Defying limits. Archaeology of social landscapes in high mountain areas of the Central Pyrenees

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Summary

In recent years, numerous research projects have broken the glass ceiling of archaeology by turning their attention towards high mountain areas. In many cases these were initiatives that originated on the margins of academia. Their area of study was located in places thought to be irrelevant for history, inhospitable and unlikely to be used for any kind of human activity in the past. Archaeological research has gradually disproved that myth. With the accumulation of empirical evidence in this regard, high mountain archaeology is beginning to come of age. And with it, numerous theoretical questions to reflect upon are emerging. One of them, especially relevant both for the characteristics of the geographical environment of the research and the documented evidence, is the conceptualization of space. How are the prehistoric spaces or landscapes documented by this archaeology? Are they also part of our object of study or only a context where it occurs? How do we deal with their representation and, within them, of a widely dispersed archaeological evidence? In this article I try to address such issues that, although already established in landscape archaeology, perhaps we have discussed little in the archaeology of the high mountains.

Introduction

A few days ago, a colleague from another university remarked that archaeology on the fringes often provides much wider perspectives on the discipline itself than forms of archaeology located in places with a more robust and consolidated tradition. He was referring to research in the high mountains of Europe, a field of study that has undergone a remarkable expansion in the last two decades.

By describing high mountain archaeology as a field on the fringes of archaeology, my colleague summed up several points. In one way, he was alluding to the fact that today many archaeologists and historians still consider mountain areas marginal to the main economic, social and cultural developments that have taken place over time. It is still usual to hear explanations that regard mountains as shelter for social forms resistant to change coming from stimuli that are always exogenous. The contemporary reality in Europe, in which political and economic systems are created from cities, is turned into a quasi-universal rule. Identifying high mountains as places of archaeological interest defies the modern limits of archaeology.

Another point refers to chronology. Academic archaeology is largely structured chronologically, both in its relation to particular historical processes and in the study of a specific empirical materiality. Thus, the acknowledgement of archaeology as a historical discipline implies its organisation into delimited periods of time which are in turn linked to a particular range of material remains that a specialist in that period can identify and situate easily. Recent developments in high mountain archaeology tend to break that pattern as attention is increasingly paid to diachronicity (for the Pyrenees, among others, Aguirre-García *et al.* 2018, Clemente *et al.* 2020, Gassiot 2016, Le Couédic 2012; Montes *et al.* 2019, Palet *et al.* 2019; Rendu 2003; Rendu *et al.* 2016). In that way, it defies the chronocultural structure of the

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discipline. This is due to two factors. First, research is oriented to determine how the population and exploitation patterns were established in those areas and how they were maintained and underwent changes over time. To a certain extent, preference is given to the *longue durée* in the analysis of social processes. Second, archaeological evidence in mountain areas does not always follow the same general pattern as in adjacent lowland areas. This conditions the capacity of rapidly attributing the phenomena observed to one or other chronocultural entity.

A third point is the management of space in archaeological research itself. As will be explained below, space is a key category in social sciences and therefore also in archaeology. Implicitly, and generally without an extensive prior theoretical reflection, highland archaeology tends to acknowledge that reality in different facets. One of them is the nuancing of the notion of 'archaeological site'. Generally speaking, archaeology has developed through the study of settlements, in caves, small villages, larger towns and cities. Even in its mortuary aspect, necropolises and burials, the delimitation of the widest area in which a particular society existed is conceived as a network of sites. In some way, high mountain archaeology defies the limits of this conception and attempts to view space as a continuum. This is partly because of the difficulty in delimiting the concept of 'site' empirically in mountains, as some authors have noted (Gassiot *et al.* 2016, Le Coéudic 2010, Le Couédic *et al.* 2016a).

In a complementary way, archaeological research in highland areas has tended to combine interest in palaeoenvironmental changes and archaeological sequences. Paradoxically, this interest partly derives from the assumption that these montane environments impose constraints for human presence and activity. However, it also corresponds to the aim of some studies to document how this human life affected and shaped high mountain ecosystems. It is frequent to observe joint research projects with archaeologists, geographers, palaeoecologists and other environmental scientists.

According to my colleague's remark, these aspects place highland archaeology on the fringes of the discipline. From this position it is perhaps easier to challenge the limits of archaeology. Finds of a considerable amount of archaeological evidence above 1,500, 2,000 and even 2,500m altitude are exceeding limits by demonstrating that these places, generally regarded exclusively as natural sites, are also archaeological areas. However, high mountain archaeological research is also breaking through theoretical and methodological limits of the archaeology consolidated in the academic sphere.

Intellectual and theoretical background

Archaeology, time and space

Archaeology is one of the scientific disciplines that study human beings over time and is one of the social sciences. In different European traditions, archaeology is also seen as a historical science (Daniel 1975; Trigger 2006). To the extent in which it focuses its interest basically on the study of the past, time and its passing become a central axis in archaeological research. This is the reason not only for the academic ascription of our discipline but also the familiarity of all archaeologists with the systems of measuring and determining time: relative chronology, stratigraphic superimpositions and absolute dates. There is a total consensus in establishing a relationship between archaeology and time.

