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Pecked and polished materials from southern Patagonia: An experimental techno-functional approach

María Celina Alvarez Soncini [a], María Estela Mansur [b, *]

[a] CADIC-ANPCyT, Argentina
[b] CADIC-CONICET, Argentina

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ABSTRACT

The archaeological contexts of different periods from Southern Patagonia (Chile and Argentina) frequently include materials showing evidence of pecking and polishing techniques. Functional analysis of these materials is essential in order to identify traces of manufacture and use, and therefore to help us understand the techno-economic organization of these hunter–gatherer societies.

This paper presents the results of an experimental program on manufacture and use wear traces on pecked and polished artefacts. This analysis allowed us to recognize natural, taphonomic, and technological traces and to build a methodological framework for the analysis of archaeological artifacts. These results are relevant for the analysis of the archaeological record, since they imply that it will be possible to recognize these traces on tools made by polishing techniques that have subsequently been used with other types of materials.

1. Introduction

In South America, more specifically in the Patagonian regions of Argentina and Chile, the pecking and polishing techniques appear in hunter–gatherer contexts since the late Pleistocene to the early twentieth century. Archaeological research has shown that these societies knew the pecking and polishing techniques, and that they used them to make many different tools: sometimes to make stone artifacts, such as weights or bolas, some others to manufacture tools in different raw materials such as wood, shells or bone (beads, knives, retouchers, harpoons, drills, etc.). In the 1980s, Mansur, Orquera and Piana made the first research that presents a review and synthesis on the characteristics and significance of pecked and polished materials from hunter–gatherer contexts from the southern part of South America (Mansur-Franchomme et al., 1987/1988). In that research, they reviewed ethnographic and archaeological literature and materials; they also presented a first approach to the techno functional analysis of this type of materials.

The main goal of our investigation is to analyze pecked and polished materials from hunter–gatherers form Tierra del Fuego and the Magellan strait region, in order to understand their contexts of manufacture and use, as well as their signification in the techno-economic systems. These materials belong to stages of two different adaptive strategies. One was dependent on littoral resource exploitation, based on pinniped hunting and coastal fauna harvesting, and including some forest exploitation for wood, bark and plants, developed along the coasts of the Beagle Channel, the Magellan Strait and islands extending south to the Cap Horn (c.f. Piana and Orquera, 2009). The other was specialized in inland resources, based on the exploitation of the guanaco (*Lama glama guanicoe*), the largest mammal of Tierra del Fuego, along with some exploitation of forest and steppe plant resources (see Mansur and Piqué, 2009).

In both cases, pecked and polished artifacts are frequently made on volcanic rocks and they are not always easy to recognize. While it is not difficult to identify those showing characteristic shapes (such as bolas, clubs, pendants), that is not the case when they do not have well defined morphologies. Sometimes it is difficult to differentiate tools with intentional polishing from artifacts bearing sectors that are polished because of use, as well as to differentiate taphonomical traces from technological stigmata (Mansur, 1997).

The analysis of these types of materials has usually been done from the standpoint of a descriptive approach, due to the lack of a techno-morphological and functional analytical framework that would enable their analysis and interpretation. Consequently, up to now it was also difficult to assess the role that these materials played within the technological strategies implemented by

* Corresponding author.
E-mail addresses: mcalvarezson@gmail.com (M.C. Alvarez Soncini), estelamansur@gmail.com (M.E. Mansur).

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hunter–gatherer societies. In order to approach the study of these technologies, we believe that it is necessary to develop a solid techno-morphological and functional framework, by means of experimentation and the application of systematic techniques for microscopic analysis. In this way, it will be possible to record, on the tools surfaces, macro and micro wear traces produced by manufacturing which in many cases constitute the only way to differentiate natural from pecked or polished artifacts.

Studies on polished materials, such as polished axes, from a functional perspective, have already been done in other parts of the world, since the pioneer research by S. Semenov (1964, 2005). They mostly correspond to artifacts made on flint belonging to Neolithic contexts from Europe and the Middle East (Rodenberg, 1983; Risch, 1995; De Beaune, 1997, 2000; Procopiou, 1998; Dubreuil, 2002; Roberts and Otaway, 2003; Hamon, 2006; Delgado Raack, 2008). There are also others concerning ornaments or axes on different semi-precious stones, such as the case of variscite and others (Gibaja Bao, 2002; Borrell and Bosch, 2012; Oliva Poveda, 2012; Gurova et al., 2013). As for North and South America, research concerns mostly materials from food production contexts, as metates and manos (Adams, 2002a,b; Babot, 2004; Pérez, 2004, 2008), or the analysis of pecked and polished tools associated with fishing techniques in coastal southern Patagonia (Torres Elgueta, 2007, 2009, 2011). In these cases, the analytical approach normally does not include the analysis with high magnification optical equipment.

