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Technical Note

The archaeology of the Neotropics

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1. Introduction

As Muñoz and Mondini indicated in their Introduction to this volume, it is very difficult to produce results which are relevant at the scale of the Neotropics. But the papers contributed in this volume constitute a good starting point.

The Neotropical lands extend on both sides of the Equator with the Pacific on one side and the Caribbean and the Atlantic on the other. The distance from coast to coast oscillates between 100 and 5000 km. The palaeoenvironmental history shows that most of these lands were minimally affected by glaciation in comparison with most of North America, Europe or Northeast Asia. The obstacles for human circulation were similar during the Pleistocene and the Holocene in contrast with the real difficulties for circulation in northeast Asia (Hoffecker, 1996; Goebel, 2004). The isthmus of Panamá, which acted as a filter between the two main landmasses added to the interest in the human experiment that was the colonization of South America. These are biogeographical considerations, whose relevance is highlighted by Araujo et al.'s paper. They use palaeoparasitological analysis to suggest that some parasites found in fossil samples of the Neotropics must have been introduced by humans using alternatives routes to Beringia, since cold temperatures constitute a limiting factor for those parasites. This suggestion should be fully explored in the light of other independent lines of research.

In a sense when we are talking about Neotropical zooarchaeology and taphonomy we are breaking new ground, since neither is really well known. Although it is true that both are showing signs of growth, development along Latin America—basically the extent of the Neotropics—is very uneven. There are countries where these disciplines are already established and others are beginning (Mengoni Goñalons, 2004). The few available compilations in English are good testimony to that diversity (Mengoni Goñalons, 2004, 2007; Gutiérrez et al., 2007).

2. The Anthropocene

The Neotropics are no exception to the notion that human–animal interactions constitute only part of the picture. We now need to encompass human–environment interaction, with the latter including both the physical and the social environments. This is probably the main methodological point made by Peter Stahl, one with which I fully concur. Anthropogenic processes are so important in the contemporary world that the necessity of defining the Anthropocene was recently defended. The concept of Anthropocene refers to the dominant role that humans play in the structure and function of the environments during the last 200 years (Crutzen, 2002; Oldfield and Alverson, 2003). Certainly, those influences are not restricted to the last 200 years, but this is the time period for which we have both instrumental measurements and good historical records. Accordingly, there is good evidence to assert that it is during this period that the process of climate change is fuelled by human activities. However, well before the Anthropocene or even the Holocene, landscapes were humanized (Neves and Petersen, 2006).

The point remains that since humans have existed, they have produced their mark on the environment. When we go back in time, we see that the effects of the human activities almost from the very beginning. Archaeological sites of the Plio-Pleistocene record the first indications of transport and transformation of rocks out of their sources. For example, Potts wrote in reference to Olduvai that "we know that stone materials, including modified tools/cores and unmodified pieces, were brought to and left at the

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artefact sites. Pieces were also probably taken away from these sites, which must be considered part of a dynamic flow of artefacts and raw materials across the ancient landscape'' (Potts, 1988, p. 247). With time these patterns only intensified: the more attractive African rock sources were mined over hundreds of thousands of years. The sum of these activities amounts to the construction of a stone landscape where previously there were no rocks (Potts, 1984). Even in the Americas, where the process of human displacement of rocks took place during a little over 10,000 years, the results are sometimes quite substantial, leading to a process that was named ''lithification'' (Martinez and MacKie, 2003). Then, even the most trivial manipulation of the environment by foragers may produce an impact with the help of time.

The exploitation of molluscs produce huge accumulations of shells, sometimes several metres high, as exemplified by the *sambaquis* studied by Volkmer de Castilho. The intensive exploitation required to produce those accumulations need not exhaust the mollusc colonies. However, in some locations that may be the case. For example, in their analysis of the Vampiros rockshelters, Carvajal-Contreras et al. evaluated the possibility that an apparent diminution in the size of shells of *Natica unifasciata* is the result of human impact.

These examples can be classified as indirect impacts on the landscape, those that change the shape of the landscape more than its function. If we now turn to direct impacts, the scale of the changes is even more dramatic. The forests of the extensive lowlands of the Neotropics were transformed by hunter-gatherers and horticulturalists beyond recognition, as commented by Politis (1996), Piperno (1995) and Stahl (2000). The range of changes goes from the creation of small gardens to the construction of whole agricultural landscapes (Denevan, 1963, 2006; Dougherty and Calandra, 1984; Erickson, 1995; Islebe et al., 1996).

