The understanding of these patterns is found in the modern world, where researchers can observe the processes in action and then establish causal relations between them and their effects. This allows inferring similar processes for similar effects in fossil contexts, throughout the use of relational analogy (Lyman, 1994; Pobiner & Braun, 2005).

Actualistic taphonomy studies search for clues in modern patterns and processes which are helpful in investigating the fossil record. As proposed by Marean (1995), researchers use observations from naturalistic studies to establish relations between actors and their effects on the bones. Then, experimental studies can be conducted to control the link between the actor and the trace. The result is a strong deductive interpretation of the archaeological effects.

Due to its geographic variation, both latitudinal and altitudinal, Argentina is a country with a high diversity of environments and landscapes (Figure 1). These include extreme arid regions, savannas, grasslands, tundra, and rainforests -among many others-

which define a high number of different ecoregions (*e.g.*, Puna, Pampas, Marshes, Patagonian steppes, Patagonian forests). Each of these environments and faunal communities are associated with specific taphonomic processes that shape and configure the faunal assemblages.

Before 1980s, taphonomic studies were not included within the scope of the archaeological projects in Argentina. After that decade, taphonomy gained strength in the field of zooarchaeological research, when investigations on faunal remains became more systematic (Borrero, 1988; Mengoni Goñalons, 2007). During late 1980s and early 1990s, actualistic research was mainly based on naturalistic approaches (Borrero, 1988). First studies were focused in the high latitudes of Patagonia (Tierra del Fuego) with the aim of evaluating the potential of contamination and preservation of archaeological contexts, as well as the dynamic of the ecosystems under study. Following a regional approach (Borrero, 1988, 1990), taphonomic analyses assessed the rates of carcass and bone decay and the natural distribution of faunal remains through the landscape. Thus, one of the scopes was to recognize modern taphonomic processes acting within a broad spatial scale to identify the “background noise”. Inspired by this perspective of “regional taphonomy” (*sensu* Borrero, 1988), many other taphonomic works focused on vertebrates were later conducted in Patagonia (*e.g.*, Belardi, 1999; Mameli & Estévez, 1999-2000; Estévez & Mameli, 2000; Guichon *et al.*, 2001; Borella, 2004; Cruz, 2006; Martin, 2013; Mondini & Muñoz, 2014; Marchionni, 2016).

The 1990s decade witnessed a gradual growth of taphonomic studies, and the research problems varied according to the characteristics of the archaeological record

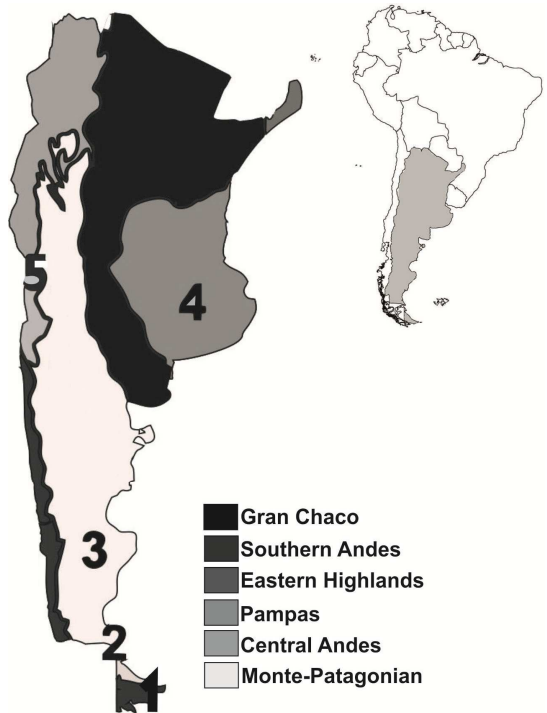


Figure 1. Map of Level I Ecoregions of Argentina (modified from http://ecologicalregions.info/html/sa_eco.htm). The numbers are the places where naturalistic studies were conducted (1) southernmost tip of Tierra del Fuego; (2) Strait of Magellan; (3) central plateau of Santa Cruz; (4) central Pampas; (5) Mendoza.

