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The Upper Paleolithic in Mediterranean Spain: A Review of Current Evidence

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In spite of an active and sophisticated archaeological research program, the Paleolithic of the Iberian peninsula remains comparatively little known to English-speaking prehistorians, with the exception of Cantabrian Spain. The rich data set compiled by Spanish prehistorians and their colleagues over the past several decades stands to make a valuable and unique contribution to our understanding of the Pleistocene prehistory of Europe. We present a detailed overview of Upper Paleolithic chronology, sites, and assemblages for Mediterranean Spain, an area of over 1,600,000 km² that extends from the French border to the Straits of Gibraltar. To interpret these data, we employ a regional perspective that emphasizes studies of paleoeconomy (especially zooarchaeology) and settlement. The Middle–Upper Paleolithic transition and Upper Paleolithic art also receive detailed treatment, and the Upper Paleolithic of Mediterranean Spain is discussed in the broader context of the late Upper Pleistocene of western Europe and the Mediterranean Basin.

KEY WORDS: Spain; Upper Paleolithic; Mediterranean; art; paleoeconomy.

INTRODUCTION

To the extent that most prehistorians are familiar with the Paleolithic of Spain, it is with the sites of Cantabria, with their rich parietal art and

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Upper Paleolithic sequences, and more recently with the spectacular Lower Paleolithic discoveries near Atapuerca (also in northern Spain). As important as this region is, it is not unique in the peninsula. However, for a variety of historical and other reasons, the prehistory of the rest of the Iberian peninsula is considerably less well known. The objective of this paper is to present an overview of current evidence for the Upper Paleolithic in the Mediterranean zone of the Iberian peninsula, the focus of considerable recent research. Because of this objective, much of the discussion is descriptive in nature and an extensive References section is provided. Interpretive syntheses are not lacking for this region, however. A few are summarized here, and citations to numerous others are provided.

In broad syntheses of the European Upper Paleolithic, the Mediterranean provinces of the Iberian peninsula, or the Spanish Levant as they are sometimes called, are commonly treated as culturally distinct from the better known Franco-Cantabrian zone. Instead, they are more often grouped with the Upper Paleolithic of the western Mediterranean and, especially, with the Italian peninsula (e.g., Broglio and Kozlowski, 1986; Desbrosse and Kozlowski, 1988; Gamble, 1986; Otte, 1989). There are indeed broad environmental similarities that characterize the Mediterranean littoral of western Europe and differentiate it from more northerly areas. However, classifying the whole of the Upper Paleolithic, from the entire extent of Mediterranean Spain, in this way obscures the spatial and temporal cultural dynamics of the region and presumes an overly simplistic environmental determinism for human adaptation in the late Upper Pleistocene. We aim to provide a more realistic overview of the Upper Paleolithic in the Mediterranean littoral of Spain. While the focus here is on the Mediterranean area, we also endeavor to show how the regional Paleolithic sequence articulates with the cultural context of the surrounding regions, especially southern France, northern (i.e., Cantabrian) Spain, and the Italian peninsula.

HISTORY OF UPPER PALEOLITHIC RESEARCH IN SPAIN

Beginning in the last century, Upper Paleolithic research in the Iberian peninsula focused on the now famous parietal art localities (Altamira, for example) and a number of other well-known sites in Cantabria and the Pyrenees (González Sainz and González Morales, 1986; Straus, 1992; Moure, 1996). This led many workers at the beginning of the twentieth century to differentiate this Franco-Cantabrian region from the rest of the Iberian peninsula. Many early syntheses of the Spanish Upper Paleolithic followed Obermaier (e.g., 1925) in using the term "Capsian" to refer to those industries from the southern half of the peninsula, emphasizing supposed linkages between southern Spain and North Africa [but see Siret (1893, 1931) for an early alternative view]. This dichotomy between Cantabria and the rest of Spain carried over into the domain of parietal art. Both Breuil and Obermaier considered what they termed *Arte Levantino* to be a distinctive Mediterranean version of Cantabrian parietal art (Obermaier and Wernert, 1919, 1929; Breuil, 1920; Porcar *et al.*, 1935). Until almost midcentury, knowledge of the Upper Paleolithic of the Mediterranean region was limited to studies by Siret in the southeast, descriptions of a few other assemblages from the southeast (Breuil and Obermaier, 1914a, b) and Andalucía (Such, 1920), and work at Sant Julià de Ramis in Cataluña (Wernert, 1920).

Only with the publication of work at Parpalló (Pericot, 1942), in Valencia, did a clearer picture of the Mediterranean Upper Paleolithic in Spain begin to emerge. Beginning in the 1930s, excavations at this site produced a rich assemblage of lithic artifacts and mobile art and, finally, established a reference sequence for the Upper Paleolithic in the Mediterranean zone. Following the disruptions of the civil war, the late 1940s and early 1950s marked the beginning of coordinated work by Corominas, Fletcher, Jordá, Pericot, and Pla and saw excavations at sites like Cova de les Malladetes and Barranc Blanc in Valencia and at Reclau-Viver in Cataluña.

Subsequently, knowledge of the regional Upper Paleolithic has developed steadily. The Iberic Solutrean (see below) was defined by Jordá (1955), and frameworks for the terminal Pleistocene and early Holocene industries were established by Jordá (1954) and Pericot (1952, 1954). Excavations were undertaken at an increasing number of Upper Paleolithic sites, including the Valencian site Volcán del Faro (Aparicio and Fletcher, 1969), Cueva Ambrosio in Almería (Ripoll, 1962), a series of caves in Málaga (Giménez Reyna, 1946), and additional sites in Cataluña excavated by Corominas and Pericot.

Building on this research, the late 1970s began a period of even more intensive and extensive studies that continue today. This work has resulted in the reanalysis of collections excavated during the 1950s–1970s, the excavation of numerous new sites, and the discovery of many new parietal art localities. Figure 1 shows many of the Upper Paleolithic sites known in Mediterranean Spain, including those discussed in the text below. Regional chronostratigraphic and paleoenvironmental sequences have been considerably refined, there is a much better framework for understanding spatial and temporal variation in lithic industries, and studies of Upper Paleolithic economy and settlement at regional scales have been initiated.

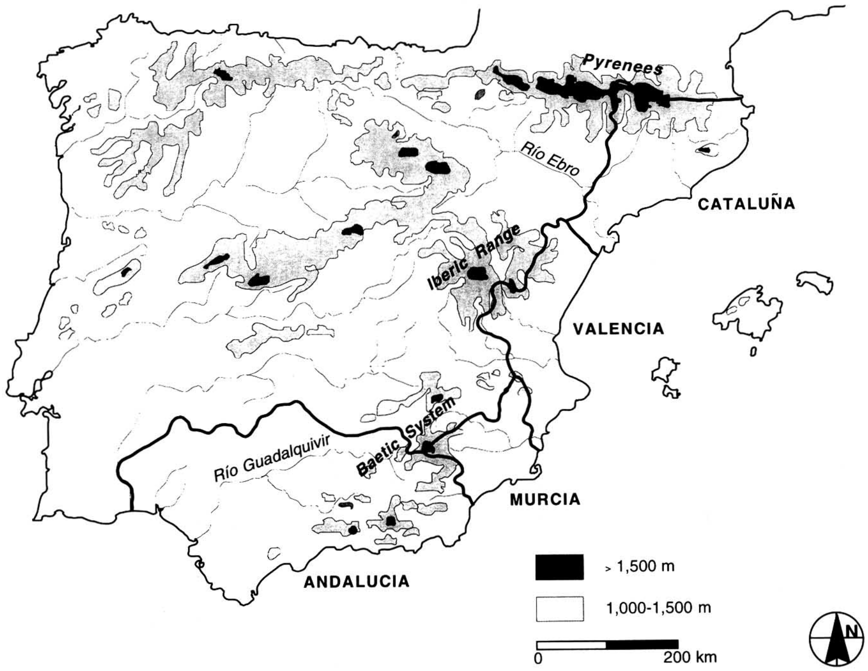

Fig. 1. Regions of Mediterranean Spain.

Nevertheless, a great deal remains to be done. Our current understanding of Upper Paleolithic systematics and socioeconomic systems is still based, to a large extent, on preliminary studies of excavated collections or material from limited test excavations. Geographical and environmental variation across Mediterranean Spain during the late Upper Pleistocene, and concomitant variation in human adaptation, further complicates the picture of the Upper Paleolithic. Although the focus of this paper is the Mediterranean zone of the Iberian peninsula, it will be necessary to expand the discussion to adjacent areas to account for spatial and temporal variability in the Mediterranean zone. Within this framework, reference to the evolution of Upper Paleolithic industries refers to diachronic change in material culture. Such change is necessarily the result of evolution of the human behavioral systems that produced these material residues. However, the nature of behavioral change and the processes that drove it remain poorly understood in Mediterranean Spain as indeed they do for much of the Paleolithic elsewhere. With these caveats in mind, we attempt to synthesize the current state of our knowledge about the Upper Paleolithic of this diverse region, offer preliminary interpretations for a few aspects of the archaeological record, and present some of the problems that remain to be addressed. We hope that by doing so, we can help prehistorians to build a more comprehensive picture of Upper Pleistocene cultural systems in western Eurasia.