Which is the discipline, within archaeology, that is best prepared to deal with human–environment transformations? Stahl in this volume and others (Balée and Erickson, 2006) refer to Historical Ecology. I agree on the power of that research programme (Balée and Erickson, 2006, p. 5) but I also believe that other approaches have much to offer to the core of that programme, as I will explain below.

When we try to understand past environments used by humans, we need to leave behind the concept of pristine environments (Denevan, 1992; Stahl, 1996; Erickson, 2006). On the theoretical side we can get support from Niche Construction Theory (Odling-Smee et al., 2003). According to this theory there is a process of heredability of landscapes. Landscapes resulting from interaction with humans are already transformed when new generations use them, and the understanding of this interactive process is one of our methodological challenges. There are different ways of dealing with this, both for interpretation and conservation (Lyman and Cannon, 2004). These are methods that need to be fully applied in the Neotropics, as the reduction of biodiversity—indeed, a global concern—is especially active here (López and Cano, 2004). Of course, there is a role for archaeology here trying to track how species and landscapes that interact with humans come and go. The role of disturbance at significant human levels is one of many ways of tracking human responses across the Neotropics. The analysis of pollen, phytolith and microparticles of charcoal provides some of the best markers that can be used to detect environmental disturbance (Piperno, 1995; Cooke et al., 1996; Markgraf et al., 2007). Finally, taphonomic markers, such as indications of intensive use of carcasses (see Mondini and Muñoz, this issue) or evidence of mass deaths (see Belardi and Rindel, this issue) constitute first hand palaeoecological data.

3. Ethnoarchaeology and taphonomy

In practical terms, ethnoarchaeology and taphonomy are among the disciplines best suited to deal with the output of human–environment interactions. Even when there is a growing critical view of ethnoarchaeological studies, I think that still there is a place for ethnoarchaeology among our research tools. We have improved our understanding of the past with the results of ethnoarchaeological research, including most of the information that is used to reject some ethnoarchaeological applications. What is really assumed when we start research with present societies is that they provide us with examples of how to interact among themselves and with the environment. By definition this approach can be applied to any society (Gould and Schiffer, 1981), and there is no requisite of ''intact'' societies surviving into the XX–XXI Centuries. Then, we are not looking at a fragment of the past and the ''pristine'' position forms no part of the ethnoarchaeological enterprise. Simply put, it alerts us to possible avenues of interpretation and discussion (Nielsen, 2001). If we revert the problem, are we going to construct an archaeology totally devoid of anthropological insight? Of course, the answer is negative. Ethnoarchaeological results allowed Carvajal-Contreras et al. to know what to expect from fish preparation in order to discuss aspects related with fish provisioning. This is an example of direct application of ethnoarchaeological results obtained in the same area of archaeological application (see also Garcia, 1988). However, the uses of ethnoarchaeology are not restricted to those cases.

Work by Politis and Martinez (1996, p. 277) showed that jaguar (*Panthera onca*) bones deposited at contemporary forager sites are sometimes polished, artificially perforated or painted and used as adornments or to construct musical instruments. In a very different context, the paper by Corona mentions bones of jaguar and puma (*Puma concolor*), some with cultural marks. The jaguar bones were basically found at places of the highest social ranking of Xochicalco in México. Thus, these carnivores—as well as bones of crocodiles (*Crocodilus acutus*) found as offerings in a ball court—probably were used within a high-ranking ceremonial context. In a sense this discussion

can be sustained by some of the ethnoarchaeological results produced by Politis and Martinez.

Thus, basic to any interpretation of ritual or symbolic meaning is the discussion of intra-site variation, an analysis that can be improved using ethnoarchaeological knowledge. Another example is offered by Capriles and coauthors when they discuss the disposal of different species of fish at Kala Uyuni, on the shores of the Titicaca lake. The location of the fish remains at some particular buildings and courts may support a ritual context.