in each region. Following a landscape approach, large-scale studies continued to be developed in Patagonia (Cruz, 1999). The aim was to account of the variability of zooarchaeological assemblages in relation with the geological processes acting within a heterogeneous space. On the other hand, research conducted in the Pampas was oriented to understand the processes acting in this vast region, as well as to explain the differential bone preservation in archaeological sites (Politis & Madrid, 1988; Barrientos, 1991; Gutiérrez, 1998). The early studies

carried out in this area focused on taphonomic effects and site scale, but also including diagenesis as part of burial processes (Gutiérrez, 1998). At the same time, other taphonomic studies were carried out in the high-altitude deserts (the Puna), mainly oriented to bone preservation and carnivore taphonomy in the context of occupational alternation of humans and other predators in caves (*e.g.*, Nasti, 1991, 1995; Olivera *et al.*, 1991-92; Mondini, 1995). Finally, beyond these regional studies, some efforts were made to constructing frames of reference, for example, bone mineral content for camelids for exploring the relationship between intrinsic bone properties and differential survivorship (Elkin & Zanchetta, 1991; Elkin, 1995).

From the year 2000 to the present, naturalistic and experimental approaches have spread out and incorporated diverse ecological settings and case studies (*e.g.*, Massigoge & González, 2012). Among the main issues are: bone modification patterns produced by carnivores (*e.g.*, Montalvo *et al.*, 2007; Borrero & Martin, 2012; Gutiérrez *et al.*, 2016a; Mondini, 2017) and diurnal and nocturnal birds (*e.g.*, Gómez, 2000; Fernández *et al.*, 2009; Montalvo *et al.*, 2011; Ballejo *et al.*, 2012; Quintana, 2015); natural accumulation and preservation of bones in different environmental units (*e.g.*, Belardi & Carballo Marina, 2003; Acosta *et al.*, 2004; Borella, 2004; Quintana, 2004; Cruz, 2009; Otaola, 2014; Massigoge *et al.*, 2015); dispersion and disarticulation processes of marine and terrestrial mammals (*e.g.*, Borella, 2004; Borella & Muñoz, 2006; Borella & Borrero, 2010); diagenetic processes (Gutiérrez 2001; Gutiérrez *et al.*, 2001); the role of water in the formation of the faunal record in fluvial and lacustrine environments (*e.g.*, Kaufmann & Gutiérrez, 2004; Nasti, 2005;

Gutiérrez & Kaufmann, 2007; Kaufmann *et al.*, 2011); the influence of the intrinsic bone properties on bone preservation (*e.g.*, Fernández *et al.*, 2001; Cruz & Elkin, 2003; Álvarez *et al.*, 2010; Gutiérrez *et al.*, 2010; González *et al.*, 2012); experimental and naturalistic studies on weathering effects on the bones (*e.g.*, Massigoge *et al.*, 2010; Cruz, 2014; Gutiérrez *et al.*, 2016b); and the use of taphonomy for conservation biology (*e.g.*, Fernández & Forlano, 2009). Of course, many other topics and subjects are being explored but we cannot mention them all. Moreover, in the last decades, taphonomic studies have expanded to other types of materials besides bones, such as lithic and ceramic (*e.g.*, Borrazzo, 2006; Ozán & Berón, 2016). This led to propose the importance of an interactive use of the different markers, a concept defined as *unrestricted taphonomy* (Borrero, 2011:269).

In October 2016, the *IV National Zooarchaeology Conference of Argentine -IV Congreso Nacional de Zooarqueología Argentina-* was held in Ushuaia (Tierra del Fuego, Argentina), organized by Drs. Mónica Salemme, Fernando Santiago, Martín Vázquez, Angélica Tivoli and Francisco Zangrando. This conference had three symposiums, one of which was called *New Perspectives in Actualistic Taphonomy in Argentina: Limitations, Contributions, and Archaeological Implications*. The aim of this symposium was to gather the results of recent advances in actualistic taphonomy in Argentina and to discuss the contributions and limitations of this approach, as well as its implications to the zooarchaeological record. The symposium had an important convene with 14 presentations. These represent a wide variability of topics including both experimental and naturalistic studies in different environments (coasts, plains, hills,

etc.), the analysis of the effects of several taphonomic agents (rodents, carnivores, earthworms, birds, among others), and the development of diverse approaches and innovative methods in actualistic taphonomy.

