In southwestern France, Paleolithic studies have long relied on the study of archaeological sites largely devoid of proper consideration of their environmental settings. Over a period lasting approximately ten years, initially researchers focused much of their attention to attributing cultural finds into chronological phases and sequences. It was only in the 1960s that serious attention began to be given to environmental contexts and raw material distributions so as to allow stone artifact sourcing studies to proceed (Valensi 1960). Subsequently, such studies on the provenance of archaeological raw materials proliferated (Borde 2002; Bressy et al. 2006; Geneste 1985; Tiffagom 2006), as did those concerned with the origins of faunal resources (Castel 1995; Costamagno 2006; Fontana 2001) and those comparing technological and subsistence provisioning strategies (Castel et al. 1998).

In contrast to these earlier and largely techno-economic programs, here we present a multidisciplinary study of past landscape engagements by systemically investigating the regional environment and its relationships with the material culture of Solutrean deposits in southwestern France. We combine these various sources of information to explore strategies of past landscape engagement, in particular as these relate to subsistence practices, technology, and social organization.

The Solutrean, an archaeological “culture” or phase (20,000–17,000 B.P.) of the European Upper Paleolithic (40,000–10,000 B.P.), is amenable to a range of functional and spatial research approaches, since its restricted temporal and spatial extension limits possible confusions between the synchronic and dynamic perspectives emphasized by Binford (Binford 1982a).

It is thus possible to approach different archaeological perceptions of Solutrean territories through patterning in the exploitation of animal and mineral resources (Castel et al. 1998, 2005, 2006). This analysis, which is synchronic owing to the short duration of the Solutrean, interrogates diverse data concerned with subsistence economy and symbolism to inform us on ecological contexts of territorial behavior through the spatial distribution of sites. In contrast to other recent studies that favor a limited disciplinary field or that concern limited data collected a long time ago, our approach concerns an interdisciplinary perspective of the human ecology of the Upper Pleistocene (Binford 1981; Ellen 1979; Guille-Escuret 1989).

In this chapter, we explore how what is by now a detailed archaeological understanding of the temporal and spatial distribution of Solutrean archaeological materials can inform us on Solutrean *territorial* networks—that is, how material distributions across
Chapter 21: From Physical to Social Landscapes

the land can be used to inform us as to past social arrangements as sociopolitical landscapes.

**Territories of Alimentary Resource Acquision**

To understand ancient territories, at least in part from animal resource acquisition activities, one must have an ensemble of well-preserved, contemporaneous sites, knowledge of the seasonality and duration of occupation at these sites, as well as an understanding of the zones of geographical distribution and patterns of movement of the fauna in question.

**The Sites**

In the Aquitaine region of France, the Solutrean sites that have well-preserved faunal remains contain palimpsests of different occupations; sites with specialized activities attributable to individual events are rare. All faunal remains were collected at four recently excavated sites: Combe Saunière, Cuzoul de Vers, Les Peyrugues, and Cave XVI. At five other sites, all fauna were collected from a limited area of the site: Le Placard, Jeanblancs, Casserole, Petit-Cloup-Barrat, and Sainte-Eulalie. The faunal assemblages of sites that were excavated a long time ago (Badegoule, Laugerie Haute, Pech de la Boissière, Fourneau du Diable, among others) have been altered by successive selection of the excavated material and by loss of parts of those collections.

**Seasonality**

The period of occupation at a site can be determined through analysis of seasonality. One method is based on tooth eruption and tooth wear among the fauna. Another consists of the analysis of dental cementum annuli for seasonality of death, a method applied mostly to ungulates (Castanet, Meunier, and Francillon-Vieillot 1992; Sergeant and Pimlott 1959). Other factors, such as the presence of fetuses, can also provide information concerning the seasonality of use at a site. These methods can be used on fauna where births are restricted to particular seasons.

We currently have seasonality information for five sites: Combe Saunière; Les Peyrugues; Cuzoul de Vers (cementum annuli, dental eruption, fetus); Badegoule; and Fourneau-du-Diable (dental wear and eruption, fetus). Seasonal hunting is characteristic of sites that were occasionally occupied and indicates geographic movements among a site of permanent residence or a palimpsest of shorter duration occupations at different times of the year (for example, seasonal occupation). It can thus be difficult to infer the movement of populations across space based only on attempts to interpret the seasonal presence of people at a given site.

On the southwestern border of the Massif Central in France, the southern sites of Cuzoul de Vers and Les Peyrugues were occupied during summer (Allard, Chalard, and Martin 2005; Martin in press). In the north, Combe-Saunière (Castel 1999; Pike-Tay in Castel 1999) and Fourneau-du-Diable (Fontana 2001) were occupied during late winter, spring, and perhaps summer. Badegoule was occupied year-round (Bouchud 1966).

