

Environmental dynamics and formation processes of the archaeological record in Latin America

Cristián M. Favier Dubois¹ | Julio Cezar Rubin de Rubin²

¹CONICET—Departamento de Arqueología, Facultad de Ciencias Sociales, Universidad Nacional del Centro de la Provincia de Buenos Aires, Olavarría, Argentina

²Instituto Goiano de Pré-Historia e Antropologia, Pontifícia Universidade Católica de Goiás, Goiânia, Brazil

Correspondence

Cristián M. Favier Dubois, CONICET—Departamento de Arqueología, Facultad de Ciencias Sociales, Universidad Nacional del Centro de la Provincia de Buenos Aires, Olavarría, Argentina.

Email: cfavier3@gmail.com

In recent years, geoarchaeology has grown significantly in Latin America both in terms of the number of researchers who practice it and the fields of application. The development of this discipline was encouraged by the pioneering work of several geoscientists including Marcelo Zárate (e.g., Zárate & Flegenheimer, 1991) and Pablo Tchilinguirian (e.g., Tchilinguirian & Barandica, 1995) in Argentina, José Luiz de Moraes (e.g., Moraes, 1999) and Astolfo Araujo (e.g., Araujo, 1999) in Brazil, and Pedro Botero (e.g., Botero, 2001) in Colombia. These early contributions showed the great potential of geoarchaeological studies to better inform the interpretation of the archaeological record and the importance of an interdisciplinary approach. In the 1990s the first courses in geoarchaeology in Latin American scientific institutions were taught by some of these pioneers.

During the 21st century, the number of practitioners and papers that could be framed in this discipline increased significantly in Latin America, promoting the organization of dedicated geoarchaeology workshops and symposia in national or international meetings, first in the field of archaeology (since 2001) and later in the field of geology (since 2005).

In 2012, with the aim of bringing together researchers working in this discipline, GEGAL “Grupo de Estudios Geoarqueológicos de América Latina” (Group of Geoarchaeological Studies of Latin America) was created and already has members in 10 countries. An important goal of this group is to develop a Latin American profile for geoarchaeology based on the interests, needs, and resources of the countries of the region. GEGAL has already organized four annual workshops in different Latin American nations. The workshops include oral presentations and field trips that facilitate discussion and exchange of methodologies, experiences, and ideas. GEGAL has also sponsored the publication of two edited volumes on geoarchaeology published in Brazil (Rubin, Favier Dubois & Silva, 2015; Rubin & Silva, 2013), which contain contributions from four countries, written in Spanish and Portuguese.

Reflecting the growth of this discipline, and in order to make these regional investigations known to a wider audience, GEGAL proposed

a special issue of Latin American contributions to *Geoarchaeology: An International Journal*. To provide a guiding focus for manuscripts, the theme “Environmental Dynamics and Formation Processes of the Archaeological Record” was chosen. We present seven of these papers in this special issue.

The contributors include geoarchaeologists with archaeology, pedology, and geology backgrounds. The case studies illustrate investigations carried out at a range of space and time scales under varied climates and landscapes of South America. An objective shared by these works is to evaluate the properties of the archaeological record produced by both macro- and microenvironmental dynamics, which influence critical aspects of cultural evidence such as its distribution, density, preservation, resolution, chronology, and geochemical signature. Archaeological interpretation is always contextual and geoarchaeology in Latin America has much to say in this regard.

Tripaldi et al. analyze formation processes of the archaeological record in ephemeral semiarid fluvial environments of northwestern Patagonia (Mendoza, Argentina) with emphasis on the sedimentological and geomorphological context. In this area, depositional processes dominated by eolian and low-energy fluvial activity quickly covered cultural materials forming archaeological deposits up to 2–4 m thick that yielded the earliest radiocarbon dated feature for the entire region. Their geoarchaeological analysis demonstrates a well-constrained chronological and stratigraphic record that encourages further study in the area in order to obtain a more complete panorama of past human dynamics in such dryland settings.

On the stable land surfaces of wetter regions, the burial and preservation of materials can take place by a very different mechanism. Favier Dubois and Politis discuss the genesis of subsurface concentrations of archaeological evidence in grassland soils of the Argentine Pampas. These materials were found at the same depth under an A horizon in two closely located, diachronic sites. Assemblages at similar depths could be interpreted as buried occupation surfaces. However, evidence of intense worm activity in the soil epipedon points to biomechanical

processes as the most probable explanation for the formation of the assemblages. This pedological factor, referred to as the *biomantle model* (Johnson, 1990, 2002) is not always considered in stratigraphic interpretations that instead tend to be based mainly on abiotic sedimentary principles and mechanisms.

The environmental context of the archaeological record is analyzed at a larger temporal and spatial scale in the contribution by Inda et al. from the Uruguay coastline. Here significant landscape changes took place after the middle Holocene marine transgression. These authors studied archaeological sites placed in well-dated coastal settings successively developed in the Castillo Lagoon area in association with the regional sea-level maximum. This provided a relative chronology for the sites while their sedimentary environments (i.e., eolian, lacustrine) shaped the particular formation processes involved in each case. All this provides important context for interpreting the spatial and temporal properties of the cultural record along this coastal region and particularly at the studied lagoonal area.