The conference presentations exemplify innovative and significant contributions to actualistic taphonomy and are useful to a wide public all over the world. For this reason, we consider that this was a good opportunity to put them together in a special issue and we contacted the editors of *Journal of Taphonomy*, who generously accepted our proposal. Eight of the 14 papers presented at the conference are published in this volume. All of them deal with different case studies and methodological approaches. Topics such as environmental conditions, patterns of gross damage, and skeletal element survivorship, they all provide actualistic analogues to eventual conditions in prehistoric times in different environments to assist in the interpretation of fossil assemblages.

The first article is the only experimental study of this special issue and it is addressed by Escosteguy and Fernández. These authors conduct an innovative methodological design to evaluate the action of edaphic macrofauna species (earthworms) as disturbing agents on archaeological sites of the Pampas. To achieve this goal, they study the displacement of different bone remains, the depth of the movements, and the seasonality of earthworm activity. The most important results warn about horizontal and vertical movement produced by earthworms and the variability in such displacements through cold and warm seasons. It is also noteworthy that there were no modifications on the bone cortical surfaces. This research alerts about the bone movement produced by edaphic animals and their incidence on the spatial arrangement of fossil assemblages,

especially those composed of small-sized vertebrates.

Five of the articles of this issue deal with naturalistic approaches, two of which develop studies on the integrity of bone assemblages, as well as the accumulation of faunal remains under specific environmental contexts. Marchioni and coauthors evaluate the state of preservation of a modern dense concentration of sheep bones (*Ovis aries*). These remains were deposited in a cave located in an archaeological locality (Los Toldos), situated in the central plateau of the Santa Cruz Province. This accumulation may have been the result of a catastrophic death in the cave. The authors provide with important information on the different agents and processes involved in the accumulation and spread of faunal remains, as well as the mortality profile resulting from this type of event. These data are useful parameters to take into consideration when analyzing bone assemblages recovered from cave contexts. On the other hand, Borella and Borrero conduct taphonomic analyses on a bone assemblage resulting from massive stranding of False Killer Whales (*Pseudorca crassidens*) occurred in 1989 in the Strait of Magellan. These authors present a sequence of disarticulation for whale carcasses, providing relevant data on weathering process and the bone dispersal. This study offers useful information to generate predictions about the incorporation and modification of naturally deposited whale parts in the coastal archaeological deposits, as well as to discuss its consumption by the human groups in the past.

Systematic observations were conducted by Alunni and coauthors at high latitude and cold climate forested environments from the southern coast of Tierra del Fuego. The main purpose of this research is assessing

natural bone dispersion and taphonomic modifications of vertebrate bone remains. These authors focus on guanaco (*Lama guanicoe*) remains, which are frequently found in the archaeological sites. Other topics addressed by the authors are the accumulation, dispersal, and preservation of guanaco bones in different coastal environments, and the local availability of this camelid in the past. Results indicate the differential incorporation of modern bones through different sub-environment, as well as time-averaging of faunal assemblages from the sites located in the coast.

Álvarez and coauthors describe the pattern of thermal alteration of a modern sample of bones collected after a natural grassland fire in the Pampas region of Argentina. This study is important because burning is commonly associated with anthropogenic activities when present in the fossil record. The authors note that natural grassland fires generate changes in color and texture in the cortical surface of bones of different-sized animals. The results discuss different diagnostic criteria to differentiate between natural grasslands and other anthropic activities.