However, it is equally obvious that all societies exist in space; a space that it occupies and which facilitates parameters that mark its very existence but which in turn is modified (or even produced) by the practices of that society. It can therefore be concluded that social sciences are necessarily historical sciences and, at the same time, they are also spatial or 'geographic' sciences. However, it is possible that none of them include in the image it builds of itself the acknowledgement that both dimensions are equally pivotal in its constitution as a tool of knowledge. Disciplines that give priority to synchronic

approaches to social reality tend to pay most attention to the spatial dimension of social phenomena. In contrast, those that are defined by diachronic approaches attach greater weight to temporal aspects.

Despite forming part of the second group, at least in European Schools, archaeology is possibly the social science where both views of reality interact most closely (Santos 2000). This may be because its main sources of information, material remains, are located dispersed in different places. Both among those sites and internally inside them, it is possible to define topological relations between the evidence; i.e. to determine the distances between them and characterise spatial associations and dissociations. Additionally, each piece of archaeological evidence corresponds to one or a series of human activities carried out in a particular context, in a specific time and with particular participants, following a specific technical sequence and with a series of purposes, functionalities, uses and discard. The combination of topological determinations and the precise characteristics of an assemblage of remains is able to define patterns in the distribution of human activities. In this way, a space can begin to be characterised archaeological, even if only intuitively. At this point, it is now necessary to attempt to define what space is.

Brief notes on space

Since the late 1970s, landscape archaeology has gained importance in the discipline, partly coinciding with the 1978 issue of *World Archaeology* with the same title. From its emergence until the present time, the conception of landscape, and even space in archaeology, has not followed a linear trajectory. At its start, the first studies that used that term employed a perspective taken from processual archaeology and cultural ecology. They assumed certain environmental determinism that foregrounded interest in palaeo-ecological information to understand the processes of adaptation of past societies (e.g., Aston and Rowley, 1974; Marshall, 1978). This was one of the developments of processual and functionalist archaeology which, from different points of view, added a growing concern for addressing spatial analysis (Vita-Finzi and Higgs, 1970; Jarman *et al.*, 1972; Binford, 1982; Hodder and Orton, 1990; etc.).

However, in the 1990s spatial studies in archaeology shifted and the terms 'space' and 'spatial archaeology' became scarcer in specialised publications to be replaced by the consolidation of the terminology 'landscape' and 'landscape archaeology'. At the same time, the consideration of landscape as an ecosystem was pushed into the background as phenomenological approaches were proposed instead (Criado, 1999; David and Thomas, 2008; Johnson, 2012; Parcero 2012, Tilley 1994; Ucko & Layton 1999). The conception of landscape as a physical entity was replaced by the view of landscape as a social element. The profusion of post-processual and post-modern perspectives in archaeology, especially in the Anglo-Saxon world, took those approaches towards concepts focusing on the social and individual apprehensions of landscapes.

The debate on space and landscape in archaeology reproduces an analogous discussion in physical geography that oscillates between the conception of landscape as a product of natural history and that of a tool to understand the representations that society makes of the territory (Pélachs 2006). One way to overcome this debate, which is quite meaningless, is to acknowledge that space is in itself a multifaceted reality, following the scheme proposed by the geographers Claude and Georges Bertrand (2000, 2002). They suggest that space should be studied in a hybrid way to overcome the duality established between nature and its opposite, which is the 'artificialisation' of space, as it is not possible to separate the social environment from the biophysical one. To achieve this, they propose the GTL system (Geosystem, Territory, Landscape), which can be used to explain three different but complementary space/time categories that define social space (Bertrand 2001).

- Geosystem represents the basic natural element of the system; that which is used, perceived and develops the function of source. It is formed by different physical entities that are connected with one another by a series of physical and chemical processes, etc.
- Territory represents the economic and social element. It defines resources and places as components of space integrated in the social dynamic.
- Landscape is the ideological component of the system. It is the result of the social-ideological practices of appropriation of the environment, in both its perception and its direct use. They establish it as a set of symbolic values in the framework of an 'artialisation' process (Roger 1997).

According to this proposal, every space comprises these three realities. As a starting point, it is a geosystem. A given geomorphology has created relief and a substrate, it hosts a series of biotic communities, past human activity has added a series of elements (terraces, artificial banks, new animal and plant species ...), insolation, precipitation and other factors favour certain physicochemical processes, etc. As such, it is the basis on which various physical entities are related in terms of natural processes, even though the origin of some of those entities may be anthropic. Territory is formed by the social use of a geographic area in a certain time. Thus, for example, the creation of common land, a road and communications network, the division of land or differentiation into habitat versus funerary spaces and other kinds of activity are central components in all territories. Finally, landscape recognises a universal reality: the fact that every community projects itself ideologically in a space and this process is historically variable, arbitrary (to the extent that the assignation of meaning is) and changeable both in time and between segments of a community. As a GTL system, social space exists diachronically. The geosystem changes over time, both due to natural dynamics and human impact. The territory, insofar as it is the materialization of historically changing economic and social practices in space, varies from one period to another and from one place to another, as does the landscape.

Highland archaeology acknowledges this scheme more or less implicitly. As its object of study, it establishes the territory, or rather a succession of territories in constant transformation, which it understands as the spatial existence of a given society. As a source of information, it resorts to the geosystem in that this is also shaped by the material alterations to the environment resulting from human activity. These alterations form the archaeological databases, although they sometimes fall outside the format that archaeology normally considers for archaeological empiricism. This aspect will be studied further below. Finally, it acknowledges the existence of the ideological appropriation of the space, as the terrain for social reproduction and conflict, but in turn it accepts the difficulty in tackling its study, since the arbitrariness of this symbolism greatly hampers its present phenomenological comprehension.