THE GEOGRAPHIC CONTEXT

Modern Landscapes

The Iberian peninsula comprises the extreme southwest of the European subcontinent, and is its closest point to Africa. The peninsula consists of a central nucleus, dominated by high plateaus, the Meseta, with average elevations between 600 and 800 m. The Meseta is bordered by two major mountain systems that include the highest elevations in the peninsula, the Pyrenees in the north and the Baetic cordillera to the south and southeast. Broad sedimentary basins separate each mountain system from the central Meseta—the Río Ebro valley in the north and the Río Guadalquivir valley in the south. The climate of the western margins of the peninsula is influenced by the Atlantic Ocean; that of the eastern and southern parts is influenced by the Mediterranean, whose warm waters mix with the colder Atlantic in the Strait of Gibraltar.

The region that is the focus of this paper extends inland about 100 km from the eastern and southeastern coast. This Mediterranean zone stretches over 1600 km, roughly 36–42°N, and includes four Spanish administrative units: from south to north, Andalucía, Murcia, Valencia, and Cataluña (Fig. 1). To characterize geographic variability in the Upper Paleolithic better, we also refer to three subdivisions of this broad region: a southern zone that includes Andalucía and Murcia, a central zone comprising València, and a northern zone represented by Cataluña. Due to its latitude and to the climatic influence of the Mediterranean Sea, there are a number of biogeographic characteristics common to the entire region. However, there is also considerable variation due to geology and landforms, the orientation of mountain ranges, altitudinal differences, local climate, and vegetation.

The Mediterranean coastal plain, of variable width, is separated from the central Meseta by a series of mountain chains. The Baetic system borders the southeastern coast, from the Gulf of Cádiz to central Valencia, and includes peaks as high as 3478 m in the Sierra Nevada. Its two parallel cordilleras are separated by a series of basins and tablelands that form important routes of communication between eastern Andalucía, Murcia, and southern Valencia. The Baetic cordilleras meet the Iberic range in central Valencia. With a maximum elevation of 2316 m, the Iberic mountains extend from southeast to northwest to terminate at the Ebro Basin. Finally, the Catalana range follows the Catalan coast between the eastern slopes of the Iberic range and the Pyrenees. The drainage systems created by this topography are characterized by streams with short, steep, irregular profiles and by irregular flow regimes of Mediterranean character.

As a result of this complex topography, the Mediterranean landscape is divided into a series of microenvironments characterized by bioclimatic heterogeneity. Temperature and precipitation vary markedly across the zone, responding to a complex interplay of atmospheric flow, latitude, altitude, and topographic aspect, strongly affecting the structure and composition of the vegetation. Four broad bioclimatic communities are defined for Mediterranean Spain (Rivas Martínez, 1982, 1987): ThermoMediterranean, MesoMediterranean, SupraMediterranean, and OroMediterranean—extending from south to north and lower to higher elevation, respectively.

Variation in the orientation of the numerous mountain systems and associated uplands also affects the character of the Mediterranean coast, which alternates between cliffs and plains. This topography, along with poorly understood neotectonism, helps to account for the differential preservation of Tardiglacial coastal sites across the regions of the Mediterranean zone (Aura *et al.*, 1989).

Upper Pleistocene Landscapes

The harsh conditions of the last glacial/interglacial cycle were ameliorated within the Spanish Mediterranean landscape because of its latitude and location on the southern periphery of Europe. Outside Cantabria, the Pyrenees, and the northwestern end of the Iberic range, evidence for late Pleistocene glaciation has been identified only in the highest parts of the Baetic cordillera (around 2350 m)—the southernmost location of glaciation in Europe (Goy *et al.*, 1989).

Nevertheless, some of the global processes associated with Pleistocene glaciation still had a marked effect on Mediterranean Spain. In the western Mediterranean Sea, a significant drop in water temperature has been proposed that coincides with the maximum marine regression (120 m below msl) at ca. 18,000 B.P. (Thied, 1978). During the early Holocene, the sea level rose again to 40 m below msl by ca. 9000 B.P. (Shackleton and van Andel, 1985). With a local rate of sea level rise of around 1 cm/year, the postglacial transgression submerged the continental shelf, causing the coastline in some areas to retreat to the edge of the upland zones mentioned above and narrowing the coastal plain in others—although the details of this process are difficult to assess due to the geologic variability in the continental margins in this zone (Fumanal and Viñals, 1988; Fumanal *et al.*, 1991; Hernández-Molina *et al.*, 1994).

Paleobotanical data from archaeological contexts suggest significant temperature depressions on land during the Upper Pleistocene. However, these vegetation shifts could also be attributed as much to variations in moisture availability as to temperature (Leroi-Gourhan and Renault Miskovsky, 1977; Dupré, 1979), indicating conditions more arid and less cold south of 40°N (Badal, 1990).

Along the same lines, there seem to be significant differences between interglacial and early glacial faunal assemblages (*i.e.*, isotope stages 5, 4, and 3), and pleniglacial faunas (stage 2). Although, large and medium-sized mammalian faunas tend to have limited value for detailed biogeographic reconstruction, some general observations are possible. Eurosiberian taxa (e.g., *Rangifer*, *Bison*, *Elephas*, and *Crocuta*) have been documented in northern Cataluña (Estevez, 1987a, b), while in faunal assemblages from south of the fortieth parallel, ungulates resemble the modern potential fauna (e.g., *Cervus elaphus*, *Capra pyrenaica*, *Bos* sp., and *Equus* sp.). This could indicate environmental changes or simply the high degree of adaptive flexibility in these taxa.

Finally, indications of colder environments are also found in avian and marine faunas from Tardiglacial sites in Andalucía and Valencia. From the Cueva de Nerja, remains of *Alca impennis* (Eastham, 1986) have been identified, along with several marine fish species that have boreal distributions today—including *Pollachius pollachius* and *Melanogrammus aeglefinus* (Rodrigo, 1991). The presence of some of these taxa can be attributed to the flow of cold Atlantic waters through the Straits of Gibraltar. Moreover, deposits of foraminifera record a temperature depression in the waters of the Alboran Sea (between the Costa del Sol and Morocco) between 12,000 and 10,000 B.P. (Pujol and Vergnaud, 1989). In Tardiglacial levels of the Cova de Cendres, the presence of *Pyrrhocorax graculus* associated with *Microtus arvalis* also indicates conditions colder than at present. Taken together, these data reinforce the likelihood that the terrestrial landscapes and ocean basins of Mediterranean Spain (and their respective floras and faunas) responded differentially to the climatic changes of the late Pleistocene.

A brief note is in order here about Upper Pleistocene chronological frameworks. Although a considerable distance from even the French Alps, the current version of the French/Alpine climatostratigraphic system is widely used for chronological and paleoclimatic frameworks throughout the western Mediterranean, including the Iberian Peninsula and Italy. That is, the Würm I–IV climatic sequence (derived primarily from sedimentological

Table I. Schematic Correlation Between Chronological and Paleoenvironmental Frameworks Used in Mediterranean Spain[a]

Oxygen isotope stage	Alpine glacial sequence	West European pollen sequence	Climatic sequence from central Mediterranean Spain	Upper Paleolithic cultural sequence	Age (years B.P.
1	Würm IV	Allërod	Tossal de la Roca Phase I	Magdalenian	
		Dryas II	Cendres Phase A		12,000
		Bölling	Cendres Phase B		13,000
		Dryas I	Cendres Phase C		14,000
			Hiatus[b]		
2			Malladetes Phase E	Solutrean	16,000
	Würm III–IV	Laugerie-Lascaux	Malladet es Phase D		20,000
	Würm III		Malladetes Phase C	Gravettian	
		Kesselt	Malladetes Phase B	Aurignacian	
3			Malladetes Phase A		
			Cova Negra Phase F	Mousterian	30,000
	Würm II–III	Hengelo	Cova Negra Phase E		
3–4	Würm II		Cova Negra Phase D		75,000

[a]After Fumanal and Villaverde (1997).
[b]The hiatus between Malladetes Phase E and Cendres Phase C is due to the lack of paleoenvironmental and chronostratigraphic data from the early Magdalenian of Parpalló. Future excavation at Cendres should provide these data.

data) and various named stadials and interstadials of the western European pollen sequence are used to mark Upper Pleistocene chronology and paleoenvironmental fluctuations for the Upper Paleolithic sites discussed below. This does not imply that environmental changes associated with various time intervals are identical in the Alps (even the French Alps) and Mediterranean Spain (or even across the extent of Mediterranean Spain). Moreover, it must be recognized that the development of a comprehensive regionwide paleoclimatic sequence, for use in environmental reconstruction as well as for chronology, is still in its early stages; comparatively few stratigraphic sequences have been studied in detail from a chronostratigraphic or paleoenvironmental perspective (Fumanal, 1995, 1997; Fumanal and Villaverde, 1997).

Nevertheless, this system provides a well-known, unified chronological framework across most of the western Mediterranean. When employed judiciously, such consistency is extremely helpful for interregional comparisons and we follow this usage throughout the rest of this paper.

Table I shows the regional paleoclimatic sequence (as based on Spanish sites from the central Mediterranean region), major chronological divisions in the Alpine glacial sequence and the pollen sequence, chronometric dates from Mediterranean Spain, and correlations with the worldwide oxygen isotope chronology.

THE BEGINNING OF THE UPPER PALEOLITHIC

The earliest Upper Paleolithic industries in Mediterranean Spain are comparatively poorly known, in contrast with the late Middle Paleolithic and later Upper Paleolithic of this area (Fig. 2). Nevertheless, they document the complex nature of the Middle–Upper Paleolithic transition in this region and hold the potential to add significantly to our understanding of the appearance of morphologically modern humans in western Eurasia. Of particular interest is geographic variation in the timing of the Middle–Upper Paleolithic transition across Mediterranean Spain, with as much as a 10-kyr difference between the northern and the southern parts of the region.