The role of two predatory bird species (*Geranoaetus melanoleucus* and *G. polyosoma*) in small mammal bone accumulation is evaluated by López and coauthors. The sample consisted of pellets collected in different localities at Mendoza province. The authors analyze the breakage patterns and the digestive corrosion and categorize this bird according to the damage that produces. Results allow distinguishing accumulations generated by *Geranoaetus* from those made by other predators that inhabit sympatrically the study area. Moreover, these data can be used as an analytical model for the interpretation of the

micromammal fossil assemblages from archaeological sites.

Morales and coauthors develop and innovative method to evaluate the state of bone preservation. The aim of this study is to explain the overrepresentation of distal and proximal epiphyses of guanaco long bones found in many open-air archaeological contexts from Southern Patagonia. These researchers assess the relationship among subaerial weathering, bone mineral density, and cortical thickness through a microscopic metrical analysis. The sample consists of partial cross-sections of modern radius-ulna with different weathering degrees. This is a valuable contribution that shows how the variability in weathering rates on diaphysis and epiphyses could explain the differential preservation and the archaeological patterns recorded in the sites.

Finally, based on a bibliographic survey, Mondini exemplifies the growing of the actualistic studies on carnivore taphonomy in Argentina during the last four decades. This author compiles the available *corpus* of data and reviews the studies on native mammalian carnivores. Different aspects, such as the set of most studied carnivore species, the actualistic approaches applied, and the most studied environments, among others, are discussed by the author. In this contribution, Mondini emphasizes the valuable studies conducted on carnivore taphonomy but she advocates for a greater application of these data to the archaeological assemblages.

As reflected in this special volume, taphonomic studies with actualistic approaches are undergoing substantial developments in Argentina. Several topics are being studying by using different methods and techniques. From this brief analysis, we consider that this discipline will continue its strong growth in the future. In this sense, as a

conclusion, in our opinion some perspectives still need to be explored or completed. These are the naturalistic and experimental study of some particular agents and/or processes whose action is not still known in detail (e.g., sedimentary abrasion, root action); the site formation processes of particular archaeological contexts (e.g., shell middens); the modification patterns generated by different agents (many of which have or are being studied); the development of actualistic studies in regions of Argentina where these analyses are scarce or null (e.g., San Luis). We strongly believe that in a few years most of these lines will be covered.

As we can notice, most of the actualistic researches aroused to answer specific archaeological questions or to solve particular regional queries. Results are outstanding so far but we still need to move to the following step, so that taphonomic results need to be integrated to the archaeological interpretations. Taphonomy done only for taphonomists is of limited scope and places it far from its desirable role in archaeology. Once archaeologists can understand that taphonomy add valuable information to our interpretations and not just judge the integrity of the archaeological records, only then taphonomic results will be broadly accepted and integrated.

Acknowledgments

We are extremely grateful to the *Journal of Taphonomy* editors, Luis Alcalá, Manuel Domínguez-Rodrigo and Travis Pickering who kindly accepted our proposal to publish this special volume. María A. Gutiérrez advised and participated in different stages of our taphonomic research and encouraged us to conduct the symposium. Thank you to

all reviewers and the authors for their contributions, and to the organizers of the *IV Congreso Nacional de Zooarqueología Argentina*. María Gutiérrez, Cristian Kaufmann and Atilio Francisco Zangrando provided insightful comments on the draft of this introduction.