A synthesis based only on these preliminary analyses would lead us to conclude that the sites in the south were occupied in summer, whereas those to the north were occupied year-round, notably including winter. The data are still too limited, however, and it is more important to observe that different site occupational strategies were probably followed in different parts of the Massif Central during the Solutrean. To further explore this issue, one must integrate archaeological results with other forms of archaeological and multidisciplinary information.

**Distribution of Hunted Animals**

We consider different animal species to be associated with different resource zones, which can for the purposes of our work be divided into three major environmental forms: (1) an open arctic zone; (2) a non-arctic open zone; (3) a forested zone (Delpech et al. 1983; Griggo 1995). Each of these environmental zones tends to be found at some distance from the others, rather than in short-spaced patchwork. The representation in the same site of species belonging to different environmental zones would thus attest to the circulation of animal bones across relatively large distances.

For the arctic environment, we use as a reference the model defined by Binford (1978, 1982b)—namely, exploitation of a territory from a residence base camp surrounded by specialized activity sites. Following this model, the species hunted within given locations will differ according to seasonal and geographical availability.

The different species identified at a site reveal choices made within an integrated, annual cycle of activities. In the case of human populations circulating over vast territories, the presence of a species represents its rank in an optimization of hunting activities, which is primarily related to the relative abundance of different species, their spatial distribution, and their seasonality.
From the perspective of the optimization of acquisition and exploitation (cf. Binford 1978; Keene 1981; Lee and De Vore 1968; Winterhalder and Smith 1981), one can distinguish three types of species representation within individual sites (Castel et al. 1998):

1. **Species brought back to the site whole then completely exploited.** These species are hunted near the sites. They correspond to specific ecological circumstances to which the human subsistence strategies are well adapted.

2. **Species of which only certain parts of the skeleton are introduced into the site.** This reduction in transport costs is sought in diverse circumstances, such as when hunting locations are far from occupation sites, when the animal carcass is particularly large, or in the absence of sufficient human means to exploit and transport the animal (e.g., Bartram 1993; Binford 1978; Bunn 1982). This is the case for bovids and mammoth, whose presence in the local environment is often difficult for archaeologists to determine. Such a representation of only partial skeletal presence could also be found among poorly represented small-sized species. We note that poorly represented species do not necessarily represent a lack of exploitation of a given environmental zone, because absence of evidence could relate to delayed consumption, among other possible explanations.

3. **Species represented exclusively by body parts of symbolic or technological value.** Such skeletal evidence cannot be taken as evidence for food consumption at those sites, because portable "art" made on animal bones could (and indeed in some circumstances at least to) were likely have been carried around over potentially large distances and over long periods of time.

For these reasons, our present analyses of the distribution of animal populations during the Solutrean concern only locally exploited ungulates.

The geographical distribution of animal populations 20,000 years ago was informed by reference to modern ethnological data in order to identify the environments favorable to different species. Being unable to reconstruct the climate of the last glacial maximum with sufficiently fine-grained precision, researchers estimated faunal distribution zones from landscape relief and soil dependent on particular physical environments, such as horse and ibex. Reindeer, however, are present in large quantities at all Solutrean sites. This species was hunted everywhere within a local range and exploited for both alimentary and technological purposes. Bovids also appear to have been ubiquitous, and for them there is also the question of transport, which was forcibly selective between the kill site and the cave or rockshelter sites studied here. These species do not contribute to the question of the circulation of bone remains over long distances.

Despite the small sample size, some significant tendencies can be observed. Reindeer are largely dominant, both in terms of the number of individuals and the quantity of meat they provided. For the other species, there is a zonal variation from north to south: ibex are present only in the south, where horse and saiga antelope appear to be absent; chamois is present further north than ibex; red deer are present only in the central zone. At the sites in the northern half, the Solutreans hunted ten reindeer for every horse. Because horse bone remains are associated with greater quantities of meat than are reindeer bones, the alimentary contribution of this animal seems to be more important than apparent from ratios of the numbers of represented fauna alone. These examples show that the relative representation of fauna within archaeological sites does not necessarily indicate the relative importance of environmental zones as food resource zones.

### The Geographical Distribution and Circulation of Technological Objects

The exploitation of non-alimentary animal and mineral resources (for technological and/or symbolic reasons) does not follow the same model of land use and geographical organization as that of alimentary resources.

