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Characterization and supply of raw materials in the Neanderthal groups of Prado Vargas Cave (Cornejo, Burgos, Spain)

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ABSTRACT

A systematic archaeological field survey has been undertaken in the area around Prado Vargas Cave (Cornejo, Burgos, Spain), which shows evidence of human occupation in the Middle Paleolithic. The aim of the study is to locate outcrops of raw materials which could have been used for the fabrication of tools by these Neanderthal groups. An archeological field survey of 46.6 km^2 in 94 different locations was undertaken, in which flint and other materials of archaeological and ethnographic interest were recovered. Different analytic techniques were employed (Fourier Transform Infrared Spectroscopy [FTIR], X-Ray Diffraction [XRD], and Inductively Coupled Plasma Mass Spectrometry [ICP-MS]) with the aim of typifying the lithic materials found in ten selected samples of flint on primary position in limestone and ten samples selected from flint on secondary position in clay. We have also undertaken the analysis of nine samples of archaeological flakes derived from the cave excavations. The flint samples were typified and the results of the data from the FTIR, XRD and ICP-MS were interpreted taking into account the similarity between samples of natural and archaeological origin, and the localization of possible areas of gathering of the lithic resources.

1. Introduction

Archaeologists have always tried to find the sources of the raw materials used by the human groups of the past to make their lithic tools. This information becomes essential in order to formulate hypothesis about migratory phenomena, routes, colonization of other areas in the region, patterns of resources exploitation and sources of raw materials (Martinez, 1991; Pérez et al., 1998; Carrion et al., 2004; Tarriño, 2004; Boulanger, 2006; Boulanger et al., 2006; Navazo, 2006; Cazals et al., 2007; Castañeda, 2008; Navazo and Díez, 2008; Olivares et al., 2009; Navazo et al., 2010; Borrazzo et al., 2010; Giles et al., 2010; Bustillo et al., 2012; Ordoño, 2012). The relationships between the human groups and the environment started to be subject of study during the decade of the 60s, in the past 20th century, following the so-called New Archaeology (Steward, 1955; Binford, 1962; Butzer, 1989; Renfrew and Bahn, 1993, 2008). In recent years, different techniques have been used (XRD, ICP-MS, etc.) so as to characterize the lithic materials, both natural and archaeological (Sieveking and Hart, 1976; Martinez, 1991; Pérez et al., 1998; Hubbard et al., 2004; Tarriño, 2004; Cazals et al., 2007; Navazo et al., 2008; Castañeda and Domínguez, 2008; Díez et al., 2008; Polvorinos et al., 2008; Shackley, 2008; Olivares et al., 2009; Borrazzo et al., 2010; Giles et al., 2010; Music et al., 2011; Quigg et al., 2011; Rieth and Johnson, 2011; Tarriño, 2011; Bustillo et al., 2012).

The first systematic work undertaken within our area of study, although centered in the cavities, was by Geoffrey A. Clark: "*The North Burgos Archaeological Survey, Bronze and Iron Age Archaeology on the North Plateau (Province of Burgos, North-Central Spain)*" — developed in 1972 and published in 1979. Other research works have also been centered upon samplings and excavations within the caves, as in the Palomera Cave, undertaken by Soledad Corchón in 1972 but without published results; in Prado Vargas Cave (Torres et al., 1993; Navazo et al., 2008); or in the Sala del Ayuntamiento (Garcia, 2001). However, outside de caves, the knowledge comes from isolated findings.

Thanks to the significance of spatial archaeology, the territory around the cavity sites started to attract the attention it deserves. Surface archaeological survey works began to be developed, and, with the aid of technology and specific programs, a relation

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between occupations and territory was found (Fernández, 1989; Orejas, 1991, 1995; San Miguel, 1992; Ruiz and Fernandez, 1993; Goodchild, 1996; Conde et al., 2000; Chapa et al., 2003; García, 2004a,b; Moreno, 2004; Navazo, 2006; Iriarte et al. 2007; Marín, 2008; Ordoño, 2008; Ordoño and Arrizabalaga, 2009; Rodríguez, 2009; Navazo et al., 2010; Maximiano, 2011; Bergsvik and Skeates, 2012).

This present work focuses on the application of the methodology on surface survey as developed in the works of the aforementioned authors, adjusting it mainly to the location of flint outcrops on primary position (hosted in the limestone substratum), as well as on secondary position, that is, decontextualized from its original location – both in limestone materials as well as hosted into clays. It entails the covering of the widest possible area of terrain, obviously according to the factors that help or hinder the achievement of this goal (Mendez et al., 2004; Navazo, 2006; Rodríguez, 2009; Navazo et al., 2010). The geochemical study of flint can be used as a technique of characterization because during the processes of host rock dissolution the flint can be enriched with elements susceptible of being included into the flint genesis. On the other hand, even though the processes of silification may be highly intense, usually there are remains of host rocks left, which are hard to valuate through the standard mineralogical analyses. However, they can be indirectly inferred through their chemical composition (Bustillo et al., 2012).

In this present work we propose a characterization of the raw materials used by the Neanderthal groups who occupied the cave of Prado Vargas. We develop a systematic surface survey with the aim of locating flint outcrops and perform geochemical and mineralogical analyses to determine their composition.