References

- Acosta, A., Loponte, D., Durán, S., Musciolo, L., Musali, J., Pafundi, L. & Pau, D. (2004). Albardones naturales vs. culturales: exploraciones tafonómicas sobre la depositación natural de huesos en albardones del nordeste de la provincia de Buenos Aires. In (Martínez, G., Gutiérrez, M.A., Curtoni, R., Berón, M. & Madrid, P., eds.) *Aproximaciones Arqueológicas Pampeanas. Teorías, Métodos y Casos de Aplicación Contemporáneos*. Olavarría: Facultad de Ciencias Sociales, UNCPBA, pp. 77-91.
- Álvarez, M.C., González, M., Massigoe, A., Kaufmann, C.A. & Gutiérrez, M.A. (2010). La densidad mineral ósea y la variabilidad ontogénica en guanaco (*Lama guanicoe*). Implicancias para la construcción de marcos de referencia en zooarqueología. In (Gutiérrez, M.A., De Nigris, M., Fernández, P., Giardina, M., Gil, A., Izeta, A., Neme, G. & Yacobaccio, H., eds.) *Zooarqueología a principios del siglo XXI: Aportes teóricos, metodológicos y casos de estudio*. Ayacucho: Libros del Espinillo, pp. 95-106.
- Ballejo, F., Fernández, F.J. & De Santis, L.J.M. (2012). Tafonomía de restos óseos provenientes de egagrópilas de *Coragypsatratus* (jote de cabeza negra) en el Noroeste de la Patagonia argentina. *Revista del Museo de Antropología*, 5: 213-222.
- Barrientos, G. (1991). Hacia la aplicación de un enfoque tafonómico regional en el Área de la Depresión del Río Salado (Pcia de Buenos Aires). *Boletín del Centro* 2: 29-39.
- Belardi, J. (1999). Hay choiques en la terraza. Información tafonómica y primeras implicaciones arqueofaunísticas para Patagonia. *Arqueología*, 9: 163-185.
- Belardi, J.B. & Carballo Marina, F. (2003). Tafonomía regional en la cuenca media del río Coyle (Santa Cruz, Patagonia Argentina). *Intersecciones en Antropología*, 4: 59-73.
- Borella, F. (2004). *Tafonomía regional y estudios arqueofaunísticos de cetáceos en Tierra del Fuego y Patagonia meridional*. British Archaeological Reports, Oxford.