For our study area, Mansur developed an approach based on microwear analysis, which includes both low and high magnification microscopic analysis, and discussed microwear traces produced by natural erosion, intentional polishing (manufacture) and post depositional phenomena (Mansur, 1997). She made experiments with different types of rocks and demonstrated that it was possible to identify different types of traces. On this basis, she analyzed materials from sites from the Beagle Channel region (Mansur and Srehnisky, 1996; Mansur, 1997).

Consequently, in order to undertake this study of pecked and polished materials from a techno-functional perspective, we decided to develop a long-term experimental program, where we characterize the traces produced during experimental tool manufacture and traces produced by tool use on different materials. We also seek to distinguish them from natural traces on rock surfaces produced by natural phenomena, as fluvio-glacial and marine erosion/transport and by taphonomic processes.

The aim of this paper is to present the first results of the experimental program. One of the first steps was trying to characterize the traces produced during the manufacture of polished surfaces, as well as those produced by utilization of natural or polished surfaces on different raw materials such as wood, leather and shell. The results of this program have helped to start building a methodological framework for our research on the use of these technologies by hunter–gatherer societies in contexts of southern Patagonia.

2. Materials and methodology

The archaeological materials taken as reference for the first part of this experimental collection belong to Offing 2, an archaeological site located on an island in the Magellan strait, that is being studied now (cf. Legoupil et al., 2011), and to different archaeological sites from the Beagle Channel northern coast (Orquera and Piana, 1996, 1999a). These artifacts are glacial pebbles and they characterize by the presence of polished and pecked faces.

Ethnographic materials and literature of the area (see references in Orquera and Piana, 1999b) inspire the types of actions included in the experimentation. We especially considered the case of artifacts made on shell, like necklace pendants and shell knives, where lithic polishers were used (cf. Mansur and Clemente Conte, 2009). In most cases these lithic polishers were fix on the ground, as anvils, and shells were rubbed on the lithic surfaces. The first step of the experimental program consisted in identifying the raw materials used in the archaeological sites in the area, followed by evaluation of the geological contexts and then fieldwork in order to collect the raw materials.

The experimental collection was made with rocks collected from the shores of the Beagle Channel. These are pebbles found on the beaches, which were originally carried on by glacial action and then reworked by marine erosion. The determination of raw materials was made on the basis of macroscopic analysis, with assistance of the CADIC Andine Geology Laboratory. It led to identification of medium-grained volcanic rocks, showing variability in their geological composition.

At this first step of the investigation, we tried to identify and differentiate the traces present on glacial pebble surfaces corresponding to at least three different stages: 1- pebbles with natural surfaces without human modification, 2- surfaces anthropically manufactured, and 3- surfaces modified by use on different materials. In order to conduct the experiments, we decided to start using pebbles not exceeding 10 cm in length, because this allowed us to render streamline the manufacturing process and moreover the microscopic analysis. In these cases it is possible to place the artifacts directly on the microscope plate, without needing to make casts, a process that is relatively time consuming.

We would also like to insist on the fact that this is a preliminary experimental series conceived to characterize the macro and microscopic traces. As many archaeological materials exceed these sizes, further observations and analyses will be performed using the casting technique with acetate peels.

During the experimentation to produce polished surfaces, it was decided not to incorporate water or additives, in order to observe the traces that are produced by direct contact between the two stone surfaces, without any intermediate substance. However, we know that the manufacturing of polished pieces has several steps, which may include use of other substances such as water or abrasives (e.g. ashes or pigments). According to ethnographic data, these manufacturing steps, which are done with dry materials and without any additive, are interdependent and they alternate between them to achieve the final finish (Procopiou et al., 2013).

Observation of use wear traces and image capture were done following the standard methodology for determination of micro and microwear traces (Plisson, 1985; Mansur-Franchomme, 1986, 1997; Adams et al., 2009). The optical equipment used for this investigation consisted mainly of a Leica S6D stereomicroscope (40×) and an Olympus BH2 metallographic reflected light microscope (200–400×). Observations were made at various intervals throughout the experimental work, which allowed recording the appearance of surfaces before and during all the working process.

An interesting approach to the analysis of polished surfaces is that of tribology (Dowson, 1998). It takes into account the existence of different tribological mechanisms involved in wear that occur during polishing processes on lithic surfaces: adhesive wear, abrasive wear, fatigue wear, and tribochemical wear (Adams, 1988, 1993). These four mechanisms are not mutually exclusive concerning the modifications that they produce on the surfaces. They are not the result of a single independent event: they interact, and it is even possible that one of them will become dominant over the others depending on the characteristics of the contact surfaces and the nature of the intermediate substances.

Considering that each of these processes leave distinct patterns on the lithic surface, such patterns can be used to reconstruct the environment of contact associated with the tool's context of use. These patterns of use wear traces depend on the intrinsic variables

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