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Thermal alteration of small mammal from El Guanaco 2 site (Argentina): an experimental approach on armadillos bone remains (Cingulata, Dasypodidae)

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ABSTRACT

The thermo-altered Dasypodidae bone remains from El Guanaco 2 site (ca. 9000–6000 YBP, Pampean Region, Argentina) were analyzed through an experimental study. The experimentation involved the cooking of three individuals of *Chaetophractus villosus* and the burring of three carapaces under the hearth, in order to recognize the degrees of burning damage on osteoderms according to the time of heat exposure and the burring depth in sediments. The results showed similarities between archaeological and actualistic assemblages, including the non-uniform burning damage and scarce endoskeleton thermal modification, but the armors buried didn't show evidence of burning damage. Based on these comparative results, it is suggested that the Dasypodidae assemblages of El Guanaco 2 site derive from hunter gatherers butchering, cooking and consumption of armadillos.

1. Introduction

Small prey handling has been archaeologically and ethnographically recorded for hunter-gatherers inhabiting different environments (Blasco, 2008; Dewar et al., 2006; Escosteguy and Salemme, 2012; González, 2005; Jones, 2006; Kelly, 1995; Laroulandie, 2001, 2005; Loponte, 2007; Lupo and Schmitt, 2005; Medina et al., 2012; Quintana et al., 2002; Quintana and Mazzanti, 2010; Santiago, 2004; Stiner, 1993; Stiner et al., 2000; Stoessel, 2012; among others). Dasypodidae is one of the small-sized families frequently recovered in archaeological sites from the Argentinean Pampean Region and requires detailed analysis of both the natural or cultural agents involved in their deposition and on the evidence of human handling (Frontini and Deschamps, 2007; Frontini and Escoteguy, 2012; Mello Araujo and Marcelino, 2003). Ethnographic and historic records describe the consumption of several species of armadillos. These animals were captured along with other species both in collective (Armaignac, [1874–1877] 1974: 125; Claraz, [1865–1866] 1988: 68, 71; Cox [1862–1863] 2006: 186; Mendoza, [1865–1866] 1965: 64; among others) and individual (Azara, [1781–1801] 1923, T. II: 21; Barne, [1753] 1910: 540; Claraz, [1865–1866] 1988: 51, 55, 117; Falkner, [1745] 1957: 150; Hux, [1875] 1979: 129; Lista, [1894] 2006: 121; Parchappe, [1828] 1945: 597 and 620; among others) hunting parties. Such observations were also confirmed by ethnographers from the 20th century in Patagonia (Aguerre, 2000: 127; Perea, 1989: 60). In several archaeological contexts the thermal alteration shown by armadillo bone remains could suggest human cooking of Dasypodidae (Bayón et al., 2010; Frontini, 2010; Quintana and Mazzanti, 2001; Salemme, 1987).

In an archaeological context different attributes are considered in order to determine the anthropic origin of the small animals' remains: cut marks, fractures, thermal modification, anatomical representation, minimum number of individuals, among others. While cut marks, fractures and MNI have been studied thoroughly, burning damage is not typically considered as anthropic evidence and has not been extensively analyzed from an experimental perspective (Laroulandie, 2001; Lloveras et al., 2009; Medina et al., 2012; Stiner, 2005). Burning damage can be the result of intentional activities such as cooking, the discarding of food wastes in the fire and the use of bones as fuel or for cremation. On the other hand, they can be the result of accidental or unintended actions such as proximity to a hearth. Also, modifications can result from natural causes such as naturally occurring fires (Bennett, 1999; Buikstra and Swegle, 1989; Clark and Ligouis, 2010; Costamagno et al., 2005; David, 1990; James, 1989; Lyman, 1994; Stiner et al., 1995). Considering that the faunal remains can be thermally altered

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through different processes, it is essential to determine the origin of the burning damage in order to reach an accurate interpretation of the assemblages. Since small prey handling requires specific procedures depending on the size, number of individuals, way of cooking, sources obtained (meat, leather, bones, feathers), it is necessary to create frameworks appropriate for the specificity of each practice (Kent, 1993; O′ Connell and Marshall, 1989; Quintana and Mazzanti, 2001; Yellen, 1977).

The aim of this article is to contribute to the recognition of material correlate of small-sized prey handling through the experimental analysis of thermal alteration on *Chaetophractus villosus* (Cingulata, Dasypodidae), a South American type of armadillo. The burning damage pattern obtained was used to identify reliable cooking evidences in the Dasypodidae remains recovered from El Guanaco 2 site (Pampean Region, Argentina).

2. Materials and methods

2.1. Experimental sample

Experimental analyses were carried out on six carcasses of *C. villosus* (Mammalia, Dasypodidae). An average adult individual weights approximately 2.5 kg and is 0.50 m long (Fig. 1B) (Abba et al., 2010; Redford, 1985). The species is characterized by a dorsal shield consisted of thick fix and movable osteoderms, arranged in transverse lines, and additional shields covering the top of the head. It also has a long tail covered with bony dermal scutes (Fig. 1A) (Cabrera and Yepes, 1940; Olrog and Lucero, 1981). The osteoderms have a specific ornamentation on the exposed surface, which allows its taxonomic identification (Fig. 1C) (Soibelzon et al., 2013; Vizcaíno et al., 1995).