- Borella, F. & Muñoz, S. (2006). Observaciones tafonómicas sobre restos de pinnípedos en la costa norte fueguina (Argentina). *Intersecciones en antropología*, 7: 399-403.
- Borella, F. & Borrero, L.A. (2010). Observaciones tafonómicas acerca de la desarticulación de carcasas de pinnípedos en ambientes litorales, el caso de Islote Lobos (Golfo San Matías, Río Negro). In (Gutiérrez, M.A., De Nigris, M., Fernández, P., Giardina, M., Gil, A., Izeta, A., Neme, G. & Yacobaccio, H., eds.) *Zooarqueología a principios del siglo XXI: aportes teóricos, metodológicos y casos de estudio*. Buenos Aires: Libros del Espinillo, pp. 371-379.
- Borrazzo, K. (2006). Tafonomía lítica en dunas: una propuesta para el análisis de los artefactos líticos. *Intersecciones en Antropología*, 7: 247-261.
- Borrero, L.A. (1988). Tafonomía regional. In (Ratto, N.R. & Haber, A., eds.) *De procesos, contextos y otros huesos*. Buenos Aires: Facultad de Filosofía y Letras, UBA, pp. 9-15.
- Borrero, L.A. (1990). Taphonomy of Guanaco Bones in Tierra del Fuego. *Quaternary Research*, 34: 361-371.
- Borrero, L.A. (2011). La función transdisciplinaria de la arqueozoología en el siglo XXI: restos animales y más allá. *Antipoda. Revista de Antropología y Arqueología*, 13: 267-274.
- Borrero, L.A. & Martín, F. (2012). Taphonomic observations on ground sloth bone and dung from Cueva del Milodón, Ultima Esperanza, Chile: 100 years of research history. *Quaternary International*, 278: 3-11.
- Cruz, I. (1999). Estepa y Bosque: Paisajes Actuales y Tafonomía en el Noroeste de Santa Cruz: La Utilización de Lagos y Lagunas en la Región de Lago Argentino (Provincia de Santa Cruz). *Soplando en el Viento: Actas de las III Jornadas de Arqueología de la Patagonia*, 303-314.
- Cruz, I. (2006). Los restos de pingüinos (Spheniscidae) de los sitios de Cabo Blanco (Santa Cruz, Patagonia Argentina). Análisis tafonómico y perspectivas arqueológicas. *Intersecciones en Antropología*, 7: 15-26.
- Cruz, I. (2009). Tafonomía en escalas espaciales amplias: el registro óseo de las aves en el sur de Patagonia. In (Acosta, A., Loponte, D. & Mucciolo, L.) *Temas de Arqueología 2: Estudios tafonómicos y zooarqueológicos*. Buenos Aires: INAPL, pp. 15-34.
- Cruz, I. (2014). Estudios sobre meteorización de huesos en Patagonia. *Revista Chilena de Antropología*, 29: 89-94.
- Cruz, I. & Elkin, D. (2003). Structural Bone Density of the Lesser Rhea (*Pterocnemia pennata*) (Aves: Rheidae). Taphonomic and Archaeological Implications. *Journal of Archaeological Science*, 30: 37-44.
- Elkin, D.C. (1995). Volume density of South American camelid skeletal parts. *International Journal of Osteoarchaeology*, 5: 29-37.
- Elkin, D. & Zanchetta, J. (1991). Densitometría ósea de camélidos. Aplicaciones arqueológicas. *Shincal*, 3: 195-204.
- Estévez, J.E. & Mameli, L. (2000). Muerte en el Canal: experiencias bioestratigráficas controladas sobre la acción sustractora de Cánidos. *Archaeofauna*, 9: 7-16.
- Fernández, P.M. & Forlano, A.I. (2009). Tafonomía, arqueología y conservación de especies silvestres: el caso de los huemules (*Hippocamelus bisulcus*) de lago la Plata (Chubut). In (Salemme, M., Santiago, F., Álvarez, M., Piana, E., Vázquez, M., & Mansur, E., eds.) *Arqueología de la Patagonia: una mirada desde el último confin*. Ushuaia: Editorial Utopías, pp. 743-758.
- Fernández, P., Cruz, I. & Elkin, D. (2001). Densidad Mineral Ósea en *Pterocnemia pennata* (Aves: Rheidae). Una herramienta para evaluar frecuencias anatómicas en sitios arqueológicos. *Relaciones de la Sociedad Argentina de Antropología*, 26: 243-260.
- Fernández, F.J., Moreira, G., Ballejo, F. & De Santis, L. (2009). Novedosos registros de aves exhumadas del sitio arqueológico Laguna El Sosneado (LS-3) para el Holoceno tardío en el sur de Mendoza: aspectos tafonómicos. *Intersecciones en Antropología*, 10: 311-326.
- Gifford-González, D. (1991). Bones are not enough: analogues, knowledge, and interpretive strategies in zooarchaeology. *Journal of Anthropological Archaeology*, 10: 215-254.
- Gómez, G.N. (2000). *Análisis tafonómico y paleoecológico de los micro y mesomamíferos del sitio arqueológico de Arroyo Seco 2 (Buenos Aires, Argentina) y su comparación con la fauna actual*. Unpublished Ph.D. Thesis. Facultad de Ciencias Biológicas, Universidad Complutense de Madrid, Madrid.
- González, M.E., Álvarez, M.C., Massigoge, A., Gutiérrez, M.A. & Kaufmann, C.A. (2012). Bone differential survivorship and ontogenetic development in guanaco (*Lama guanicoe*). *International Journal of Osteoarchaeology*, 22: 523-536.
- Guichón, R., Muñoz, S. & Borrero, L. (2000). Datos para una tafonomía de restos óseos humanos en Bahía San Sebastián, Tierra del Fuego. *Relaciones de la Sociedad Argentina de Antropología*, XXV: 297-311.
- Gutiérrez, M.A. (1998). *Taphonomic effects and state of preservation of the guanaco (Lama guanicoe) bone bed from Paso Otero 1 (Buenos Aires Province, Argentina)*. Unpublished Mg. Thesis. Texas Tech University, Lubbock.