The identification of space by archaeology comes up against another problem, whose solution is often not achieved totally consciously although how it is done is very important for all studies. Again, this problem is related to how, from social sciences, we understand that space is shaped. In fact, in Western thought the notion of space has swung between two poles. One has led to it being presented as an *absolute element* in itself. The other, as a *relational sphere.* In the former, space is viewed as a container of processes and things; in the latter it is seen as a mesh of relations between the processes and the entities that shape it (Harvey 1969; Conolly & Lake 2009).

The absolute or Euclidian characterisation of space explains it as a container of entities and understands that its existence is independent of the elements it contains. This approach can be traced in the Greek atomist philosophers and later in the Renaissance. Newton's development of physics stimulated this point of view as he formulated a series of laws that govern the objects and processes in that space. In turn, the English physicist resorted to God to justify the pre-existence of space over the phenomena it contains. Similarly, Kant considered space as an '*a priori*' condition, as the place or setting where a range

of events occur, a series of objects coincide and different processes take place (Sus 2016). From this perspective, space allows an element to be introduced to classify those events, objects and phenomena according to their position. In the late nineteenth and early twentieth centuries, geography and other social sciences objectified that perspective and gave space a character of externality to social practices as it was considered the base, container or place where these take place and largely determines or conditions them (Ratzel 1889; Sauer 1925). In the twentieth century, this perspective was also hegemonic and has led to physical space often being assigned a determinant role in social reality.

In sum, space is envisioned as a setting for social practices and the objects shaped, altered or produced by those practices. Following this thread, every society occupies a space with a particular relief, hydrographic network, climate, vegetation, etc. In theory it can be delimited precisely and to a certain extent an explanation for the geographic reach of that society can be sought in the nature of those limits. This does not exclude the possibility that the said society might alter its physical environment, depending on its technological capacity and social 'needs'. This sequence of arguments, which is common in archaeology (Bender 1993, Heilen 2005, McGlade 1997, Tilley 1994), reproduces the approach to space as external to society and faithfully follows the 'nature-culture' dichotomy that has been at the heart of some of the concerns of geography and anthropology since the late nineteenth century.

At this point, the analysis of social space has always come up against two issues that are hard to solve. First, if space pre-exists, what is its influence on human societies over time? Does it determine them and how much? Does it affect all societies in a similar way? Archaeology has responded to this problem in several ways, oscillating from a Ratzelian determinism to possibilism supported by the proposals of such geographers as Sauer and anthropologists as Kroeber (Gassiot, 2001). However, the answer has generally been implicit and it has usually been assumed that pre-industrial societies, especially in prehistory, adapted to a pre-existing environment. Following this logic, the only way to deny determination of the environment over a society requires their activities to be explained outside the context of the setting in which they take place. In prehistoric archaeology, these situations have normally been linked to colonisation processes in a territory; although after the initial settlement, the environment is again assumed to influence later social and cultural developments.

The second issue refers to the limits of the space: how far does a given social space reach? This issue often arises in monographic studies and research programmes that need to delimit their spatial frame. The limit can be situated at the edge of an archaeological site, or in a physiographic, biogeographic, administrative or cultural entity. Considering high mountain archaeology as an independent field of study, focused on supposedly isolated and self-sufficient populations in those areas, also comes up against this problem. In general terms, research in those areas shows that the human presence in mountain areas during different periods cannot be studied out of its context in the economic and social dynamics of a wider geographic area, of which it formed part.

However, space can be conceptualised in a radically different way. It can be understood as a positional quality of the world of objects and events (Harvey, 1969; Lefevre 1991; Olsson 1974; Soja 1980). That is to say, space exists to the extent that there are objects and events occur. Some objects and some events appear and occur in a place, for which a relationship of proximity or distance can be defined. In contrast, it does not exist without objects or events. During the nineteenth century, for example from the positivism of Comte, some philosophers of science began to advocate that view partly as a reaction to Newton's metaphysical identification of absolute space with God (the *Sensorium Dei*). The development of the theory of relativity contributed to spread this relational perspective of space in physics, as science had been reluctant to abandon the Newtonian approach until the early twentieth century. Thus, a topological, or rather a topometric, conception of space has gradually become accepted; at a physical

level it is assimilated to a network of relations between different entities. These relations are expressed as distances and directions that can therefore be quantified and also represented mathematically.

By the mid-twentieth century, this view of space began to be introduced in geography (Watson, 1955), initially from a quantitative logic but later it was also included in radical and Marxist geography (Harvey, 1969; Santos, 2000). It was steadily accepted that, in social space, the distance between the entities that form it can be expressed in terms of cost, effort, time, labour or other variables derived from social interaction. In some ways, this categorization of space involved a framework of analysis that was compatible with the usual procedures in archaeology when spatial associations are defined. At the same time, by focusing the notion of space on the entities that form it and their relations, it established a framework that the developments of geodatabases and GIS applications were able to represent with increasing precision.