The late survival of Middle Paleolithic industries, until the beginning of the late Würm, is documented at four sites in the central and southern regions of the Mediterranean zone: Cueva de Carihuela and Boquete de Zafarraya in Andalucía and Cova Negra and Cova Beneito in València. In spite of the inherent imprecision in dating at these time ranges, these assemblages seem contemporaneous with Aurignacian assemblages elsewhere in the Iberian peninsula and the rest of Europe. Furthermore, recent evidence from Portugal (Zilhão 1998) indicates similarly late dates for the

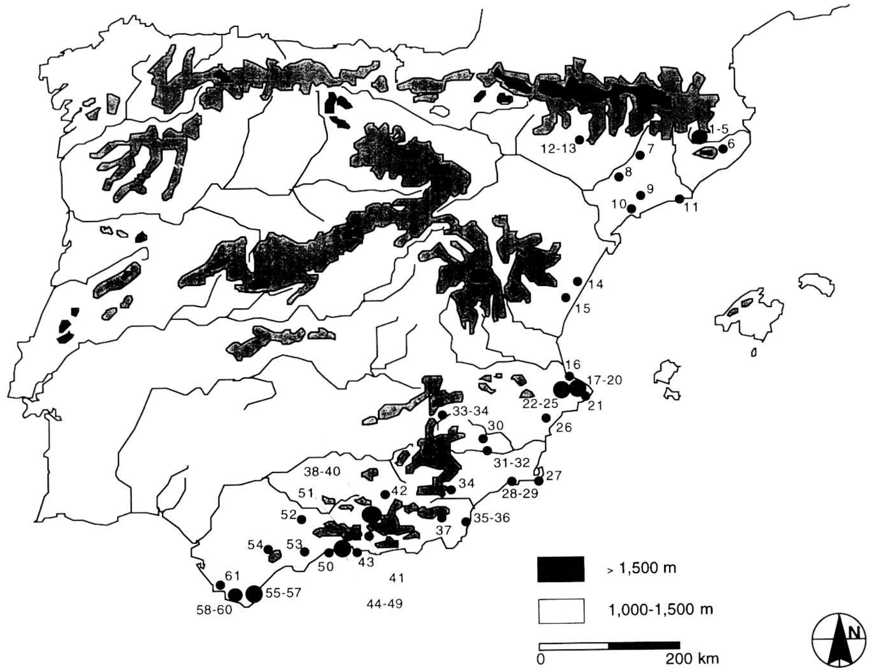

Fig. 2. Sites and parietal art localities mentioned in text [MP, Middle Paleolithic; IUP, Initial Upper Paleolithic (Aurignacian, Gravettian); UPIndet., Indeterminate Upper Paleolithic; S, Solutrean; M, Magdalenian; PRA, Paleolithic Rock Art; PMA, Paleolithic Mobile Art]. 1, L'Arbreda (MP, IUP, S); 2, Reclau Viver (IUP, S); 3, En Pau (IUP, S); 4, Bora Gran (M); 5, Roc de la Melca (IUP); 6, Cau de les Goges (S); 7, Parco (M); 8, Bauma de la Peixera (M); 9, Cova de la Taberna (PRA); 10, Mallada (M); 11, Bauma de la Griera (IUP); 12, Chaves; 13 (S, M), Trucho (PRA); 14, Matutano (M); 15, Blaus (M); 16, Volcán del Faro (S, M); 17, Parpalló (IUP, S, M, PMA); 18, Malladetes (IUP, S, PMA);, 19, Barranc Blanc (IUP, S, M?); 20, Cova Negra (MP, UPIndet.); 21, Cendres (M); 22, Tossal de la Roca (M); 23, Beneito (MP, IUP, S); 24, Cova Fosca (PRA); 25, Reinós (PRA); 26, Ratlla del Bubo (IUP, S); 27, Mejillones (M); 28, Caballo (M); 29, Algarrobo (M); 30, Cueva de Jorge (PRA); 31, Cejo del Pantano (S); 32, Hernández Ros (S); 33, Cueva del Niño (PRA); 34, Ambrosio (S, PRA); 35, Serrón (IUP, S); 36, Morcegillos (S); 37, Piedras Blancas (PRA); 38, Carihuela (MP, UPIndet.); 39, Malalmuerzo (S, PRA); 40, Pantano de Cubillas (S); 41, Los Ojos (S); 42, Morrón (PRA); 43, Nerja (IUP, S, M, PRA); 44, Humo (S); 45, Higuerón (S, M); 46, Cueva de la Victoria (M); 47, Navarro (PRA); 48, Hoyo de la Mina (M); 49, Bajondillo (MP, IUP, S); 50, Toro (PRA); 51, Zafarraya (MP, UPIndet); 52, Trinidad (PRA); 53, Tajo del Jorox (S); 54, Pileta (PRA) 55, Gorham (MP, IUP, M?); 56, Cueva del Moro (PRA); 57, La Paloma (PRA); 58, Cuevas de Levante (S); 59, Cubeta de la Paja (S); 60, Tajo de las Figuras (PRA); 61, Chorrito (S).

final Middle Paleolithic in the western part of the Iberian peninsula. Of special interest here are the identification of Neandertal remains associated with late Middle Paleolithic assemblages in Andalucía but without lithic elements like those found in Chatelperonnian and Uluzzian industries that appear transitional between the Middle and the Upper Paleolithic. While recent syntheses of this transition have discussed evidence from northern Spain (e.g., Mellars, 1993, 1996), relevant current information from the rest of the peninsula remains to be incorporated (e.g. Barroso and Hublin, 1994; Barton, 1988; Bischoff *et al.*, 1989; Cabrera, 1993; Carbonell *et al.*, 1990; Carbonell and Vaquero, 1996; Farizy, 1990; Hublin *et al.*, 1995; Soler and Maroto, 1990; Straus *et al.*, 1993; Vega, 1990, 1993; Villaverde and Fumanal, 1990; Zilhão, 1993a, b).

The Middle–Upper Paleolithic Transition in the Southern Mediterranean Zone

Dated Middle Paleolithic sites in the southern zone suggest that this industry persisted until the beginning of isotope stage 3, well into the second half of the Upper Pleistocene. At the site of Cueva de Carihuela, Granada, a 6-m-deep stratigraphic sequence contains Middle Paleolithic assemblages and probably begins with the last Interglacial. Analysis of pollen from these sediments suggests interglacial conditions at the beginning of the sequence (pollen zones O–R, with R being a climatic optimum) and cold, pleniglacial conditions near the upper end (pollen zones L–N) (Carrión, 1992b). An erosional hiatus separates the two sets of pollen zones. In the upper part of the sequence, units V and IV are assigned to the beginning of the upper Pleniglacial or late Würm and contain both Middle Paleolithic assemblages and Neandertal remains (Vega, 1993). Previously suggested associations of modern humans and a Mousterian lithic industry at Carihuela (Almagro *et al.*, 1970) have been critically reevaluated and are now attributed to the redeposition of Mousterian lithics, derived from an earlier deposit located at the cave entrance, with later human remains (Vega, 1993).

A late persistence of the Middle Paleolithic is also suggested at other sites in this region. At the site of Boquete de Zafarraya, Málaga, Neandertal remains and a Mousterian industry are associated with the Hengelo interstadial and the beginning of the Würm III. Radiocarbon and thermoluminescence dates for these units place them between 28,000 and 35,000 B.P. (Barroso and Hublin, 1994; Hublin *et al.*, 1995). Evidence from Gorham's Cave, Gibraltar, may also suggest a late survival for the Middle Paleolithic in Andalucía. A C-14 date in the range of 29,000 B.P., associated with Upper Paleolithic levels F–D, can be considered at least as a minimum possible date for the final Mousterian. However, there are various interpretations of this site's stratigraphy and chronology due to the age of the excavation at the site and of its radiocarbon dating (Barton, 1988; Vega, 1993; Cortés *et al.*, 1996). Hopefully, ongoing new work at Gorham's will help resolve these questions.

In spite of the apparent late persistence of the Middle Paleolithic in the southern Mediterranean region, there is no evidence for contemporaneity between final Middle Paleolithic and initial Upper Paleolithic industries, nor is there support for an *in situ* transition from Middle to Upper Paleolithic industries. In fact, assemblages that are classifiable as Aurignacian (or even clearly early Upper Paleolithic) are few, and in only one case, Bajondillo, are late Middle Paleolithic and early Upper Paleolithic assemblages found in stratigraphic context at the same site.

Recent excavations at the site of Bajondillo have revealed a long Middle Paleolithic sequence overlain by a level containing an Upper Paleolithic industry preliminarily classified as generic Aurignacian (Cortés and Simón, 1997a, b). This small Upper Paleolithic assemblage includes carinated and nosed endscrapers, a burin, and Dufour-type bladelets. It clearly differs technologically and typologically from the late Middle Paleolithic assemblage that immediately precedes it. Cortés and Simón are cautious about classifying this industry due to the lack of a bone industry and the limited artifact sample recovered. They do suggest that it may date roughly to the Arcy and Kesselt interstadials (Cortés *et al.*, 1996). With this new information on the Bajondillo early Upper Paleolithic industry limited to a brief note, we must await more detailed publication of chronology, stratigraphy, and paleoenvironmental sequence better to assess its significance.

Cueva de Nerja is the only other site in the southern Mediterranean zone with a well-documented early Upper Paleolithic industry (Jordá, 1986), although it lacks a known Middle Paleolithic occupation. Here, a series of clearly pre-Solutrean assemblages (levels 17–19 in the Sala de la Mina and 11-13 in the Vestíbulo) is documented at the base of a deep and rich archaeological sequence of late Würm age. However, the poverty of the lithic and bone material recovered makes classification of these assemblages difficult. The C-14 dates obtained (ca. 25,000–21,000 B.P.) as well as the character of the lithic assemblages suggest that they are more likely Gravettian than Aurignacian (Aura *et al.*, 1997).