- Gutiérrez, M.A. (2001). Bone Diagenesis and Taphonomic History of the Paso Otero 1 Bone Bed, Pampas of Argentina. *Journal of Archaeological Science*, 28: 1277-1290.
- Gutiérrez, M.A., Martínez, G. & Nielsen-Marsh, C. (2001). Alteración diagenética y preservación diferencial de los conjuntos óseos de la localidad arqueológica Paso Otero (provincia de Buenos Aires, Argentina). *Estudios Geológicos*, 56: 291-299.
- Gutiérrez, M.A. & Kaufmann, C.A. (2007). Criteria for the identification of formation processes in guanaco (*Lama guanicoe*). Bone assemblages in fluvial-lacustrine environments. *Journal of Taphonomy*, 5(4): 151-176.
- Gutiérrez, M.A., Kaufmann, C.A., González, M., Massigoge, A. & Álvarez, M.C. (2010). Intrataxonomic variability in metapodial and femur bone density related to age in guanaco (*Lama guanicoe*). Zooarchaeological and taphonomical implications. *Journal of Archaeological Science*, 37(12): 3226-3238.
- Gutiérrez, M.A., Kaufmann, C.A., González, M.E., Scheifler, N.A., Rafuse, D.J., Massigoge, A. & Álvarez, M.C. (2016a). The role of small carnivores in the movement of bones: implications for the Pampas Archaeofaunal record, Argentina. *Archaeological and Anthropological Sciences*, 8: 257-276.
- Gutiérrez, M.A., González, M., Álvarez, M.C., Massigoge, A. & Kaufmann, C. (2016b). Meteorización ósea en restos de guanaco y ñandú. *Arqueología*, 22: 57-84.
- Kaufmann, C.A. & Gutiérrez, M.A. (2004). Dispersión potencial de huesos de guanaco en medios fluviales y lacustres. In (Martínez, G., Gutiérrez, M.A., Curtoni, R., Berón, M. & Madrid, P., eds.) *Aproximaciones Contemporáneas a la Arqueología Pampeana. Perspectivas teóricas, metodológicas, analíticas y casos de estudio*. Olavarría: Facultad de Ciencias Sociales, UNCPBA, pp. 129-146.
- Kaufmann, C.A., Gutiérrez, M.A., Álvarez, M.C., González, M. & Massigoge, A. (2011). Fluvial dispersal potential of guanaco bones (*Lama guanicoe*) under controlled experimental conditions. *Journal of Archaeological Science*, 38: 334-344.
- Lyman, R.L. (1994). *Vertebrate Taphonomy*. Cambridge University Press, Cambridge.
- Mameli, L. & Estévez, J. (1999-2000). Seguimiento tafonómico de carcasas de camélidos, ovinos y bovinos en Tierra del Fuego (Argentina) e implicaciones arqueológicas. *XAMA*, 12-14: 87-106.
- Marchionni, L. (2016). Taphonomic study in Argentinian Patagonia: analysis of variability through time and space in the Central Plateau (Santa Cruz Province). *Archaeological and Anthropological Sciences*, 8: 241-255.
- Marean, C.W. 1995. Of taphonomy and Montalvo, C.I., Pessino, M.E.M. & González, V.H. (2007). Taphonomic analysis of remains of mammals eaten by pumas (*Puma concolor* Carnivora, Felidae) in central Argentina. *Journal of Archaeological Science*, 34: 2151-2160.
- Martin, F. (2013). *Tafonomía y paleoecología de la transición Pleistoceno-Holoceno en Fuego-Patagonia*. Ediciones de la Universidad de Magallanes.
- Massigoge, A. & González, M.E. (2012). Taphonomic approaches in archaeology: Current topics and methods from southern South America. *Quaternary International*, 278: 1-2.
- Massigoge, A., González, M.E., Kaufmann, C.A. & Gutiérrez, M.A. (2010). Observaciones actualísticas sobre meteorización ósea en restos esqueléticos de guanaco. In (Berón, M., Luna, L., Bonomo, M., Montalvo, C., Aranda, C. & Carrera Aizpitarte, M., eds.) *Mamii Mapu: pasado y presente. Perspectivas de la arqueología pampeana a comienzos del tercer milenio*. Buenos Aires: Libros del Espinillo, pp. 309-322.
- Massigoge, A., Rafuse, D.J., Álvarez, M.C., González, M.E., Gutiérrez, M.A., Kaufmann, C.A. & Scheifler, N.A. (2015). Beached penguins on the Atlantic Coast in the Pampas region of Argentina: Taphonomic analysis and implications for the archaeological record. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 436: 85-95.
- Mengoni Goñalons, G.L. (2007). Archaeofaunal studies in Argentina: a historical overview. In (Gutiérrez, M., Mioti, L., Barrientos, G., Mengoni Goñalons, G.L. & Salemme, M., eds.) *Taphonomy and Zooarchaeology in Argentina*. Oxford: BAR International Series, Archaeopress, pp. 13-34.
- Mondini, M. (1995). Artiodactyl prey transport by foxes in Punarock shelters. *Current Anthropology*, 36: 520-524.
- Mondini, M. (2017). Carnivore taphonomy in South America: a review of actualistic studies and their implications in the southern Neotropics. *Historical Biology*: 1-12.
- Mondini, M. & Muñoz, S. (2014). La tafonomía en la zooarqueología argentina de los últimos veinte años. Su representación en las publicaciones periódicas y reuniones académicas nacionales. *Revista Chilena de Antropología*, 29: 95-101.
- Montalvo, C.I., Pessino, M.E.M. & González, V.H. (2007). Taphonomic analysis of remains of mammals eaten by pumas (*Puma concolor* Carnivora, Felidae) in central Argentina. *Journal of Archaeological Science*, 34: 2151-2160.
- Montalvo, C.I., Tallade, P.O., Fernández, F.J., Moreira, G.J., Rafuse, D.J. & De Santis, L.J.M. (2011). Bone damage patterns found in the avian prey