Within this line of thought, and following Santos (2000), social space is a material reality that can be defined as a topological relation between 'technical' objects. In simple words, space is formed by 'things', each one of which, through a series of processes, is located in a place. This means that between one 'thing' and another there is a certain distance in a particular direction. Thus, a topological relation can be defined, measured and, in physical terms, it can be described objectively as a vector. The limits and the character of this space can be established by the distribution of the elements that form it, by their density, the aggregations they form or the absence of them, and the characteristics of their relations. As archaeologists, we are interested in the social facet of this space and not only the physical aspect. This implies that two relevant issues arise. The first is that we focus on the 'technical' aspects of the things that constitute it. That is, on the objects that participate in some way in social life, whether as raw materials, as domestic places, as means of production, as symbolic referents, as excluded places, and so on. The second is that the measurements of proximity and distance can be transferred to other units, such as the duration of movements, the effort, and other types of accessibility. It is also understood that, in the absence of entities, the consideration of this space is meaningless.

This forces us to go beyond the simple topology of the objects that form a given space. In other words, it also implies observing the characteristics of the entities that, with specific locations, define a given space. In fact, in many cases, these qualities explain the exact position of the entity and consequently the relations of proximity or distance (of association or dissociation) with other entities in the space. Santos's notion of 'technical' object (2000) is the outcome of the acknowledgement that, in a human and therefore social space, every object can be characterised in connection with the activities that are performed. Through its labour, every human society transforms matter to ensure the necessary means for its existence (Marx and Engels, 1974). The application of human labour in the process of the production of social life involves a series of actions on a pre-existing matter that, in general terms, comes from previous situations of social life. These actions acquire a certain morphology and take place in a particular sequence depending on the product being created, and the knowledge, technical resources and capacity of investment in labour of those who carry out the actions. This is therefore the reason for the 'technical' nature of the different objects forming a social space. In other words, they are products of the work of men and women who live in a specific time, who seek to solve specific needs and relate to each other and to their environment in a certain way. In this process they recreate an existing reality and, at the same time, modify it. This means that space, from a social point of view, is historical and changing.

However, it is also necessary to take into account those entities that exist in a geosystem but do not receive a direct action and therefore their morphology is not directly and clearly altered by human activity. Two points must be considered. First, both the inclusion and exclusion of a given productive process are defined in the frame of a social practice. This practice defines the utility or otherwise of an

object for human life and, in that case, the place it occupies in it. The abandonment of many highland pastures with the changes in livestock production in the late twentieth century, as well as the disinterest in Pyrenean iron seams of the populations prior to 900 or 800 cal BC, to cite two cases, are examples of this. In the eyes of the researcher, both cases contribute to characterise the productive systems and consequently, the social practices in the different historical periods and geographic settings. To complement this aspect, the spatial arrangement of the entities that form a space and do not receive direct human labour also indicate continuities and discontinuities in terms of distances (and therefore of time costs, social relationships, etc.) in the human practices and thus also define the social spaces where they exist. While they are part of the geosystem, they do not participate in shaping the territory or, consequently, the landscape.

The second question refers directly to the identification of human action on matter. When the impact of labour on a material is direct, the identification of human activity is clear. In the context of a living society, it derives from the very awareness of the actions that are performed. In the case of a fossil record, archaeology has gradually developed procedures to identify such labour (Daniel, 1975; Trigger, 2006). In contrast, this identification is not so direct or evident in those alterations that the same human actions cause to elements in the space but which do not receive the action directly. One example is the introduction of domestic cereals in south-west Europe in the Neolithic, which involved the spread of a series of adventitious plants, modification of the speciation of ecosystems, changes in edaphological processes, etc. These materials also receive an anthropic impact that modifies their morphology, distribution, frequency, etc. In fact, in recent decades, archaeology has increasingly identified this reality more clearly, for example by employing techniques from palaeoenvironmental sciences to assess the degree of anthropisation of a given space (Berger, 2005, Butzer 1982; Catalan *et al.* 2013, Ejarque 2009, French 2005, Ninot *et al.* 2017).

The relational categorisation of space is able to overcome some of the issues associated with absolute space and is especially useful in archaeology. In the first place, it places matter in the centre of its own space, so that the space would not exist without it. Therefore, it fixes the source of information *par excellence* in our discipline as the basis for the identification of the space. Similarly, social space is structured by a materiality that, as well as being characterised by specific physical properties, is formed in connection with human labour and activity. In this way, the elements articulating the social space are the social practices that are realised materially. In fact, the space is that materialisation. Therefore, society itself cannot pre-exist in abstract as a social space. It is not external to it but is it in itself. Apparently contradicting this, the pre-existence of a social space derives from the fact that in turn, every space is a social product. In the same way as every intentional action corresponds to the existence of an 'idea' of that action, and that this previous notion comes from the experience of the person who has it, human existence is carried out in a space that it previously produced or socialised; that is, on a previous historical experience that is also spatial by definition.

In second place, it is the social action that defines the size of its own space. This solves the problem of its delimitation. Indeed, in a space that is continuous, it allows gradual boundaries to be established resulting, for example, from a decrease in the intensity in which a society is active as the distances increase (fewer activities, less frequent presence, etc.). Finally, this theoretical proposal requires the focus of archaeological study to be concentrated on space as a territory. A centrality that is also compatible with the recognition of the two other dimensions of social space; as a geosystem and as a landscape.