A very pertinent discipline to deal with the complexities of the Neotropics is taphonomy. Among its many virtues, taphonomy offers answers to important questions. We need to know in which regions the contamination produced by recently deposited bones is a problem for interpretation. We can also ask, what is the degree of averaging of surface bone assemblages? Since most of the research obtained on this subject is derived from African projects it has become more and more important to test how those results fared in the Neotropics. Cruz's paper is a good indication of what kind of research is required, presenting a comparison of the rates of deposition and the values of some taphonomical markers in both coastal and hinterland environments in Patagonia. In turn those values are compared with those obtained at Serengeti, Ngorongoro or Virunga. The study of different biomes as well as the selection of large spatial units maje the comparison relevant. In the same vein Mondini and Muñoz evaluate the existing knowledge concerning bone accumulations and damages produced by pumas, one of the largest carnivores of the Neotropics. Together with previous research about the damage and transport capabilities of foxes (Borrero, 1990, 2007; Mondini, 1995, 2002; Martin, 1998, 2006) those studies provide the basis for an assessment of the transformations produced by carnivores in the Neotropics. On the other hand, the multiplicity of sources on the taphonomy of pumas that slowly is becoming available—and extensively reviewed in Mondini and Muñoz's paper—is beginning to produce a relatively complete picture of the significance of this carnivore within different conditions and ecosystems.

The study of the deposition of guanaco carcasses under conditions of stress is very helpful to begin to understand the "guanaco bone rain" at rockshelters and open air sites (see Belardi and Rindel, this issue). Longitudinal observations of the same carcasses will produce rich insights into the best markers that we can use to recognize the importance of that process in the past. What we will need to know in the future is which of the markers of mass deaths will be observable in buried bone assemblages. As Belardi and Rindel clearly point out, the palimpsests created by the overlap of archaeological remains—including prey bones—and those of animals not related with human activities are difficult to deal with. Taphonomy is the discipline that will help us to deal with this problem. Volkmer de Castilho explains that mixing of anthropic and non-anthropic whale bones is not a problem for sites in the coasts of Brazil since the environment is not adequate for bone preservation. I do not think that this is a good reason to consider that contamination is not a problem. Perhaps the human modified topography associated with the *sambaquis* is a better reason. *Sambaquis* are so high above the ground that mixing with bones from stranded whales appears to be difficult.

The biodiversity of the Neotropics is part of the reason to require a taphonomic perspective. The papers by Carvajal-Contreras et al., Nogueira de Queiroz, and Alexandre de Carvalho indicate the difficulties of dealing with faunas in the Neotropics. The archaeology of the lowlands can be difficult considering the variety of processes than can incorporate bone remains to the fossil record, and it is not a comfort to accept that some of them simply will not survive. We should add vertical migration problems. Carvajal-Contreras et al. mention that the human reoccupation of the Vampiros rockshelter "constantly penetrated earlier strata". Moreover, the list of natural formation processes at those shelters is impressive, including the activities of many burrowing animals and plants. The highlands also offer difficulties when it comes to small animals. Capriles et al.'s study indicates the difficulties of dealing with fish remains, which are fragile, fragmented and sometimes modified by heat. Many of those remains will simply not survive the vagaries of preservation. However, there are ways of dealing with these issues, all of them including a taphonomic component. At least we need to know which bones are the result of human and which are the result of carnivore activities. Moreover, we need to know which remains of small mammals, reptiles, birds and fishes can be included in the human subsistence, and thus can be used to support wide-spectrum diets, processes of complexity, etc. In that sense, the information provided by Nogueira de Queiroz and Alexandre de Carvalho indicates that this task is difficult due to the lack of adequate criteria to separate both sources of organic remains. These are reasons to engage in contemporary taphonomic studies in the Tropics. However, the analysis should not be restricted to the bone assemblages. For example, Nogueira de Queiroz and Alexandre de Carvalho mention changes in the shape of the rockshelters through time. This is a problem that is not exclusive of the lowlands (Collins, 1991; Borrero et al., 2007), and requires at least the incorporation of a geoarchaeological perspective in tandem with the taphonomic analysis.