Early Upper Paleolithic associations have been proposed for assemblages from a few other sites, but all suffer from a variety of problems, including uncertain stratigraphic context and/or ambiguous dates, that leave such an assignment open to question. This is the case for Zájara II (Cacho, 1983) and Ambrosio (Fortea, 1973; Cacho, 1980) in Almería and for Horá

(Toro *et al.*, 1979, 1984) and Higuerón (López and Cacho, 1979) in Granada (for a critical overview, see also Vega, 1993).

The absence of chronometric dates for the earliest Upper Paleolithic levels, the lack of clear industrial associations, and the small number of relevant assemblages known allow only the identification of a generic Aurignacian in the southern third of Mediterranean Spain. With currently available data, it is not possible to characterize the processes involved in the replacement of Neandertal populations by those of anatomically modern humans in this region, nor is there support for the contemporaneous occupation of the southern Mediterranean region by such biologically different populations in spite of their proposed coexistence elsewhere in western Europe. Nevertheless, the possible persistence of Middle Paleolithic industries and, apparently, of Neandertals to a date later than anywhere else in western Eurasia suggests that southern Mediterranean Spain (and the central zone, too, where the same phenomenon is observed) is a critical area for understanding the replacement of archaic *Homo sapiens* by morphologically modern humans.

The Middle–Upper Paleolithic Transition in the Central Mediterranean Region

Evidence from two sites in the central part of Mediterranean Spain, Cova Negra and Cova Beneito, also suggests that the Middle–Upper Paleolithic transition took place later in the Iberian peninsula than elsewhere in Europe. The site of Cova Negra, as at Carihuela, has a long stratigraphic sequence that begins with the Riss/Würm Interglacial. Its upper levels contain Middle Paleolithic assemblages and have been dated to the late Würm, and possibly as late as the end of isotope stage 3 (Barton, 1988; Villaverde and Fumanal, 1990; Villaverde, 1995; Villaverde *et al.*, 1997a). Level IV (Cova Negra E) sediments have been interpreted as representing a temperate phase, characterized by seasonal precipitation, that ends with an interval of soil formation, indicative of geomorphic stability. In levels III–I, this phase is followed by a period of cold, dry climate (Cova Negra F) and mechanical weathering of the sediments. This paleoenvironmental reconstruction is supported by microfaunal data (Guillém, 1996).

Unfortunately, attempts to date the Cova Negra sequence more precisely have been disappointing so far. Uranium-series dating of the lower travertine of the sequence has been unsuccessful, as have attempts to date bone from the upper units. Sediments from the upper interstadial level IV have produced TL dates of 53,000 ± 8,000 and 50,000 ± 8,000 B.P. However, dating of level V has produced inconsistent results. C-14 dates on organic material in flow stone at the top of level V exceeded the limit for conventional radiocarbon dating—possibly due to contamination by older carbonates—and a new series of TL dates on lithics from this level has returned extraordinarily old ages (e.g., 235,000 ± 21,000 B.P.) that seem inconsistent with others from lower levels and with biostratigraphic and lithostratigraphic evidence.

The upper units at Cova Negra contain a Middle Paleolithic industry without evidence of transformation toward the Upper Paleolithic. It is characterized, rather, by a high percentage of side scrapers, a low frequency for the Upper Paleolithic group, and little evidence for blade technology, varying little from preceding Middle Paleolithic levels with respect to lithic technology and assemblage composition (Villaverde, 1983, 1984). The Middle Paleolithic deposits are topped by a reworked unit in which a little Upper Paleolithic material has been found. This assemblage seems to predate the evolved Solutrean, but does not seem particularly early in the regional Upper Paleolithic sequence. In any case, there is insufficient material to date this material more precisely and bracket the late Middle Paleolithic assemblages of levels III–I.

Cova Beneito is another site that has produced a long sequence of deposits that extend from the Middle Paleolithic (levels XII-X) through much of the Upper Paleolithic (levels IX–II), including assemblages classified as Aurignacian, Gravettian, and Solutrean. As at Cova Negra, the latest Middle Paleolithic seems associated with the Würm II–III interstadial (levels XII–XI) and the beginning of the Würm III (level X). Radiocarbon determinations for the Würm III level include a conventional date of 30,160 ± 680 B.P. and an AMS date of 38,800 ± 1900 B.P. (Barton, 1988; Iturbe and Cortell, 1987; Iturbe *et al.*, 1994).

In contrast with other late Middle Paleolithic sites discussed above, the final Middle Paleolithic assemblage from level X at Beneito appears transitional between earlier Middle Paleolithic and later Upper Paleolithic industries. It shows an enrichment in notches and denticulates (Group IV), increased frequencies of the Upper Paleolithic group (Group III), and abundant naturally backed knives. Of note are the significant frequencies of endscrapers, burins, and typical perforators and a laminar index that reaches 19% (Iturbe and Cortell, 1992; Iturbe, 1991). Even more interesting, a pendant made of a lynx canine tooth was recovered from this level. Its root is abraded and it is perforated with a biconical hole, evidencing technology similar to another example found in the Aurignacian levels of the site. If this assemblage is representative of the final Mousterian, it appears transitional between the Middle and the Upper Paleolithic in technological and typological characteristics, exhibiting evolutionary processes significantly different from those indicated at other contemporaneous sites in Mediterranean Spain.

Given the uniqueness of the Beneito final Middle Paleolithic, it is possible that the transitional appearance of the level X assemblage has resulted from mixing of material culture from temporally discrete Middle and Upper Paleolithic occupations. Typological aspects of the lithic and bone industry of this level have clear parallels in the Aurignacian industries of overlying units, while the higher frequencies of denticulates or even atypically backed knives would not be surprising in a Middle Paleolithic context. There is a greater possibility of palimpsest deposits at rock shelter sites than open sites, since intervals of very slow sediment rates can lead to mixing of materials from multiple occupations (Barton and Clarke, 1994; Collcutt, 1979). Furthermore, the deposits that slope toward the cavity's interior, where the deep *sondage* that reached the Middle Paleolithic levels is located, include sediments derived from outside the rockshelter. It is not inconceivable that such exterior slope deposits could have been redeposited in the back of the cave by colluvial processes or mass wasting. Such mixing, of course, would call into question the transitional nature of the level X assemblages.

The Middle–Upper Paleolithic Transition in the Northern Mediterranean Region

In contrast with the central and southern zones, the Upper Paleolithic in the northern zone appears comparatively early in the "primitive Aurignacian" (*Auriñaciense primitivo*) at Arbreda (Table II). These early dates, with a mean of 38,500 ± 1000 (Bischoff *et al.*, 1989), are provocative and accord with a time-transgressive model of the Middle–Upper Paleolithic transition, discussed below. However, they remain to be reconciled with previous chronostratigraphic interpretations of the sequence that put the Middle–Upper Paleolithic transition in the beginning of late Würm (Soler and Maroto, 1987).

At Arbreda the excavators note that an early Aurignacian industry immediately follows the Mousterian with no apparent break in the sedimentary sequence (Soler and Maroto, 1987). With respect to material culture, however, the Middle-to-Upper Paleolithic transition is marked by a clear break that affects the raw materials present as well as technological and typological characteristics of the assemblages (Soler *et al.*, 1990).

The only other final Mousterian industry, outside the Cantabrian area, that displays aspects of technological change is from the site of Gabasa, in the middle Río Ebro valley. Levels a+c contain Middle Paleolithic assemblages classified as Mousterian of Acheulian Tradition and are dated to

Table II. Selected Radiocarbon Dates from Upper Paleolithic Sites in Mediterranean Spain