This theoretical reflection has accompanied 20 years' research in upland areas carried out by the High Mountain Archaeology Group (GAAM) at the Autonomous University of Barcelona (UAB) and the Spanish National Research Council (CSIC). It has grown with the need to constantly rethink an archaeological

practice that did not always fit in previously learnt schemes. At the same time, it has also pointed to horizons that the research should head towards. I shall now try to point out some of the implication of these proposals in the fieldwork. In my opinion, these implications are not at all peripheral to the development of archaeology as a science even though they have partly taken shape in a 'marginal' area for research.

Methodological approaches

Surveying as a source of information

One of the foundations of highland archaeology is the premise that the past territories become fossilised and that it can in part be recognised archaeologically. This assumption has increased the value of surface surveying as an archaeological method enormously. It is nothing new for archaeological surveys to be regarded as a vital archaeological method, not with the aim of discovering a 'good site' but a source of archaeological information in themselves. They began to be introduced in Anglo-Saxon archaeological research programmes in the 1970s as a way to strengthen a view of the territory of study over and above the site. In Spain, this development has clearly not been so complete and surface surveys have mainly been carried out to complete administrative archaeological catalogues and in the context of preventive studies connected with building work and territorial planning (Clemente *et al.* 2019, Gassiot 2016, Montes *et al.* 2019, Palet *el al.* 2019, Rendu 2003, Rendu *et al.* 2016, etc).

The scarcity of previous archaeological records has meant that research in high mountain areas has generally attached great importance to surveying, at least in initial phases of their programmes. At first, the purpose of this surveying was surely not too different from its role in traditional archaeology: to locate archaeological remains where more intensive research could be carried out later. However, with time, surface surveying has acquired a more central position. First, it has emerged as a possible, accessible and useful method to reduce the deficit of archaeological records in certain areas (Gassiot *et al.*, 2016, Le Couédic 2016a). Secondly, and more importantly, it has enabled a wide and varied array of archaeological remains dispersed across a physical space to be located, positioned and described. The situation of those remains has sketched out a first archaeological map which, rather than being a more or less dense point cloud, has introduced a first perception of the archaeological space. Each point refers to a morphology of the remains and an initial hypothesis about their functionality and chronology. Thus, point by point, a first zonification of the space has been achieved, with their different uses and intensities.

In physical terms, each archaeological site is still a discrete unit, delimited on the surface by the presence of walls, the distribution of portable objects, etc. However, this first assignation of significance transfers it to a continuous space. To give an example, a pen suggests the stabling of livestock, which in turn leads to the pastures around the places where these archaeological remains are visible. Similarly, a habitat in a small rock-shelter leads to a consideration of the firewood burnt in the hearth, among many other aspects. Archaeological surveying does not therefore only contribute a list of points or archaeological remains. It also provides an initial basis to begin to draw the main lines that shaped a territory in a given period. As surveying reveals evidence of different periods, it also sketches out the sequence of changes in territories over time.

The consideration of surveying as a way to obtain archaeological data also involves risks as well as its strengths. It is able to cover large areas with a limited cost in economic, human and time resources. The correct use of the information it generates creates attractive and plausible pictures of the possible past territories. However, in many cases an archaeological site ends up characterised by its location; by variables related to its place. Making the inference of the function of a site depend solely on these

variables can lead to a kind of micro-geographic determinism: a particular location implies a specific function of the site and even the occupation pattern. Plentiful empirical evidence reminds us of the need to increase the information with archaeological data from different places as a way to reinforce the inferences about their meaning. A fixed equation between type of place and type of function or use of its occupation cannot be assumed beforehand.

From the site and the settlement to the territory

The new importance of archaeological surveying in high mountain areas has resulted in a change of perspective that has involved numerous methodological challenges in addition to a theoretical reflection. First, it has reduced the importance of the category 'site' in archaeological records for several reasons. At an empirical level, without excavating, it has proved difficult to establish the relations of coetaneity between the different elements visible on the surface enabling their association with a synchronic settlement (Carrer *et al.* 2015, Le Couédic 2010). Similarly, the frequent dispersion of the remains also makes it difficult to establish the spatial limits, especially when the ability to define settlements only by surface finds is debated. The solution of this issue is not easy and has led to cooperation between different research teams (Le Couédic *et al.* 2016b, Laurent *et al.* 2019).

In addition, high mountain areas in southern Europe were generally not the location of large political power centres as, for different reasons, they have not been suitable terrain for state systems. In the same way, in many cases winter weather conditions have limited the possibility of all-year settlements and imposed very mobile population dynamics. These two realities mean that few archaeological remains are usually found at the sites, which limits the capacity to assign them significance. One way of partially overcoming this limitation is to turn attention away from the site itself and seek a complementary source of information in its location and proximity or distance relationship with other entities (Gassiot *et al.* 2019).

The central importance of the site has also decreased on the analytical level. In the first place, the recreation of space as a continuous realm of relationships also affects the boundaries of the site. We should recall that this is a concept that comes from entities that are easily delimited archaeologically, such as a cave, a fortified settlement or a dolmen. From a 'macro' point of view, territory acquires the role of the mirror of a society and illustrates the organisation of its activities, the shaping of its places and its structuring, the socialisation and transformation, ultimately, of the geosystem in a social instance. As this reality becomes fossilised, the material record dispersed across the space is the basis of the archaeological identification of the territory (Bradley 2000). This record is formed by traditional archaeological evidence (artefacts, ruins of buildings, graves, etc.) but also by numerous physical remains distributed across the geosystem, which necessarily correspond to human action on it. In this way, the archaeological attention to territory widens the scope and acquires new depth. It explores palaeo-ecological records, changes to the relief that cannot be explained solely by natural processes, alterations to biological speciation, traces of atmospheric pollution... but without ignoring the value of traditional archaeological remains as a robust source of information about the past (Wash 2008).