In a more specific analysis of a common topographic situation where the archaeological record can be found, Ozán offers a wide-ranging compilation of case studies regarding gravity-driven processes on hillslopes, illustrated by sites mainly from southernmost South America (Argentina and Chile). She states that an appropriate research approach requires an understanding of specific mechanisms and processes that occur in each context, starting with a careful taphonomic study of the spatial distribution, frequency, size, diversity, and orientation of materials comprising the archaeological record. The author concludes that each process affects the cultural evidence in a singular way, though the existence of palimpsests seems to be a common post-depositional result in these hillslope settings.

Slope dynamics in a context of soil formation may be the principal mechanisms to explain the presence of cultural evidence found at more than 1 m depth within a sandy Oxisol at the Lagoa do Camargo 1 Paleoindian site. The paper by Araujo et al. discusses the evidence of early archaeological occupations in tropical soils developed on a plateau in southeastern Brazil. There, paleosurfaces were identified that were buried through vertical accretion resulting in a thick colluvial soil. Paleoindian sites may therefore be deeply buried in these upland settings that are usually considered stable, and would not be detected by traditional archaeological survey.

Regarding the modification of tropical soils by cultural activities, Souza et al. address the relationship between in situ anthropogenic practices, such as fires and burials, and pedological/geochemical parameters in the Late Pleistocene Santana do Riacho rockshelter (Minas Gerais, Brazil). This paper highlights the use of varied soil analytical techniques (e.g., micromorphological, scanning electron microscopy energy dispersive spectrometry, X-ray diffraction, and routine chemical analyses) for understanding site formation processes, bone preservation, and human geochemical signals in rockshelter stratigraphy. In such a context, sediments experienced pedogenetic alterations related largely to human activities, which give rise to an Anthrosol.

Concerning Anthrosols at a broader scale, Kern et al. present a discussion about Amazonian Dark Earths, that is, *terras pretas* and *terras*

mulatas. Rich in lithic artifacts, pottery and other cultural debris, these dark anthropogenic soils are extensive in the Amazon Basin. Through the interaction of pedogenetic and human-induced processes (e.g., the incorporation of organic waste), prehistoric inhabitants turned soil with low agricultural potential into areas with high chemical fertility and productivity. The authors emphasize the value of interdisciplinary studies, including a consideration of traditional Amazonian perspectives, in understanding these soils as part of a larger anthropogenic landscape.

We hope that this volume helps in the diffusion and strengthening of geoarchaeology in Latin America. We are a small but growing community and there is much work to do, beginning with identifying geoarchaeological questions that are most relevant to archaeological investigations in each region. We hope that this special issue will encourage colleagues and students to cultivate this discipline and help make it an essential part of Latin American archaeological and Quaternary earth science research.

ACKNOWLEDGMENTS

We are very grateful to the editors of *Geoarchaeology*, Gary Huckleberry and Jamie Woodward, for accepting the proposal of this special issue and for their dedication to make it successful. We want to especially thank our English Editor, Peter White, at the University of Sydney, Australia, for his help in copy editing the manuscripts. Finally, we thank Antonio Maldonado (CEAZA, Universidad de La Serena, Chile) for the initial suggestion about this volume.

REFERENCES

- Araujo, A. G. M. (1999). As Geociências e suas implicações em teoria e métodos arqueológicos. *Revista do Museu de Arqueologia e Etnologia*, 3, 35–45.
- Botero, P. (2001). Relaciones entre las ciencias de la tierra y la arqueología. In G. Morcote (Ed.), *Memorias del Simposio Pueblos y Ambientes: Una Mirada al Pasado Precolombino, colección Memorias* (Vol. 10, pp. 7–46). Bogotá: Academia Colombiana de Ciencias Exactas, Físicas y Naturales.
- Johnson, D. L. (1990). Biomantle evolution and the redistribution of earth materials and artifacts. *Soil Science*, 149, 84–102.
- Johnson, D. L. (2002). Darwin would be proud: Bioturbation, dynamic denudation, and the power of theory in science. *Geoarchaeology*, 17(1), 7–40.
- Morais, J. L. (1999). A Arqueologia e o fator geo. *Revista do Museu de Arqueologia e Etnologia*, 9, 9–22.
- Rubin, J. C. R., Favier Dubois, C. M., & Silva R. T. (Eds.). (2015). *Geoarqueologia na América do Sul*. Goiânia, Brazil: Editora da Pontifícia Universidade Católica de Goiás, 500 pp.
- Rubin, J. C. R., & Silva, R. T. (Eds.). (2013). *Geoarqueologia*. Goiânia, Brazil: Editora da Pontifícia Universidade Católica de Goiás, 270 pp.
- Tchilinguirian, P., & Barandica, M. (1995). Acontecimientos naturales que favorecieron el asentamiento humano en ambientes de la Puna Catamarqueña Argentina. *Hombre y Desierto* (Vol. 9, pp. 351–352). Universidad de Antofagasta y Sociedad Chilena de Arqueología.
- Zárate, M. A., & Flegenheimer, N. (1991). Geoarchaeology of the Cerro la China locality (Buenos Aires, Argentina): Site 2 and site 3. *Geoarchaeology*, 6(3), 273–294.