Site and level	Ref.	Date ± 1 SD	Period	Reference	Method
Parco IIb (hogar)	ICEN-501	10,390 ± 300	Magdalenian	Fullola & Bergadà (1990)	C-14
Caballo 2	GAK-12,261	10,780 ± 370	Magdalenian	Martínez & Reu (1989)	C-14 (bone)
Bora Gran	M-1,023	11,470 ± 500	Magdalenian	Almagro (1978)	C-14 (bone)
Nerja Vestíbulo 5	UBAR-154	11,930 ± 160	Magdalenian	Aura *et al.* (1996)	C-14
Chaves 2a	GrN-12,682	12,020 ± 350	Magdalenian	Baldellou & Utrilla (1985)	C-14
Matutano III	I-11,314	12,130 ± 180	Magdalenian	Gusi (1978)	C-14
Nerja Vestíbulo 7	UBAR-156	12,130 ± 130	Magdalenian	Aura *et al.* (1996)	C-14
Nerja Vestíbulo 6	UBAR-155	12,190 ± 150	Magdalenian	Aura *et al.* (1996)	C-14
Nerja Sala de la Mina 16	UBAR-97	11,850 ± 190	Magdalenian	Aura *et al.* (1996)	C-14
Nerja Sala de la Mina 16	UGRA-147	12,060 ± 150	Magdalenian	Aura *et al.* (1996)	C-14
Nerja Sala de la Mina 16	UGRA-98	12,270 ± 220	Magdalenian	Aura *et al.* (1996)	C-14
Tosssal de la Roca II int	UGRA-120	12,390 ± 250	Magdalenian	Cacho *et al.* (1983)	C-14
Tosssal de la Roca II int	UGRA-119	12,480 ± 210	Magdalenian	Cacho *et al.* (1983)	C-14
Chaves XIc	Ly-5810	12,650 ± 80	Magdalenian	Fumanal *et al.* (1991)	C-14
Cendres 2b	GrN-14,561	12,660 ± 70	Magdalenian	Baldellou & Utrilla (1985)	C-14
Cendres 2b	GrN-15,635	12,950 ± 70	Magdalenian	Baldellou & Utrilla (1985)	C-14
Cendres X	Ly-5585	13,320 ± 170	Magdalenian	Fumanal *et al.* (1991)	C-14
Matutano XIc	Ly-5834	13,840 ± 85	Magdalenian	Fumanal *et al.* (1991)	C-14
Matutano IV	I-11,312	13,960 ± 200	Magdalenian	Gusi (1978)	C-14
Parpalló 1.5/1.7 m	Birm-519	13,976 ± 300	Magdalenian	Bofinger & Davidson (1977)	C-14 (bone)
Tossal de la Roca IV int	UGRA-130	15,360 ± 1,100	Magdalenian	Cacho *et al.* (1983)	C-14
Malladetes (E) III	KN-I/918	16,300 ± 1,500	Solutreo-gravettian	Jordá & Fortea (1976)	C-14
Beneito II	Ly-3,593	16,560 ± 480	Solutreo-gravettian	Iturbe & Cortell (1987)	C-14 (bone)
Rattla del Bubo II	Ly-5,219	17,360 ± 180	Solutreo-gravettian	Soler *et al.* (1990)	C-14
Parpalló 4.25/4.00 m	Birm-521	17,900 ± 340	Solutreo-gravettian	Bofinger & Davidson (1977)	C-14 (bone)
Chaves 4	GrN-12,681	19,700 ± 310	Solutreo-gravettian	Baldellou & Utrilla (1985)	C-14
Nerja Vestíbulo 8i	UBAR-157	15,990 ± 260	Solutrean	Aura *et al.* (1996)	C-14
Cueva Ambrosio II	Gif-7,276	16,500 ± 280	Solutrean	Ripoll López (1988)	C-14
Cueva Ambrosio VI	Gif-7,277	16,590 ± 1,400	Solutrean	Ripoll López (1988)	C-14
Cueva Ambrosio IV	Gif-7,275	16,620 ± 280	Solutrean	Ripoll López (1988)	C-14
L'Arbreda 3.03/3.15 m	Gif-6,418	17,320 ± 290	Solutrean	Delibrias *et al.* (1987)	C-14
L'Arbreda 3.25/3.50 m	Gif-6,419	17,720 ± 290	Solutrean	Delibrias *et al.* (1987)	C-14
Nerja Vestibulo 8c	UBAR-98	17,940 ± 200	Solutrean	Aura *et al.* (1996)	C-14
Nerja Vestibulo 8k + 1	UBAR-158	18,420 ± 530	Solutrean	Aura *et al.* (1996)	C-14
L'Arbreda		21,000 ± 5,000	Solutrean	Yokoyama *et al.* (1987)	C-14 (bone)
L'Arbreda		23,400 ± 5,000	Solutrean (top)	Yokoyama *et al.* (1987)	C-14 (bone)

Parpalló 4.75/5.00 m	BM-861	18,080 ± 800	Upper Solutrean	Bofinger & Davidson (1977)	C-14 (bone)
Malladetes (E) Va	KN-I/919	20,140 ± 460	Middle Solutrean	Jordá & Fortea (1976)	C-14
Parpalló 6.25/7.75 m	Birm-520	20,166 ±	Early Solutrean	Bofinger & Davidson (1977)	C-14 (bone)
Parpalló 6.75/7.00 m	BM-859	20,490 ± 850	Early Solutrean	Bofinger & Davidson (1977)	C-14 (bone)
Malladetes (E) VI	KN-I/920	21,710 ± 650	Early Solutrean	Jordá & Fortea (1976)	C-14
L'Arbreda 3.80/3.95 m	Gif-6,420	20,130 ± 220	Gravettian	Delibrias *et al.* (1987)	C-14
L'Arbreda		20,600 ± 4,400	Gravettian (base)	Yokoyama *et al.* (1987)	C-14 (bone)
Roc de la Melca	MC-2,219	20,900 ± 400	Gravettian	Soler (1979–1980)	C-14 (bone)
Balma de la Griera	AA-8649	21,255 ± 350	Gravettian	Fullola *et al.* (1994)	C-14 (bone)
Nerja Vestíbulo 13a+b	UBAR-341	21,760 ± 970	UP indet.	Aura *et al.* (1996)	C-14
Nerja Vestíbulo 12b	UBAR-342	23,400 ± 2,300	UP indet.	Aura *et al.* (1996)	C-14
Nerja Vestíbulo 13c	UBAR-340	24,300 ± 1,400	UP indet.	Aura *et al.* (1996)	C-14
Nerja Vestíbulo 12a	UBAR-343	25,600 ± 4,800	UP indet.	Aura *et al.* (1996)	C-14
L'Arbreda 5.05/5.40 m	Gif-6,422	25,830 ± 400	Aurignacian	Delibrias *et al.* (1987)	C-14
Gorham's Cave D	GrN-1.363	27,860 ± 300	Aurignacian (?)	Almagro (1978)	C-14
Gorham's Cave D	GrN-1,455	28,700 ± 200	Aurignacian (?)	Almagro (1978)	C-14
Malladetes (E) XII	KN-I/926	29,690 ± 560	Aurignacian	Jordá & Fortea (1976)	C-14
Beneito VIII	Gif-7650	26,040 ± 890	Aurignacian	Iturbe & Cortell (1992)	C-14
Beneito VIII	AA-1.388	33,900 ± 1,100	Aurignacian	Iturbe & Cortell (1987)	AMS
L'Arbreda 4.85/4.95 m	Gif-6,421	22,590 ± 290	Developed Aurignacian	Delibrias *et al.* (1987)	C-14
L'Arbreda 5.50/5.55 m	AA-3,779	37,700 ± 1,000	Lower Aurignacian	Bischoff *et al.* (1989)	AMS
L'Arbreda 5.50/5.55 m	AA-3,780	37,700 ± 1,000	Lower Aurignacian	Bischoff *et al.* (1989)	AMS
L'Arbreda 5.50/5.55 m	AA-3,782	38,700 ± 1,200	Lower Aurignacian	Bischoff *et al.* (1989)	AMS
L'Arbreda 5.50/5.55 m	AA-3,781	39,900 ± 1.300	Lower Aurignacian	Bischoff *et al.* (1989)	AMS

the beginning of the late Würm and (Utrilla and Montes, 1993; Blasco *et al.*, 1996). These assemblages are characterized by high values for the Upper Paleolithic group (Group III), but this is due primarily to the frequencies of atypical backed knives. Utrilla and Montes do not consider this as evidence for an *in situ* Middle–Upper Paleolithic transition (1993, p. 237), as the atypical backed knives are not associated with other typical Upper Paleolithic artifacts. Moreover, these backed knives were produced by reduction techniques similar to those identified in underlying Mousterian levels, where they are found at lower frequencies.

Discussion

Evidence from a number of sites across most of Mediterranean Spain suggests a comparatively late persistence of the Middle Paleolithic, possibly until the beginning of isotope stage 3. Only on the northern part of Mediterranean Spain does the beginning of the Upper Paleolithic seem roughly contemporaneous with its appearance in other parts of western Europe. However, these late Mousterian assemblages with the possible exception of Beneito, lack evidence of technological or typological transition to the Upper Paleolithic. Furthermore, apparent differences in the timing of the Middle–Upper Paleolithic transition suggest that the Upper Paleolithic expanded from north to south through Mediterranean Spain. It would be unwise to simplistically equate all cases of Middle Paleolithic lithic technology with Neandertals and Upper Paleolithic technology with morphologically modern humans (Clark and Lindly, 1989). Still, in the few cases in which human osteological remains have been found in association with lithic assemblages in Mediterranean Spain, only Neandertals have been found with Middle Paleolithic assemblages and only morphologically modern humans with Upper Paleolithic assemblages.

It is tempting to use these data to propose a scenario in which morphologically modern humans, bearing Upper Paleolithic technology, spread inexorably from north to south across Mediterranean Spain, replacing the somehow inferior extant Neandertals using Middle Paleolithic technology. However, such a model almost certainly oversimplifies what was probably a complex process. First, from a more realistic evolutionary standpoint, the Iberian evidence suggests Neandertal populations using Middle Paleolithic technology successfully outcompeted anatomically modern humans using Upper Paleolithic technology for more than 10,000 years after they disappeared from the archaeological record in the rest of Europe. Furthermore, we need to take into account the coarse-grained nature of the archaeological record and the likelihood of considerable variation across space and time in the Upper to Middle Paleolithic transition. First, as is the case across most of Europe, available relevant data are very limited. Models (and disagreements) about the transition process often focus on the few available chronometric dates while deemphasizing the better developed chronostratigraphic data. Second, as we discuss in more detail below, the initial stages of the Upper Paleolithic still are not well known in the central and southern Mediterranean zone, and their chronology remains poorly defined. This leaves open the possibility of coexistence of Middle and Upper Paleolithic populations and the potential for considerable regional variation in the timing and character of the transition. Third, although the late survival of Middle Paleolithic industries seems reasonably well documented, there remains considerable uncertainty about the spatial and temporal dimensions of this persistence due to the above-mentioned problems with chronology. In fact, similar chronological difficulties affect the relationship between the French Chatelperronian and Italian Uluzzian and the succeeding Aurignacian in both areas.