This new array of empirical interests requires new inter-disciplinary alliances and indeed, many studies in mountain areas have been a good example of this in recent years. At the same time, interest must be enlarged to cover everything that occurs outside the archaeological site. External evidence is no longer a simple contextual element and becomes the manifestation of a past territory. This is also emerging as a characteristic of highland archaeology.

Relational space, GIS, geodatabases and territorial analysis

Understanding space as a mesh of distances between objects, events and processes removes it from appearing as static representation, for example like a picture in a frame. It involves a complete change of perspective which, in some ways, is fully coherent with the usual apprehension of space in archaeology. In an excavation we record the coordinates of objects to determine their position; we represent the extension of the strata and draw structures. Even when photogrammetric techniques are introduced, we also aim to georeference the images. In this way, as in a jigsaw, we construct the representation of space piece by piece. When associations between objects are used to identify and characterise areas and contexts, we are operating within a relational perspective of space. When we move outside the excavation square grid and carry out the operation at a smaller scale, locating cabins, isolated walls, terracing, galleries, charcoal kiln sites, isolated objects, paths, etc. we are doing the same. By establishing the relations between these elements, each of which is in a specific position, we are characterising an archaeological territory. If other records are available, such as the geology or inferences about the palaeovegetation, we superimpose them as layers in order to increase the robustness of our representation of the past space.

Archaeology may have come late to the use of Geographical Information Systems (GIS) and also unequally. Although in Spain their use has developed most rapidly in preventive archaeology linked to territorial planning, in recent years it is also becoming more widespread in basic research (Quirós & Vigil-Escalera 2019). It is now a common tool in many archaeological research projects in different fields of knowledge. In high mountain archaeology, the use of different GIS programmes is practically universal, not only to project archaeological data spatially and represent them but also to perform analyses and make inferences (Carrer *et al.* 2015, Gassiot *et al.* 2020, Le Couédic 2010). While the use of this software follows the standards of its use in other fields of archaeology, the extension of its application to practically all the research teams is noteworthy. This means that the systems of collecting information and codifying it are gradually being modified, both in response to the spatial nature of the data and to facilitate their representation.

Thus, for example in architectonic contexts in the open air, in the GAAM we try to avoid the complicated term of site to record, at different levels, archaeological zone, settlement, enclosure, wall, activity area and object. Each category corresponds to a segment of the archaeological record, which is largely assumed to be continuous when observed at different scales. In turn, each one of them is formed by different zones, settlements, enclosures, etc. situated in a particular place, with a specific geometry and with a specific set of spatial relations with other entities, either archaeological or belonging to other components of the geosystem.

The consolidation of the use of geodatabases in highland archaeology, together with the growing application of geographic analysis software, is allowing increased modelling of archaeological territories as continuous spaces. It is necessary to resolve several issues to complete this representation. One of them is to represent the past geosystem and its successive alterations as precisely as possible. In mountain archaeology, the integration of both fields of research has been intense for several years, with numerous joint research programmes (Catalan *et al.* 2013 y 2019, Ejarque 2009 y 2010, Gassiot *et al.* 2014, González-Sampériz 2019). Another is the inference of the social practices that determine the link between the entities that shape a particular territory. This last aspect is at the heart of all archaeological explanations and, as in other fields of the discipline, different initiatives of methodological development are being explored in high mountain research.

Discussion of an example: archaeology and mining territories in Bosc de Virós

Numerous high mountain archaeological case studies have promoted the previous analyses, none of which had been determined barely 15 years ago. This has taken place within the GAAM, as the advancement of empirical research has demanded parallel theoretical development to solve several issues which had not been foreseen initially. Thus, the realization of archaeological surveys with their subsequent excavations in various areas of the Pyrenees in the last 20 years (figure 3.1) has forced us to face unforeseen challenges. I would imagine that other teams working in similar environments will be undergoing analogous processes. Archaeological investigation in the area of Bosc de Virós is a good example, a sample that can be transferred to other fields of research.

Located on the northern slope of Pic de Màniga, the Bosc de Virós is a forested area that extends over 1,800 ha. at altitudes of between 900 and 2,540m (figure 3.1). Now belonging to the High Pyrenees Natural Park (PNAP), it is located in Vallferrera, a Catalan place name that means 'iron-producing valley', one of the places in the Pyrenees that saw intensive iron production during the modern age.

Three different projects focused on Bosc de Virós, the forested part of the mountain slopes, in the years from 2002 to 2004. One was the archaeological surveying by the GAAM. The second was an environmental geohistory study by the High Mountain and Landscape Research Group (GRAMP) at the UAB and the last one was carried out by the Mining School in the Polytechnic University of Catalonia (UPC) (Castellarnau & Mata 2002, Gassiot *et al.* 2007, Pélachs 2005). From the archaeological point of view, a total of 1,037 charcoal kiln sites, 237 beginnings of iron mines (shafts, ditches and galleries) (figure 3.2) and 19 mounds of slag from direct iron reduction (figure 3.3) were located and documented (Augé *et al.* 2012, Gassiot 2016). The charcoal kiln sites were dated between the 11th century and the present, except those associated with the slag heaps. Like the slag heaps, these were dated between the late 2nd and mid-6th centuries cal AD (with some rare later sites, in the 7th century). The chronology of

Figure 3.1. The Bosc de Virós is a north-facing slope in the western Pyrenees of Catalonia. In the map, its location.