2. Regional setting

Prado Vargas Cave is located at the bottom of the left bank of the Ulemas River, upstream from Cornejo village, comprised within the Ojo Guareña karst in the municipality of Merindad de Sotoscueva (Fig. 1a, b). It is located within a large geological unit called Basque-Cantabrian Basin (Ramírez del Pozo, 1978; Jiménez, 1997; Tarriño, 2004; Tarriño et al., 2007), and is mainly constituted of materials from the Mesozoic Era. The depressed areas and the synclines are covered by Cenozoic sediments. This basin, comprising the west of Navarre, the Basque Country, the north of Burgos and Palencia provinces, and a great part of Cantabria, is characterized by the enormous power of its sedimentary successions, especially those of the Cretaceous (Del val et al., 2007).

Within the Basque-Cantabrian Basin we can differentiate three domains based on the structural criteria of age and the sedimentary characters of the outcropping rocks: from south-west to north-east these three domains are known as the North-Castilian Platform, the Navarre-Cantabrian Groove, and the Basque Arc. The Ojo Guareña karst is located in the second one, in the Navarre-Cantabrian Groove or domain. The Navarre-Cantabrian Groove corresponds to an area of important subsidence in the Mesozoic era, even though such a subsidence was compensated by a sedimentation which hindered the achievement of deep marine conditions.

From a structural point of view, and within the area under study, the materials in the northern part correspond to the Lower Cretaceous, with a high tectonic tranquility. In the southern part of the area under study, the materials correspond to the Upper Cretaceous and present a high tectonic activity – influenced by fold structures, faults, and important fractures (Ramírez del Pozo, 1978).

The Upper Cretaceous is very well represented in the area under study, alternating between continental and marine events, from the Lower Cenomanian to the Middle-Upper Cenomanian and the Turonian, up to the Middle-Upper Coniacian where the Ojo Guareña karstic complex – to which the Prado Vargas Cave belongs – is developed. It is in this geological layer where the majority of the flint materials found are located (Fig. 2a).

From a geomorphological point of view, the slope relief stands out, a monocline structure of limestone materials more resistant than those found beneath them, which are of a weaker quality and which conform the screes (Ortega et al., 2013). The Somo hills develop to the north of the Cenomanian limestone escarpments, formed by sediments from the Lower Cretaceous, of terrigenous and siliceous character, producing a monocline series belonging to the Weald facies, the Aptian, and the Albian (Ramírez del Pozo, 1978). At the opposite side of the Coniacian limestone slopes there is a succession of fields of limestone pavements, colmated and active dolines of different sizes, as well as geomorphological structures which conform the exokarst. Likewise, towards the south of the Coniacian limestone slopes, a second slope of limestones and marls from the Middle-Upper Santonian is developed, as well as the hanging wall syncline of Mesa from the Santonian (Ortega et al., 2013).

From an archaeological point of view, Prado Vargas Cave is known from the works of exploration and cartography done in the karstic complex of Ojo Guareña by the speleological group Edelweiss (G.E.E, 1986), which in the decade of the 70s recovered a skull of *Ursus spelaeus* and other remains, placed at the Museum of Burgos. Trinidad Torres became interested in this cave and performed a dig in 1986 making several samplings in which remains of fauna and lithic material attributed to the Middle Paleolithic appeared (Torres et al., 1993; Navazo et al., 2005). Subsequently in 2006, Dr. Marta Navazo and her team from the University of Burgos began the work of digging in the cave, extending the previously dug area, and recovering lithic materials and fauna (Navazo et al., 2008). From the recovered materials at level four of the sampling called "Alpha" a dating through the technique of amino acid racemization in a horse premolar (*Equus* sp.) was performed, resulting in 46.4 BP (Navazo et al., 2005).

3. Material and methods

3.1. Survey

In order to design the archaeological survey correctly, a working plan was developed from the recommendations and approaches formulated by different authors (Ruiz, 1988; Ruiz and Fernández, 1993, 1996, 1997; Fernández, 1989; Vaquerizo et al., 1991; Bendala, 1992; Almagro and Benito-López, 1993; Renfrew and Bahn, 1993, 2008; Burillo, 1997; Cerrillo, 1997; Chapa et al.,. 2003; Carrion et al., 2004; García, 2004a,b; Mendez et al., 2004; Moreno, 2004; Navazo, 2006; Navazo et al., 2008; Domínguez and García, 2007; Baena et al., 2008; Ripoll, 2010; Cerrato, 2011). These methodologies, originally focused on the search of locations with archaeological interest, have been adjusted to fit the main goal of the present work: the localization of flint outcrops, as well as to the results obtained in other related works in what pertains to the area of the gathering of resources (Tarriño, 2004; Navazo, 2006).

We start from the criterion of some of the authors (Higgs and Vita-Finzi, 1972; Davidson and Bailey, 1984) in relation to the radius of the optimum distance that the groups of hunter–gatherers could have inhabited, between 5 and 10 km (Lee, 1969); the calculation of distances based on the proportion of raw materials which appear in sites from the Middle Paleolithic in the southeast of France (Gamble, 2001); and the areas of gathering at different sites of the Basque Country (Tarriño, 2004). A radius of 5 km was delimited surrounding the site of Prado Vargas Cave, functioning as the center of the resulting circumference, an estimated area of 78.54 km^2.

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