In the face of such gaps in our knowledge of the Middle–Upper Paleolithic transition, it does not seem prudent to discount the possibility that Beneito is simply an example of variation in the transition process with an "acculturated" Middle Paleolithic resulting from coexistence with early Upper Paleolithic populations. Still, the lack of any known other sites in Mediterranean Spain with similarly transitional industries and the lack of evidence in the region for a contemporary Aurignacian industry leave such an interpretation open to question. In any case critical reappraisal is needed of the relevant depositional processes for these time periods and the possibility of sediment mixing at the site.

Chronostratigraphy of the Earliest Upper Paleolithic

Because there are comparatively few sites in Mediterranean Spain with well-described initial Upper Paleolithic (i.e., Aurignacian) sequences (Fig. 2), we focus on several sites in the central part of the region where Beneito, Malladetes, and Ratlla del Bubo have produced Aurignacian assemblages in stratigraphic context (Tables II and III). Perneras, in Murcia, also contains a succession of Middle and Upper Paleolithic levels, possibly including Aurignacian material (Montes, 1985). But the corresponding sedimentary and palynological data have yet to be described or related to the archaeological assemblages, making it difficult to evaluate the site. In the southern region, only limited data from Bajondillo are currently available.

At Beneito, a long and rich sequence of Aurignacian levels (IX–IVb) is found above the Middle Paleolithic levels and beneath units with Gravet-

Table III. Early Upper Paleolithic Industries from Selected Sites in Mediterranean Spain

Site	Level	IG[a]	IB	Gpd	Ihr	n + d	Prc
Aurignacian							
Beneito[b]	B8–B9	11.9	23.3	0.3	2.3	8.6	1.3
Ratlla del Bubo[b]	—	18.5	22.2	18.5	16.1	11.1	2.5
Gravettian							
Beneito[c]	7A–7B	20.2	13.9	20.7	21.2	3.4	4.9
Parpalló[d]	All	55.8	3.4	15.1	10.4	3.5	10.4
Barranc Blanc[d]	All	27.8	12.8	5.9	1.6	10.2	27.8
Malladetes[d]	All	34.7	6.9	11.5	6.4	6.6	22.8

[a]IG, endscraper index; IB, burin index; Gpd, backed pieces; Ihr, microblade index; n + d, notches and denticulates; Pcr, continuously retouched pieces.
[b]Iturbe and Cortell (1992).
[c]Iturbe *et al.* (1994).
[d]Miralles (1982).

tian material (Table III). The lower part of the Aurignacian sequence (levels IX–V) produced only a small amount of material, but the assemblages are clearly Upper Paleolithic, containing endscrapers, burins, retouched blades and bladelets, and prismatic and pyramidal blade cores. The upper two Aurignacian levels produced larger lithic assemblages, classified as developed Aurignacian (*Auriñaciense evolucionado*). These are characterized by an abundance of Dufour and Font Yves bladelets, a high burin index (especially dihedrals), and an absence or very low frequency of endscrapers on Aurignacian blades and of carinated endscrapers. The bone industry from these levels includes single-beveled points and double points with predominantly flat or oval cross sections. The presence of a backed tool, microgravette points, and backed bladelets in the upper part of these levels is difficult to evaluate at present. Small backed pieces (1–2 cm long) also have been found in the developed Aurignacian industry from Arbreda, Cataluña, and are more frequent in the upper part of that sequence (Soler and Maroto, 1987, p. 225). However, Sacchi *et al.* (1996) have recently noted that there is considerable typological diversity among the assemblages classified as developed Aurignacian. Given this diversity and the current lack of chronometric dates for this part of the Beneito sequence that could establish its contemporaneity (or lack thereof) with developed Aurignacian assemblages from other sites such as Arbreda and Caunecaude (eastern Pyrenees, France), it is perhaps premature to classify the earliest Beneito Upper Paleolithic assemblage as developed Aurignacian.

Angular gravels in the early Upper Paleolithic deposits at Beneito register an interval of climatic deterioration, and associated paleobotanical evidence indicates that the surrounding region was dominated by xerophytic steppic vegetation. Only in levels VIIa and VI is there evidence for slight climatic improvement, with an increase in pine and other taxa indicative

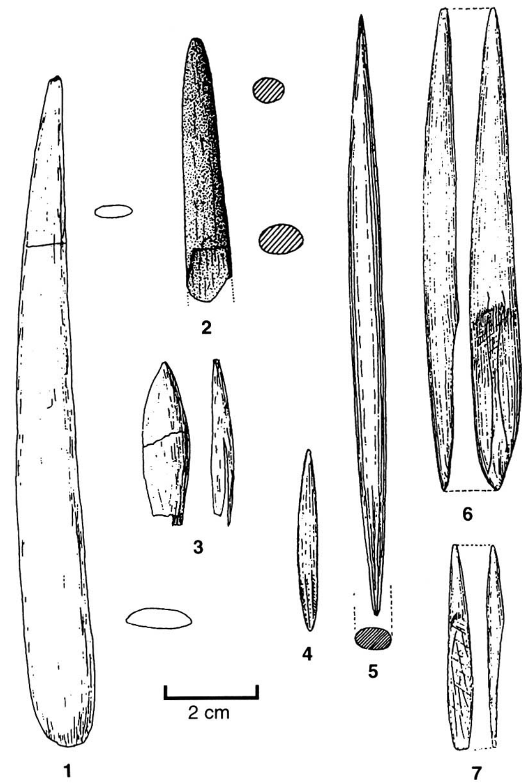

Fig. 3. Aurignacian, Gravettian, and Solutrean bone points from Malladetes, Reclau Viver, Cova Beneito, and Parpalló (after Fortea and Jordá, 1976; Canal, 1989; Iturbe *et al.*, 1993; Pericot, 1942): 1, flat bone point with rounded base (Aurignacian); 2, bone point with oval section (Gravettian); 3: split base bone point (Aurignacian); 5, point with poligonal base (Solutrean); 6: double point (Solutrean); 6 and 7, single bevel points (Solutrean).

of slightly more humid conditions. Fumanal (1995, p. 120) (Fig. 3) suggests that the latter interval is correlated with the climatic improvement of Malladetes B (see below and Table I).

Radiocarbon dates for Beneito differ notably according to whether they were obtained by conventional C-14 methods or by AMS dating (Table II). One set of samples comes from the final Mousterian level X (Gif-8098, 30,160 ± 680 B.P., AA-1387, 38,800 ± 1900 B.P.). A second set is from the overlying initial Upper Paleolithic level IX (Gif-7650, 26,040 ± 890 B.P.; AA-188, 33,900 ± 1100 B.P.), a thick unit with little occupational evidence and an assemblage classified as a generic Aurignacian (Iturbe and Cortell, 1987; Barton, 1988). The fact that the conventional dates (Gif series) are considerably younger than the AMS dates (AA series) suggests that the humic acids may not have been completely removed from the samples dated by conventional means (Carrión, 1992a, p. 3; Iturbe *et al.*, 1994, p. 82).

Information on the earliest Upper Paleolithic at Malladetes derives from a *sondage* in the east trench (Fortea and Jordá, 1976). Beneath well-defined Gravettian levels, the basal units at the site comprise a series of Aurignacian levels (XIV–XI). The sparse lithic and bone industry in these units resembles Aurignacian assemblages excavated from Malladetes in the 1940s and includes a flat, diamond-shaped bone point and a flat bone point with a rounded base.

The Aurignacian deposits consist of sediments interpreted as indicating two episodes of more rigorous climate, Malladetes phases A and C, separated by a more mesic interval, Malladetes B (Table I). Paleobotanical data suggest an arboreal landscape, dominated by pine for the cooler episodes and by Mediterranean or thermophilous taxa during the more mesic interval (Dupré, 1988). The Malladetes B mesic interval previously was correlated with the Hengelo or Cottes interstadial. However, associated radiocarbon dates (29,690 ± 560 B.P. for level XII) suggest a better correlation with the younger Kesselt or Arcy interstadials.

The early Upper Paleolithic sequence at the site of Ratlla del Bubo seems very similar to the Malladetes and Beneito data (Table III). Although currently under study and awaiting complete publication, materials already published for the site indicate a developed Aurignacian industry underlying a Gravettian industry (Miralles, 1982; Iturbe and Cortell, 1992).

In the southern part of the Mediterranean zone, the early Upper Paleolithic sequence from Bajondillo closely resembles those already discussed. Again, a generic Aurignacian industry follows the Middle Paleolithic, is overlain by a Gravettian industry, and is considered roughly contemporaneous with Malladetes phases A and B (Cortés *et al.*, 1996). This pattern seems characteristic for the Mediterranean zone of Spain, including Cataluña.

Discussion

In the central and southern regions there is no evidence for an early or "primitive" Aurignacian, such as is found in the northern region. An apparently late persisting Middle Paleolithic in the former regions seems contemporaneous with the earliest Aurignacian in the latter. Furthermore,

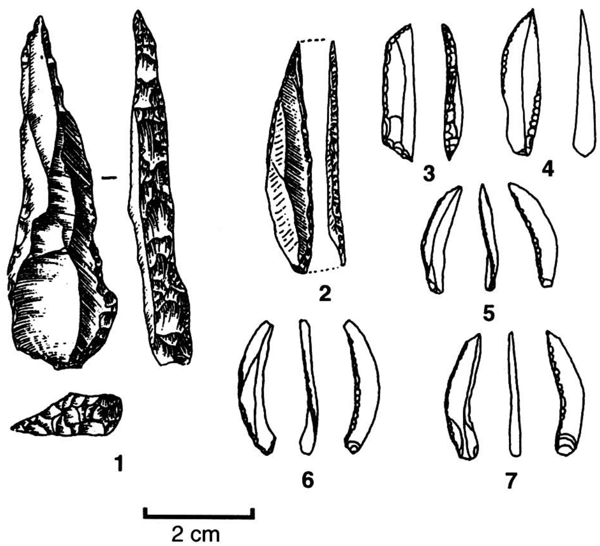

Fig. 4. Gravette points (1 and 2), backed bladelets (3 and 4), and Dufour bladelets from Parpalló, Malladetes, and Cova Beneito (after Pericot, 1942; Fortea and Jordá, 1976; Iturbe *et al.*, 1993).

with the possible exception of Beneito, there is no evidence for the contemporaneous coexistence of the final Middle Paleolithic and early Aurignacian in the central and southern regions.