Figure 3.2. Example of two iron mines in the Bosc de Virós. Up: open-air trench mine, possibly with a Late Antiquity chronology. Bottom: slag heap of an active mine in the 19th century.

Figure 3.3. Image of a slag heap cut by a forest track. The cleaning of a section of the profile allowed the recovery of coals, direct iron reduction slag and fragments of furnace walls.

the mines was more variable. Some of them were active in the 19th century, whereas others displayed no contemporary evidence and were only associated with the slag heaps, generally less than 100m away. Stone tumuli and circles, possibly corresponding to the 1st millennium cal BC; some small much more recent pastoral constructions, and remains of the Spanish Civil war were also documented in the area. The research continued from 2006 to 2009 in a joint project by the GAAM and the GRAMP, in which the palaeoenvironmental study, based on a sedimentary core taken in Coma de Burg, was combined with the archaeological information.

The fieldwork has defined Bosc de Virós as an old iron-working territory at different periods and in a changing manner over time. A huge number of materials directly related to past iron production are distributed across an area of a little over 900 ha. They include evidence of mining for ore, the transformation of the ore into metal, and the production of fuel for the furnaces and forge. Ruins of buildings connected with the mines and furnaces and some tracks have also been conserved. In this regards, Bosc de Virós is therefore a continuous archaeological space. From the start, numerous doubts were raised by the recording system, which was based on the category of archaeological site, inspired by the usual procedures in both academic archaeology and administrative archaeological catalogues. What level should the 'site' be limited at? Was the whole area a 'site' or should it be delimited at the level of each particular entity? And in this case, if it was clear that a 4th century slag heap could be a 'site', what was the correct procedure for a charcoal kiln site or a mine that additionally formed part of a series of mines following a seam? Questions like these were salient for both research and heritage management.

The solution to these issues proved to be even more complex when the modern vegetation and data about its development over the last 3,000 years was added to the equation. Pollen and micro-charcoal evidence indicated that after the 2nd century cal AD, the number of fir trees and deciduous species declined and pine began to predominate as it occupied the spaces left by the former taxa (Augé *et al.* 2012, Pélachs *et al.* 2009). Numerous ^{14}C dates confirmed that this process began at the same time as the direct reduction furnaces were functioning in the late Roman Empire. The woodland recovered after the 6th to 7th centuries although this did not involve the regeneration of mixed forests. This was followed by a new decline in the forests during the 10th/11th century AD, which was mainly of pine, and it only began to recover again in the second half of the 20th century. Historical sources place in the 15th / 16th century AD a new iron and steel production in the region, this time centered on workshops with hydraulic furnaces in the valley bottoms. Unlike the previous one, this second decline in the forest mass does not correlate with evidence of in the Bosc de Virós area. In fact, its origin cannot be associated with evidence of metallurgical activity given the absence of slag heaps. Rather, it seems to be linked to a marked increase in cereal production and the opening of pastures. In sum, Bosc de Virós, as it exists today, is largely the consequence of different processes, including their intensive forestry use linked to iron production both in the late Roman period and later, from the end of the Middle Ages to the 19th century. The evidence of this is not only the size of the forest but above all the decrease in its diversity. The modern forest is therefore also a material product of the past.