4. Camelids, horses and niches

Many of the authors in this volume touch on relevant issues for our understanding of the biological and cultural history of the Neotropics. The extinction of Pleistocene mammals and their possible replacement by camelids in many areas of the Netropics is one of the processes considered by both Izeta and Garcia. Some authors (i.e., Saxon, 1976) even considered a hypothesis of competence between guanacos (*Lama guanicoe*) and *Mylodon darwini,*

in which the latter was displaced and went extinct, or even that the process of extinction created niches for the humans themselves (see Redman, 1999). The study of camelid fibres (Reigadas, 1994), or morphometric studies of camelid bones are some of the studies needed to pursue that kind of questions (Cardich and Izeta, 1999–2000; L'Heureux, 2005; Mengoni Goñalons and Yacobaccio, 2006). Ideas of coevolution between camelids and their hunters for the more than 10,000 years of interaction recorded in Patagonia and Tierra del Fuego must also be considered (L'Heureux, 2005). In other regions of South America this issue is even more challenging. Izeta reminded us that in the Andean region this long process includes camelid domestication. The analysis of this transformation should proceed within a regional context of changing landscapes at high-altitude habitats (Yacobaccio et al., 1997–1998; Mengoni Goñalons and Yacobaccio, 2006; Yacobaccio, 2007). These are high-risk environments, as emphasized by Rosenfeld's paper (see also Aldenderfer, 1998). Accordingly, she suggests that guinea pigs (*Cavia porcellus*) were incorporated to the human diet as a source of fat, especially during times at which carbohydrates were in short supply. Anyway, the importance of different classes of resources in past high-altitude environments is just beginning to be known. The paper by Capriles et al. present compelling evidence about the quantitative importance of fishes in the Bolivian plateau. Garcia indicates that extinct horses (*Hippidion* sp.) are highly versatile, emphasizing its capacity to survive with quite different vegetal diets both at ca. 2000 and 4000 m asl. We can add that horses also managed quite well at the end of the Pleistocene in treeless Patagonia at or slightly above sea level (Alberdi and Prado, 2004). This is interesting in terms of our understanding of the distribution of horses. However, there are other patterns that should be mentioned. In the first place Garcia mentions three sites with evidences of horse and other Pleistocene animals below human occupation levels—El Manzano, Los Morrillos and Gruta del Indio—all of them located near the Andes. Human association with Pleistocene mammals is not important at those sites. In the second place, these sites can be added to several others along the eastern fringe of the Andes in Patagonia in which the imprint of megafauna do not overlap in time with that of humans (Borrero, 2004).

5. Ecotones and complementarity

Fernández's analysis is interesting in that he is trying to discuss a cultural system which is not predetermined by fidelity to any given environment. In other words, to go beyond the assumption that equates the extent of one cultural system to that of one environment. The diversity of the Neotropics makes this a crucial distinction. Even the archaeology of megapatches (*sensu* Beaton, 1991) as in the Patagonian steppe, can be improved with an approach focused on complementarity of resources from different patches (see Fernández, this issue). The issue of specialization in the resources of the steppe is unresolved. Guanaco is basically the only middle-size mammal in the region, since the huemul (*Hippocamelus bisulcus*) is confined to a small-forested area near the Andes. What is the importance of huemul near the forest-steppe ecotone? Only with a complementarity approach we can deal with this. Another potential resources are flightless birds (Rheidae). Fernández notes the low number of ñandu bones found at a number of sites. This result repeats a pan-Patagonian pattern that still requires an explanation. There is a contradiction between historical sources that routinely indicate that the Aoni'kenk of Patagonia relied on these birds for their subsistence, and the almost complete lack of their bones in the middens. This discussion requires the services of taphonomy and minimally includes the evaluation of differential preservation, identifiability of fragmented bones, and peculiar cultural practices.

The analysis of Carvajal-Contreras et al. about fish provisioning at sitio Sierra, Panama, is another example. For this and other cases stable isotope analysis on human bones is one way of dealing with the problem (Parkington, 1991; Cooke et al., 1996; Barberena, 2002).

6. Conclusions

In synthesis, this volume provides a much needed introduction into the archaeological treatment of the Neotropics and its diversity. It is clear that one of the main characteristics of the area—its biodiversity—mandates an appreciation of faunal and floral changes through time, and which are the result of human manipulation. In a restricted sense this refers to processes of domestication, but in a wider sense also applies to whole landscapes which were the proper range of human societies.

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