The earliest Aurignacian industries found in each region of Mediterranean Spain are clearly Upper Paleolithic in their technological and typological characteristics (see Figs. 3 and 4) and lack transitional Mousterian precursors. There is little evidence to support their *in situ* development from regional Middle Paleolithic industries, which show instead minimal vectored, diachronic change.

The spatial and temporal patterns for the beginning of the Upper Paleolithic are paralleled by data from beyond the Iberian peninsula, especially across southern Europe. This suggests that the earliest Upper Paleolithic is a phenomenon of considerable geographic extent, apparently linked with the appearance of anatomically modern humans and Aurignacian lithic industries. In Mediterranean Spain, the beginning of the Upper Paleolithic displays a north-to-south chronological gradient. However, the current paucity of chronological data, both chronometric dates and stratigraphic data, makes it difficult to assess the development of the Aurignacian in more detail.

EARLY UPPER PALEOLITHIC PALEOECONOMY: SUBSISTENCE, MOBILITY, AND TECHNOLOGY

The Middle–Upper Paleolithic transition is defined on the basis of a suite of changes in lithic technology. Given that technology, in general, and lithic technology, in particular, is closely tied to economic behaviors (Bleed, 1997; Barton, 1997b), reconstructing paleoeconomies can provide insight into the processes involved with the beginning of the Upper Paleolithic. Recent taphonomic studies of accumulations of faunal remains and stone artifacts provide provocative evidence for differences between late Middle Paleolithic and early Upper Paleolithic populations in terms of resource extraction and mobility patterns.

Faunal Evidence

Studies of fauna from several late Middle Paleolithic assemblages indicate that nonhuman carnivores were major—and, in some levels, quite possibly the primary—bone accumulators at these sites. At Cova Negra, the taxa identified, mortality profiles, body parts represented, and taphonomy indicate that nonhuman carnivores played an important role in the configuration of the herbivore faunal assemblage, especially in the representation of medium-sized taxa such as ibex and tahr (*Hemitragus sp.*). This, and the diversity of the Cova Negra fauna, including not only medium-sized herbivores such as ibex, tahr, and deer, but also larger herbivores such as horse and aurochs, suggests that the cave was alternatively occupied by humans and carnivores (primarily dhole and wolf). Evidence for breeding and hibernating bats and microfaunal evidence for regular use of the cave by raptors and small carnivores (Villaverde *et al.*, 1997b) also attest to the infrequent nature of human occupation at Cova Negra. Lagomorph remains are common, but these, too, seem mainly the result of nonhuman carnivore activity, with little evidence for human butchering or consumption (Pérez Ripoll, 1992; Martínez Valle, 1996).

Late Mousterian faunal assemblages from Cova Beneito reveal similar patterns (Iturbe, 1993). There are abundant nonhuman carnivore marks on ibex remains, more frequent human butchering marks on deer and horse bones, and a moderate frequency of butchering marks on rabbit bones.

This contrasts with faunal evidence from regional Upper Paleolithic sites. While the earliest Upper Paleolithic units (levels IX–V) at Beneito contain few faunal remains, and carnivore marks are common on those that have been recovered, attesting to the nonhuman accumulation of these materials, the faunal assemblage from the overlying developed Aurignacian levels displays a very different pattern. Of special note is the importance of small prey, primarily rabbit. Rabbit remains dominate the fauna in the two Aurignacian levels analyzed (89.5 and 92.8% NISP) and evidence for their use by humans is common. Medium-sized ungulates also seem to be more important among the larger herbivores, especially ibex, on which human butchery marks are more frequent than carnivore marks. Together, these data suggest that rabbits served as an important complimentary resource in a faunal exploitation pattern focused much more on medium-sized ungulates than was the case for the late Middle Paleolithic and that nonhuman carnivores played a much lesser role in the accumulation of Upper Paleolithic faunal assemblages (Villaverde and Martínez Valle, 1992).

The small faunal and artifact assemblage from the early Upper Paleolithic deposits at Les Malladetes (Davidson, 1989) suggests only sporadic human occupation. Nevertheless, the high percentage of lagomorph remains (83.3% NISP) and the dominance of ungulate remains by deer and ibex agree well with the regional model of faunal use for the early Upper Paleolithic described above.

The faunal assemblages associated with the Aurignacian of Arbreda, in Cataluña, show patterns similar to those at Beneito, although Estévez (1987) has reservations about the usefulness of the interpretations that can be made from the materials from early excavations by Corominas. Rabbit reaches 80% of identified remains, adults dominate the assemblages, and many of the bones are burned (Soler and Maroto, 1987, p. 227). Clearly it would be useful to compare the agents responsible for the Middle and Upper Paleolithic faunal accumulations at Arbreda with those at Cova Negra and Beneito.

We propose a preliminary model for Mediterranean Spain that explains this shift in animal exploitation patterns at the beginning of the Upper Paleolithic transition in terms of the relationship between energy expenditure and return for hunting different-sized prey within the context of differential mobility patterns. The pattern for the Middle Paleolithic seems to have been one of periodic high energy expenditure in the hunting of large animals with the potential for a correspondingly high energy return. This was associated with higher mobility within larger territories, use of a generic technology less specialized for the hunting of medium-sized taxa of limited migration radius, and opportunistically combining scavenging and hunting to obtain animal products. This model accords well with the record at Cova Negra and other Middle Paleolithic sites, helping to explain cultural assemblages that appear to be palimpsests of short occupations and deposits that contain relatively diverse faunas from a variety of geographic settings. This diversity of taxa also differentiates Middle from Upper Paleolithic faunal assemblages, which are characterized by the dominance of one or two taxa.

During the Upper Paleolithic, animal exploitation shifted to a more evenly distributed energy budget (lower energy expenditure and return, but more consistently distributed through time) that operated over a more limited geographic range. Upper Paleolithic hunting seem to have focused on taxa that were relatively gregarious, had a limited migration radius, had a relatively high reproductive rate, and were comparatively easy to find (Villaverde *et al.*, 1996). In this context, rabbits were complementary to taxa, such as deer and ibex, with larger protein returns per individual (Davidson, 1989; Aura and Pérez Ripoll, 1992; Villaverde and Martínez Valle, 1995; Martínez Valle, 1996). These important differences between Middle and Upper Paleolithic economic behaviors have not been discernable elsewhere in Europe, where small game, especially lagomorphs, began to have an important economic role only in the later Upper Paleolithic.

Lithic Evidence

The picture of changing land use provided by faunal data is complemented by taphonomic analysis of Middle and Upper Paleolithic artifact assemblages. A recent study of accumulation and modification processes affecting lithic assemblages at Gorham's Cave, Gibraltar (Barton, 1997a) suggests that the site was only sporadically occupied by very mobile foragers during much of the Middle Paleolithic. These data are compared with similar information for several Valencian sites in Fig. 5. While variation in local circumstances (including deposition rates, and access to and quality of raw materials, for example) limits detailed comparisons between sites with regard to the variables considered, the patterning of assemblages within sites and more general comparisons between sites is informative. The lithic record from Cova Negra parallels aspects of the Gorham's Cave record in several important respects. Low artifact densities (2–14/m^3) and a high ratio of maintained (i.e., retouched)-to-minimally utilized artifacts (44–77% retouched) typify the Cova Negra sequence. This high frequency of artifact maintenance was previously interpreted as indicating exhaustion of local stone resources, possibly due to relatively long occupation spans (Barton, 1988, 1991). However, in the light of the Gorham's Cave study, this pattern seems more likely the result of brief occupations by mobile foragers, who discarded primarily exhausted lithic artifacts that had been maintained (i.e., curated *sensu* Shott, 1996) while being transported. This reconstruction of Middle Paleolithic use of the site corroborates previously discussed faunal evidence.