In this way, the archaeological focus expanded, not only from the 'site' to the territory but also to the modern form of the geosystem which displays, like a palimpsest, the impact of human activity in the area at least during the last centuries. The result is a series of layers of information, one on top of another, to complete the representation of an archaeological space. However, that does not complete the definition of the territory. As explained above, territory is constantly redefined by the social practices in a space in each period. It therefore requires a synchronic study. While the palimpsest that is deposited in the geosystem records the diachronicity, the definition of the territory should discriminate the synchrony for each period. This also requires chronological information to be assigned to each entity documented and situated in the space. Thus, the establishment of age, mainly by absolute dates, becomes a necessity and implies discriminating the components in the space to find synchronies between them and
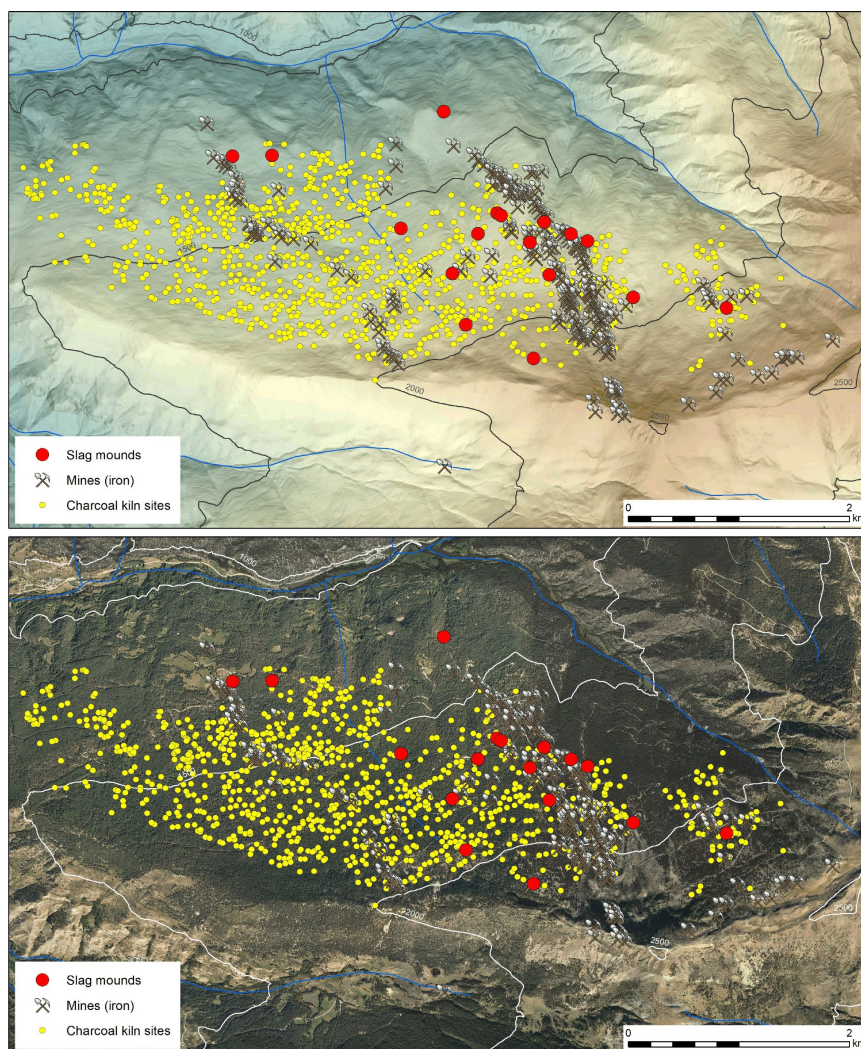
Figure 3.4. Dispersion of the archaeological vestiges of mining and iron and steel production in the Bosc de Virós. Up: topographic map. Bottom: aerial photography.

represent each territory. Their temporal succession is also able to sketch out the social changes in the territory over time.

Territory is represented by the sum of different kinds of entities with specific associated metadata. To complete the representation, it is also necessary to determine the geographic reach of the territory. As mentioned above, in archaeology we are accustomed to defining delimited geographic frameworks in which we focus the study, and we tend to allot them certain historical and social significance. In a very nuanced way, Figure 1 may also play that role: the mining-metallurgical territory of Bosc de Virós is given those boundaries, it covers this area with these characteristics. However, it is obvious that the activities that defined this geographic area as a mining-metallurgical territory went beyond those boundaries. In the modern age, reduction was carried out in furnaces in the valleys, where hydraulic energy was used. Furthermore, part of the mining work may have been performed by labourers from the Ariège, on the northern side of the Pyrenees, while the local population were mainly farmers. Finally, the iron produced was transported downriver to the port of Tarragona, where it was traded.

From this point of view, the spatial aspect of iron production in Vallferrera in the 18th century displays numerous facets. The supply of iron to the forges in Àreu and Ainet came from mines a few kilometres away, like the charcoal. The labour force, particularly specialised workers, came from the north of the mountain range. Then the product was sold in a Mediterranean port. The topological relations between these activities characterise a mining-metallurgical territory in the modern age very clearly, but in a very different way from the territory that existed before the 6th century cal AD. At that time, the iron reduction workshops were a few metres away from the mines and these, unlike in the 18th century, exploited the four iron-ore seams in the area. Even the charcoal hearths where the fuel for reduction was made were nearer at hand. At least some of the metallurgical workers may have lived near the workshops, in the light of the architectonic evidence documented at some of them. These workshops may not have functioned in winter as in many cases they are at above 1,700m altitude and up to 2,100m. Although we do not know the use that the iron was put to, its distribution was possibly much less extensive geographically. The Late Antiquity production in Vallferrera came into being when other much larger Roman iron-producing centres, as at Montagne Noire in France, lost importance and much more local workshops emerged. Thus the set of relationships that shaped the mining-metallurgical territory before the 4th century cal AD was very different in appearance (Decombeix *et al.* 2001).

Conclusions

By challenging its altitudinal limits, high mountain archaeology may have moved outside our discipline's comfort zone; and not only because of the difficult access to the places it studies. The lack of prior information about many of the issues it addresses, together with the nature of its sources of information, has obliged it to solve problems that emerge in it with particular relevance. The need to consider space, understood as a territory or social landscape, as the focus on which it concentrates to represent the past, is not unique to this field of archaeology. However, this need is seen clearly and openly in highland archaeology and has led the different research groups to seek solutions to shared problems as they appeared. Answers have largely been reached through practice, by addressing aspects such as how to define the units of observation, establish the links between the different scales of that observation, combine different types of data and manage it as a set of information that possesses both a geographic and a temporal nature. This has also involved the need to consider how this space is understood and recognise its duality as the place where societies exist and at the same time the place produced and recreated by the same societies.

Little by little, the need for practical solutions to the different situations is also opening a window to other considerations. This paper has tried to describe part of the GAAM's 20 years of experience and explain some of the reflections that this has encouraged. They are really issues that emerge in many other fields of archaeology but which perhaps occur with a special intensity in mountain archaeology. The collective effort to solve them, to which this paper aims to contribute, must undoubtedly also assist progress in archaeology as a whole.

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