#### Animal Resource Exploitation

The ibex remains at Combe Sauvière (Castel 1999), Badegoule (Cheynier 1949), Le Placard (Griggo In press), and probably Fourneau du Diable (Stéphane Madeleine, personal communication), exist only in the form of pierced or unpierced incisors. Their presence attests to territorial relations with the southeast, as this is where ibexes came from. At Cuzoul de Vers, horse remains are represented almost exclusively in the form of retouchers (fragments of long bone diaphyses used to retouch flint tools), which could have been introduced into
Chapter 21: From Physical to Social Landscapes

Mineral Resource Exploitation

The study of the origins of lithic materials allows us to perceive a locality of social and environmental engagement, exploited daily (the “local zone”); a “neighboring zone,” exploited episodically; and a “distant zone,” which sometimes simply represents the preceding residence site(s). However, the raw materials exploited do not always represent the geographical patterning and physical availability of natural resources in the environment. For example, Bergeracois flint, an abundant and high quality material, appears to have been minimally used during the Solutrean.

Technological studies of lithic industries allow exogenous materials (Castel 1999). The situation at Les Peyrugues seems to be analogous (Michel Allard, personal communication). These remains could have originally come from some considerable distance away, if horse was absent in the Quercy region, or from earlier times, if horse was not exploited during the period of site occupation, or a combination of both.

Do the unique saiga antelope remains present in the Solutrean assemblage of Jeanblancs (Drucker et al. 2000) indicate a displacement from the north, or mixing with the Magdalenian levels in which this species has been identified, or perhaps an introduction by carnivores? This example illustrates the difficulty of interpreting the status of a species represented by very few remains. In any case, it does not appear to result from confusion with chamois because this species is absent from the deposits.

Mammoth is represented in several sites in the form of ivory fragments that are sometimes worked. In this case, it seems that we can attribute the presence of this material to an exploitation of a raw material source rather than to the exploitation of an animal for its meat. At Laugerie Haute, the presence of dozens of mammoth molars, numerous ivory fragments, and a few diaphysis fragments of standardized dimensions also indicate the transport of materials for purposes other than alimentary needs.

These different elements attest to the presence of technological and symbolic products made from animal materials in regions far from those where archaeozoological analyses show the presence of corresponding species, and which were intensively exploited following transport over short distances. These displacements of animal materials in the form of technological and symbolic products attest either to the movement of human groups or exchanges between partners within interacting groups.

The economic strategies adopted within a local zone, regularly and intensively exploited within a 5-kilometer range around the residence sites, differ from those developed within the broader range that includes the distant zone. In the latter case where the distant zone is exploited, only selected sources are exploited and the products are diffused in the optimized form of raw blanks or roughouts within a vast interregional zone according to the rules, now classic for the Palaeolithic, of long-distance diffusion (Renfrew 1977). The distances of between 50 and 200 kilometers in the region considered at such broader spatial scales are far greater than those that can be covered in one or two days of walking. At the intermediary scale that incorporates a consideration of the neighboring zone, which varies according to the relative position of resource sources and habitats, we encounter intermediate economic solutions. It is also possible that within zones of social interaction (contacts and exchanges) located at medium distances from residence sites (one or two days by foot), unworked raw materials and roughouts may have circulated through exchanges between groups. Detailed studies of these questions are in progress.

The multiple territorial entities related to the economy of lithic materials are distributed over a vast geographic zone constituted by the middle and high valleys of the rivers circulating over the highlands of the Massif Central toward the Atlantic. This multiplicity has already been used to characterize the duration of occupation of the Solutrean.
observed (Peyrony 1932) and remains difficult to interpret. Though a systematic confrontation of data related to the exploitation of the physical and faunal environments in this ensemble of Solutrean sites is still lacking, it already appears that geographical zones of engagement determined on exclusively economic bases were integrated within a single environmental zone. Human movements across long and medium distances are oriented according to a large north-south axis, whereas the east-west movements, following the river courses and natural paths of circulation, concern only short and medium distance movements, which archaeologically appear less frequently as these are more difficult to detect because of the natural downstream transport of flint blocks by rivers.

The Circulation of Objects of Sociosymbolic Value

To compare and contrast the geographical circulation of alimentary and technological objects with that of sociosymbolic objects (artistic, aesthetic, or ritual items), we now consider body ornaments (worked teeth, pendants on horse hyoid bones, beads, buttons, bracelets, shells, and fossils). Such an approach will enable us to consider the circulation of people across space in terms of relations of symbolic value.

