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Review

Obsidian transport in Fuego-Patagonia (Southernmost South America): A spatial statistical approach

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ABSTRACT

Petrographic, chemical, technological and distributional analyses of obsidian artifacts are a main focus of research in Fuego-Patagonia (Argentina and Chile, Southernmost South America). Despite the increasing interest in rocks exploited by Patagonian hunter-gatherers, few studies explored the large-scale distribution pattern of different types of obsidian. This paper compiles geographical data from stratified archaeological sites which record two main obsidian types over the past 10,000 years: black obsidian from Pampa del Asador (exploited by terrestrial hunter-gatherers from the Patagonia mainland) and green obsidian from the Otway Sound (exploited by maritime populations from the Fuegian Archipelago). The spatial distribution of sites with black and green obsidians is evaluated separately using spatial statistics. Results from spatial analyses statistically prove the differential nature of the spatial pattern between both sets of sites over time. It is suggested that the difference in the initial chronology of the human colonization, recognition of obsidian sources and long-distance transport of exotic raw materials between the mainland and insular spaces largely explains these results. Differences in human mobility and social interactions between terrestrial and maritime hunter-gatherers would account for further spatial variability between both sets of sites.

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1. Introduction

Since some archaeological materials were transported over long distances, they are particularly useful to provide insights into past human mobility and social interactions (e.g. Andrefsky, 2009; Dillian and White, 2010; Kelly, 1992; Kuhn, 1994; Li et al., 2016; Meltzer, 1989; Torrence, 2001; Wendrich and Barnard, 2008). A classic example are obsidian artifacts (e.g. Boyer and Robinson, 1956; Eerkens et al., 2008; Kelly, 2011; McCoy and Carpenter, 2014; Taliaferro et al., 2010). Obsidian is the easiest lithic raw material to identify and describe macroscopically (Shackley, 1998), and it often exhibits a distinct geochemical signature characteristic of a particular source (Glascock, 2002; Hughes, 1998).

In the Fuego-Patagonia region (41°–54°S, 66–74°W, southernmost South America), there are several obsidian sources showing evidence of human exploitation since at least ca. 10,000 BP (Civalero and Franco, 2003; Stern, 2004). Current archaeological research suggests that obsidians are common in most archaeological sites near their sources, while their frequencies in distant lithic assemblages up to 1000 km away are usually very low (Molinari and Espinosa, 1999; Morello et al., 2015; Pallo and Borrero, 2015; Stern et al., 2012). It seems that obsidians, whether directly or indirectly obtained, were not sistematically or intensively transported over long distances but rather resulted from incidental deposition. On the other hand, they are probably one of the few main identifiable archaeological materials with an appropriate distribution for assessing temporal and spatial trends in hunter-gatherer mobility and social interactions. Hence, contributions focused on archaeological data of obsidians have diversified although they are mainly focused on the large-scale distribution of a single type of obsidian (Manzi, 2004; Morello et al., 2004, 2015; Molinari and Espinosa, 1999; Pallo and Borrero, 2015; Stern et al., 2012) or different types at smaller temporal or spatial scales (e.g. Ambrústolo et al., 2012; Belardi et al., 2009; Charlin, 2009; Civalero, 1999; Espinosa and Goñi, 1999; Franco, 2014; Hermo and Miotti, 2011; Méndez et al., 2012; Stern et al., 2013).

Compared to previous studies, this paper presents a synthesis of all stratified sites which record the two main types of obsidian exploited within Fuego-Patagonia: black obsidian from Pampa del Asador and green obsidian from the Otway Sound. Two main topics of both obsidian distributions are addressed. First, their spatial and temporal variability by using spatial statistical techniques based in Geographical Information Systems (GIS). A second aim is to interprete the way and intensity of how the spatial distribution of sites with black and green obsidians changes over time. To achieve this aim, it is evaluated if the temporal trend of obsidian transport fits with a series of general expectations on lithic behaviour derived from the model of human peopling for Fuego-Patagonia (Borrero, 1989–90). As mobility imposes certain limitations on technological and transportation behaviours (e.g. Binford, 1980; Nelson, 1991), understanding where obsidians were commonly transported over time may help improving inferences about past human mobility and social interactions. To that end, approaches on raw material transport usually apply different methods for estimating artifact discard (e.g. Close, 2000; Dichfield, 2016; Kuhn and Clark, 2015; Morales et al., 2015; Nash et al., 2013; Pintar et al., in press; Sellet, 2013; Tomasso and Porraz, 2016). However, it can be particularly useful when complemented with spatial statistical analysis of the distribution of sites with artifact findings.