- remains of crested caracara *Caracara plancus* (Aves, Falconiformes). *Journal of Archaeological Science*, 38: 3541-3548.
- Nasti, A. (1991). Tafonomía de vertebrados en contextos sedimentarios modernos de la puna sur: chances de enterramiento y formación del registro arqueológico. *Schincal*, 3 (1): 234-251.
- Nasti, A. (1995). Desarticulación natural y supervivencia de partes anatómicas: Tafonomía de vertebrados modernos en medioambientes puneños. *Palimpsesto Revista de Arqueología*, 4: 70-90.
- Nasti, A. (2005). Dragging and scattering of camelid bones by fluvial action in the Real Grande Gorge, Province of Catamarca, Southern Argentinean Puna. *Journal of Taphonomy*, 3(4): 173-183.
- Olivera, D., Nasti, A., de Aguirre, M.J. & Horsey, A. (1991-92). Tafonomía en desierto de altura. *Anales de Arqueología y Etnología*, 46-47: 75-106.
- Otaola, C. (2014). Actualistic Zooarchaeology in Central Western Argentina in Cave and Open Air Contexts. *Ethnobiology Letters*, 5: 94-103.
- Ozán, I. & Berón, M. (2016). Procesos postdeposicionales del registro cerámico superficial de cazadores-recolectores de la provincia de la Pampa. *Comechingonia*, 20 (2): 215-242.
- Pobiner, B. & Braun, D.R. (2005). Applying actualism: Considerations for future research. *Journal of Taphonomy*, 3 (2): 57-65.
- Politis, G. & Madrid, P. (1988). Un hueso duro de roer: Análisis preliminar de la tafonomía del sitio Laguna Tres Reyes 1 (Pdo. de Adolfo González Chaves, Pcia. de Buenos Aires). In (Ratto, N. & Haber, A., eds.) *De Procesos, Contextos y Otros Huesos*. Buenos Aires: ICA y Facultad de Filosofía y Letras, UBA, pp. 29-44.
- Quintana, C. (2004). Acumulaciones de restos óseos en reparos rocosos de las sierras de Tandilia oriental, Argentina. *Estudios Geológicos*, 60 (1-2): 37-48.
- Quintana, C. (2015). Tafonomía de contenidos dispersos de egagrópilas de *Tyto alba* en un ambiente serrano. *Historia Natural*, 5 (1): 29-47.