Briefly, the method used here to understand the circulation of “non-economic” symbolic objects, for which we do not have localized sources identifiable through the natural sciences, consists of an analysis of the spatial distribution of objects with highly determined characteristics (nature, technique, morphology, decoration) and which are found only in Solutrean contexts. Bi-lobed ivory buttons, ivory “bracelets” and “rings” with notched decoration, quadrangular beads with geometric motifs (Geneste and Rigaud In preparation), and notched pendants made on horse hyoid bones materialize contacts and exchanges between groups.

The geographical distributions of these objects indicate human movements across a maximum distance of 80 kilometers. These distributions are well integrated within the range of transported lithic raw materials; they may thus also correspond geographically to the alimentary subsistence zones superposed on the distribution zones of the exploited animals.

The origins of marine shells found in the majority of Solutrean sites indicate two constant but diametrically opposed sources: the Atlantic coast (both along the coastline and at fossil deposits in These contact zones, geographically the most distant identified during the Solutrean, forcibly imply intergroup exchange zones that overlap at their margins with those of other contemporary sociocultural entities.

Conclusions

Certain aspects of the economic organization of prehistoric human groups across space and through time will always be out of reach; data relevant to the recurrence and seasonality of occupation are perceptible within archaeological sequences only in a relative and generalized time frame. Consequently, our conclusions must necessarily be restricted in scope. Although in this chapter our results are preliminary, this study, which is above all methodological in its attempt to integrate the results of archaeozoological analyses with those of graphic zones of engagement determined on.

Part III: Thinking through Landscapes
in the framework of an ecological exploitation differentiated in space and time, and by varied spatial and temporal scales. Technological and symbolic relations between places allow us to trace past contacts between sites during the Solutrean. In this way, the conventions employed in the manufacture of body ornaments indicate close social relationships between Combe Saunière, Fourneau du Diable, and Le Placard in the north (ivory beads, rings and bilobed buttons). Combe Saunière could thus be considered as a satellite to the larger confirmed occupation sites, such as Fourneau du Diable (1 day by foot) and Le Placard (2 or 3 days by foot). The contents of these latter sites is much more diverse, and projectile points are proportionally less numerous. These larger occupation sites could also be defined as aggregation sites (Conkey 1980). This difference in status of site use seems to be confirmed by an integration of data related to parietal and portable art. Among these three sites,

Figure 21.1 Spatial circulation of objects with a social value for all of the sites studied, as well as the lithic raw materials and shells of the Solutrean of level IV at Combe Saunière. The sites: 1 = Le Placard, 2 = Le Fourneau du Diable, 3 = Combe Saunière, 4 = Badegoule, 5 = Laugerie Haute, 6 = Les Jeanblancs, 7 = La Grotte XVI, 8 = Pech de la Boissière, 9 = Le Cuzoul de Vers, 10 = Les Peyrugues, 11 = Sainte-Eulalie. The shoreline shown is today’s, not that of the Solutrean.
Combe Saunière is the only one without evidence of portable and parietal art.

The strategies for the exploitation of alimentary animal resources, lithic resources, as well as non-utilitarian objects with a primarily social and symbolic function, show that different ways of relating to place prevail at each domain.

The spatial inscription of these different subsistence activities through the deposition of material items within sites and regions allows us to identify social landscapes of human interaction and land use. The environmental homogeneity (of geology, climate, biomass, physical environment, habitat in natural rockshelter) in the geographical distribution of Solutrean sites along the Atlantic zone, at the limit of the plains and the western border of the Massif Central, is in fact remarkably consistent from the Loire River to the Pyrenean Piedmont, to the Basque Country, and beyond until the Asturian coastal zone. It is probable that an analogous situation exists also along the French and Spanish Mediterranean coast.

Despite the reservations formulated above concerning the criteria used to define faunal resource zones, the Solutrean sites discussed here appear to represent more or less prolonged residence sites where a range of activities related to the acquisition, exploitation and consumption of hunted species took place. Based on the skeletal remains of these diverse species, we can estimate human movements within this landscape. Through a determination of the ages of the animals hunted or fished, we can obtain indications of the seasonality of occupation within these sites, and of regional land use.

Finally, the results of this study show that lithic raw material exploitation is organized in relation to the intended end products (domestic needs, commonly used tools, projectile points, hearth stones, and so on). Similarly, before any archaeozoological, economic, or alimentary understandings can be claimed, the animal species must be understood in relation to their accessibility and subsistence, technological and economic importance, as well as, if possible, their symbolic roles for particular peoples at particular times.

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Note

1. We use the term non-economic for objects whose primary reason for existence concerned their symbolic and/or aesthetic values, rather than alimentary or technological values. This is not to deny that such symbolic and aesthetic values may also be components of broader economic strategies or networks.

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