The experimental study involved two procedures: the cooking of hairy armadillo carcasses and the burial of hairy armadillo carapaces in a hearth. Three individuals (two females and one male) were completely cooked in an experimental hearth specially built for this purpose in the Área de Metalurgia at Universidad Nacional del Sur. The experimental procedures included the complete cooking of the prey lying over its carapace, with hot-rocks inside two of the carcasses. The techniques used replicated historical observations of cooking processes of Dasypodidae, which describes that once the entrails were removed, the animal was cooked using its armor as a natural container, directly on the fire. Then the cavities were filled with hot-rocks (Beerbohm, [1877] 2004: 54; Hux, [1875] 1979: 36; Prichard, [1900–1901] 2003: 55). This culinary practice was described as follows: “They are (…) usually cooked in the shell on the fire, the entrails, &c., being taken out, and the cavity filled with heated stones. When they are in their best condition, one leg is sufficient for a man, as there is about an inch of yellow fat on them” (Musters, [1869–1870] 1871: 190).

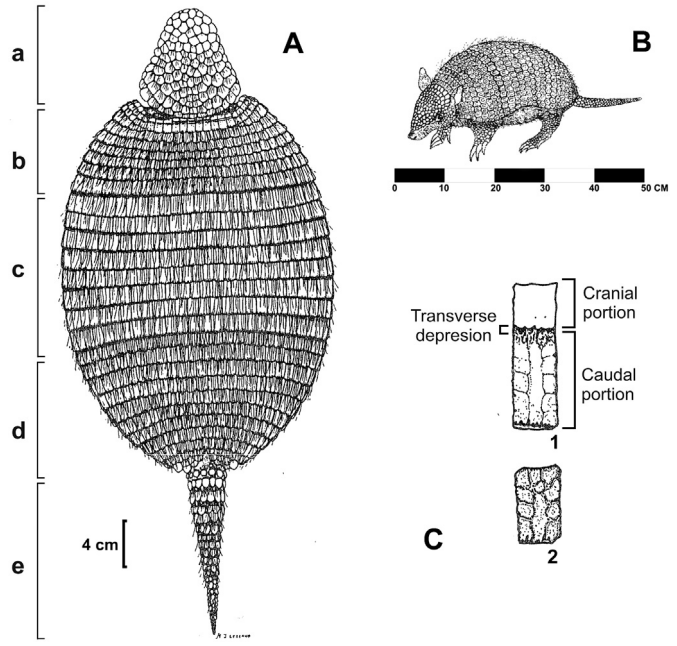

Fig. 1. A: Dorsal view of *Chaetophractus villosus* armor; a: head shield; b: scapular shield; c: mobile band; d: pelvic shield (taken from Vizcaino and Bargo, 1993:439); B: Specimen of *Chaetophractus villosus* (taken from Olrog and Lucero, 1981); C: 1 mobile osteoderm and its sections; b, fix osteoderm (taken from Vizcaino and Bargo, 1993 and from Soibelzon et al., 2013).

The stone used in the experiment were metaquartzite pebbles from secondary deposits of the Sauce Grande River and *tosca* stone (caliche), which outcrops extensively during the Holocene in the South of Buenos Aires province.

Individuals 1 and 3 were cooked under direct fire and individual 2 was barbecued with charcoal. The fuel used consisted of *Condalia microphylla* (piquillín) wood, an autochthonous species corresponding to the *Espinal* province of the South of Buenos Aires province (Cabrera, 1968). The type of wood is relevant since it is related to the maximum temperature reached and, consequently, to its effects on the remains (Nicholson, 1993; Pupio and Cattáneo personal communication, 2013).

The carapace was divided schematically in five sectors, following Vizcaino and Bargo (1993) and Soibelzon et al. (2013) in order to record the modifications (Fig. 1A). During the cooking events, the following aspects were recorded:

a. Temperature at 1-min intervals, with three thermocouples located (1) at fire level, (2) over the armor shell; (3) over the meat.
b. The degree of thermal alteration of the scutes at 5-min intervals. This was carried out macroscopically during the cooking, without extracting the prey from the hearth.
c. The total cooking time.
d. The degree of thermal alteration in the bones. The meat was removed from the bones once the carcasses were cooked.

The burning damage of each individual osteoderm was described in the laboratory after the cooking. Four-color categories correlated with burning damage were considered (De Nigris, 2004; Lyman, 1994; Mengoni Goñalons, 1999; Nicholson, 1993). A cream tone was considered as unburned; brown was considered as burned; black was considered as carbonized, and blue-gray and white as calcined. Eight analytical categories of burning damage were applied considering the osteoderm surface affected (dorsal or internal), the percentage of surface affected and the intensity of the burning damage: 1- Only carbonized externally; 2- Carbonized externally and burned internally; 3- Partially carbonized on both surfaces; 4- Completely carbonized on both surfaces; 5- Calcined on the external surface, carbonized internally; 6-Carbonized externally and calcined internally; 7- Partially calcined on both surfaces; 8- Completely calcined on both surfaces. The description of the movable osteoderms affected area was performed following the Soibelzon et al. (2013: 3) scheme. It was possible to observe the presence or absence of burning evidence across the cranial portion of the movable osteoderms.

A second experience consisted in the study of three *C. villosus* buried carapaces below the experimental hearths, because the thermal alteration of buried remains has been suggested as a plausible explanation for certain assemblages (Bennett, 1999). The carapaces used were donated by a researcher who had already