2. Background

Fuego-Patagonia includes continental and insular areas between Argentina and Chile, separated mainly by the Strait of Magellan (Auer, 1960). Current geography is characterized by well-marked environmental gradients. Due to the presence of the Andean mountain range to the west, which functions as a barrier to air flow, westerly winds normally produce a remarkable rain shadow where mean anual precipitation ranges from less than 200 mm in the northeast to more than 1800 mm in the southwest. Vegetation zones consist of the western mountain forests, which are mainly represented by evergreen species of Nothofagus, and a transition zone (ecotone) characterized by Nothofagus woodland mixed with steppe vegetation communities, plus the eastern semiarid steppe plains with grasslands and shrubs (Garreaud et al., 2009). While the southwestern smaller islands are separated by a complex network of channels, Isla Grande de Tierra del Fuego- currently divided between Chile and Argentina- is the largest island of the Fuegian Archipelago (Fig. 1). Tierra del Fuego, which is subject to a high oceanic influence that tempers climatic seasonality, is considered as a transition zone between the arid mainland and the fuegian sub-antarctic islands (McCulloch et al., 1997).

When early humans settled on the Patagonia mainland and Tierra del Fuego, the geography of Fuego-Patagonia was very different from today, at least at the end of the Pleistocene (11,000–9000 BP, McCulloch and Morello, 2009; Martin and Borrero, 2015) and prior to the definite flooding of the Strait of Magellan (ca. 8000 BP, McCulloch et al., 1997). Rapid and large scale changes occurred associated with the global warming pattern of the late Late-Glacial/Holocene transition (ca. 15,000–10,000 BP). The most important change was perhaps that the Patagonian ice field began to recede, thus exposing new areas available for human use (ca. 12,800 BP to 10,315 BP, McCulloch et al., 2005; McCulloch and Morello, 2009). Given the increasing availability of new spaces in Fuego-Patagonia, a process of slow, discontinuous and multidirectional migration of terrestrial hunter-gatherers took place during the Holocene (Borrero, 1989–90). There are different chronologies for the first human signals in periglacial environments of western mainland Patagonia (post 11,000 BP, Aschero et al., 2005; Mancini et al., 2013; Martin and Borrero, 2015), the Fuegian Archipelago (post 7000 BP, Legoupil and Fontugne, 1997; San Román, 2014) and along the southwestern coast of Tierra del Fuego (post 8000 BP, Morello et al., 2012; Orquera et al., 2011).

A scheme of human spatial organization with settlement nodes and marginal areas for different home ranges of hunter-gatherers with terrestrial and maritime strategies was established over time. Fig. 1 shows a line that marks the theoretical boundary between the two major Fuego-Patagonian settlement strategies: on the one hand, canoe people in the Fuegian Archipelago and southern coast of Tierra del Fuego; on the other hand, pedestrian hunters in the Patagonia mainland and most of the main island (Legoupil, 1985–86). Far from exhibiting a marked territoriality, spaces occupied by terrestrial and maritime hunter-gatherers appear to have been flexible, with a resulting overlapping of them within a framework of low demography and high mobility (Borrero, 1994–95). Additionally, long distance transport of obsidian and other exotic materials seems to have been very low and flexible over time due to the irregularity of social interaction networks (Borrero et al., 2011; Pallo and Borrero, 2015).

3. Developing expectations: artifact transport patterns over time

The model of the human peopling for Fuego-Patagonia (Borrero, 1989–90) allows addressing two main aspects of artifact transport patterns. The first aspect is to recognize the limits and recurrence or uniqueness of artifacts in space. The second aspect, in turn, is to interpret the way in which the spatial distribution of artifacts changed over time.

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