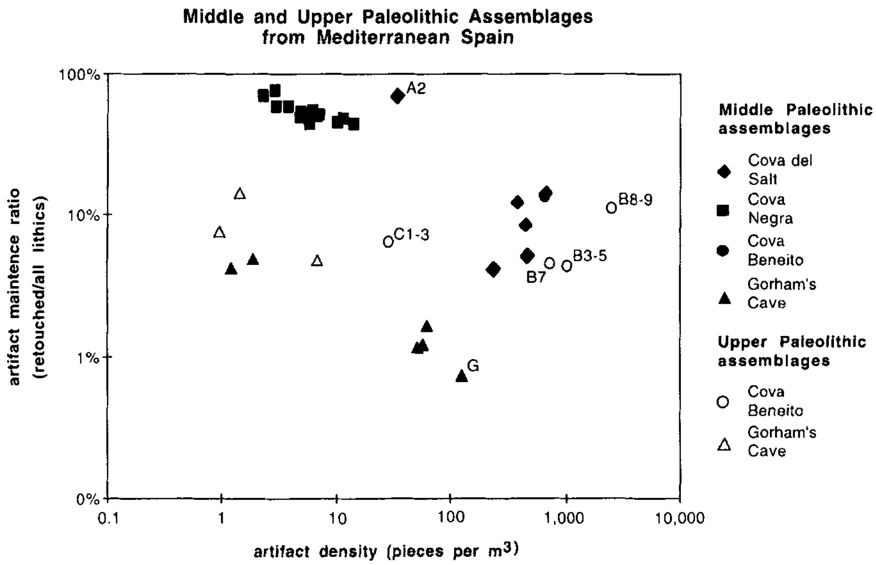

Fig. 5. Artifact maintenance ratios (measured as percentage retouched for entire assemblages) and lithic discard densities for selected late Middle and early Upper Paleolithic assemblages from Mediterranean Spain. Most of the debitage is probably missing for Cova del Salt A2. For Cova Beneito, C1–C3 is early Aurignacian, B8–B9 is developed Aurignacian, B7 is Gravettian, and B3–B5 is middle Solutrean (data from Barton, 1988, 1997a; Iturbe *et al.*, 1993). Note log scale for both axes.

There is also suggestive evidence for considerable variation in Middle Paleolithic settlement patterns, however (Fig. 5). In the final Middle Paleolithic level at Gorham's Cave (level G), the high artifact density and minimal maintenance suggest longer stays at the site and a focus on local resources, a pattern that is considerably different from that of other Middle or Upper Paleolithic assemblages at Gorham's (see also Barton, 1997a). At the Valencian Middle Paleolithic site of Cova del Salt (Barton, 1988; Galvan, 1992; Villaverde, 1984), the ratio of maintained artifacts to unmaintained ones is higher than at Gorham's but much lower than at Cova Negra, and the artifact density is much higher than at either site (Fig. 5). Given that sedimentation rates at Salt (primarily fluvial in nature) were probably not slower than at Gorham's or Cova Negra (Barton, 1988; Barton and Clark, 1994) and that the total occupation span was probably less than at the other sites, and assuming that Middle Paleolithic group size did not vary by orders of magnitude, the much higher artifact densities at Salt (238-644/m^3) probably indicate much more regular reoccupation and/or longer occupation spans. The Middle Paleolithic occupation at Cova Beneito

(Iturbe, 1982; Iturbe *et al.*, 1993) seems similar to Salt in terms of both artifact density and maintenance. It also has higher maintenance levels than any of the Beneito Upper Paleolithic levels. Of the sites displayed, Beneito is closest to Salt geographically and, hence, these two sites may share taphonomic constraints to some degree. Unfortunately there are not yet analyses of the Gorham's or Salt faunas comparable to the Cova Negra study that could be used to test the settlement reconstruction from the lithic data.

The Cova Beneito Upper Paleolithic lithic data also support the results of the faunal analysis (Fig. 5). All Upper Paleolithic assemblages show lower amounts of artifact maintenance than displayed in the Middle Paleolithic. The small assemblage from the initial Upper Paleolithic deposits (C1–C3 in Fig. 5) also exhibits a low artifact density that suggests sporadic occupation of the site. Very high artifact densities characterize the remainder of the Upper Paleolithic sequence at Beneito. Along with corresponding lower frequencies of artifact maintenance, these assemblages suggest longer-term occupations and somewhat reduced overall mobility compared with the Middle Paleolithic. The Upper Paleolithic lithic assemblages from Gorham's, on the other hand, are characterized by very low artifact densities and higher frequencies of maintenance than most of the Middle Paleolithic assemblages, especially layer G (Figure 5). This is suggestive of short-term occupations by mobile foragers (Barton, 1996). Frequencies of maintained artifacts at Parpalló vary within the range of the Beneito Upper Paleolithic sample, again corroborating the faunal evidence for reduced forager mobility

Discussion

In sum, a number of economic changes seem associated with the Middle-to-Upper Paleolithic transition in Mediterranean Spain. Middle Paleolithic foragers appear to have employed a generic, but flexible stone technology that changed little over the course of the Upper Pleistocene, prior to isotope stage 3. They used this technology to acquire diverse taxa of medium to large ungulates in wide-ranging, but relatively unspecialized hunting and/or scavenging, and certainly other resources that have left no trace in the archaeological record. Their most apparent response to changing Upper Pleistocene environments was changing settlement pattern. In other words, human distribution seems to have shifted in response to changing resource distribution, while technology and faunal resource procurement strategies remained stable.

In contrast, while settlement shifts helped Upper Paleolithic foragers adapt to fluctuating late Upper Pleistocene environments, these selective pressures also favored new technological strategies and faunal exploitation patterns. In terms of technology, hafting and compound artifact manufacture permitted a set of even more generic lithic forms that could be transformed into more effective, functionally specific tools (e.g., Barton *et al.*, 1996; Myers, 1989). Concurrently, hunting became more specialized, operated more logistically over more restricted geographic areas, focused on a very few taxa of medium-sized ungulates, and emphasized small game (especially lagomorphs) to a much greater degree.

The models proposed here are still in preliminary stages of development and it will be necessary to test them against other aspects of the archaeological record, including lithic raw material sourcing, seasonality of resource exploitation, and especially, a larger sample of Middle and Upper Paleolithic sites. Further, it is not yet possible to say whether the changes in economic behaviors discussed here might have been due in part to human biological evolution [e.g., of human cognitive processes (cf. Mithen, 1992)] or to selective pressures acting directly on behavior independent of biological change. Nevertheless, these represent the types of studies needed if we are to understand and hope to explain the beginning of the Upper Paleolithic.

THE GRAVETTIAN: THE EMERGENCE OF A REGIONAL UPPER PALEOLITHIC

Because the sample of known Aurignacian sites in Mediterranean Spain with adequately described assemblages in stratigraphic context is very small, it is not yet possible to discern patterns of geographic variability in the earliest Upper Paleolithic of southwestern Europe. Such spatial variability begins to appear with the Gravettian of Mediterranean Spain. However, because there are still relatively few known Gravettian sites with adequate stratigraphic and assemblage data, spatial patterning can only be observed at a rather coarse, regional scale, serving to differentiate the Upper Paleolithic of the Spanish Mediterranean zone from other contemporaneous industries of southwestern Europe. As shown in Fig. 2, Gravettian sites are known from all three regions of Mediterranean Spain. In Cataluña, these include the sequences from Arbreda, Reclau Viver, Roc de la Mecla, and Balma de la Griera (Estévez, 1976; Soler, 1979/1980, 1986; Soler and Maroto, 1987; Fullola *et al.*, 1994). Gravettian occupations are known from the Valencian sites of Malladetes, Parpalló, Barranc Blanc, and Cova Beneito (Fortea and Jordá, 1976; Fullola, 1979; Miralles, 1982; Fortea *et* *al.*, 1983; Iturbe *et al.*, 1993). From Andalucía, Gravettian assemblages are known from the Cueva de Nerja and Bajondillo (Aura *et al.*, 1997; Cortés and Simón, 1995). Although the Gravettian seems to initiate a pattern of greater regional diversity, there remain significant difficulties in correlating assemblages within regions and even greater difficulties in linking them with similar industries in Mediterranean France and Italy or even with those of Portugal and Cantabria.

The Gravettian in Northern Mediterranean Spain

Within Mediterranean Spain, Gravettian industries from the northern region display relatively little diversity, but differ from contemporaneous Gravettian facies in other regions (Bosselin and Djindjian, 1994; Djindjian and Bosselin, 1994). At Arbreda, for example, the Gravettian occupation is divided into two levels. The lower one produced gravette points but few other pieces. The upper level, with a larger sample, is characterized by a high frequency of endscrapers, few burins, the presence of Gravette and microgravette points, and abundant backed bladelets (Soler and Maroto, 1987). The Gravettian industry from level C of Reclau Viver, excavated in the late 1940s, exhibits a similar composition: abundant endscrapers, few burins, gravette and microgravette points, and other backed pieces (Estévez, 1976). In level D Estévez notes a decrease in debitage size and greater artifact diversity compared with level C, below. The site of Roc de la Mecla, on the other hand, has produced a distinctive Gravettian assemblage, with more burins than endscrapers, rare gravette and microgravette points, and moderate frequencies of backed bladelets and truncations (Soler, 1980). It has been identified as final Gravettian on the basis of a radiocarbon date of 20,900 ± 400 B.P. (Table II) and considered an example of the diachronic change in the Catalan Gravettian. However, the upper level at Arbreda has an equivalent date of 20,130 ± 220 B.P. (Table II) but a Gravettian assemblage that differs from that at Roc de la Melca.

There is a lack of early Solutrean levels in Cataluña to mark the end of the Gravettian, as is also the case in the central Mediterranean region. Soler and Maroto (1996) proposed that level E of Reclau Viver be classified as "ProtoSolutrean." This classification is based on materials excavated by Corominas in the 1940s and not universally accepted, even though the assemblage does contain bifacially retouched pieces (Fullola, 1994).

The Gravettian in Central and Southern Mediterranean Spain

In Valencia, a small Gravettian assemblage was excavated from below an early Solutrean level at Parpalló (Table III) (Pericot, 1942; Miralles, 1982). Typologically (Fig. 4), it resembles the upper Gravettian assemblage from Arbreda. The considerably longer Gravettian sequence from Malladetes also is similar, though the numerical dominance of endscrapers over burins is accompanied by minimal variation in backed pieces (Fortea *et al.*, 1983). Although no chronometric dates are available for these assemblages, there are C-14 dates for the initial Solutrean above and Aurignacian below (Table II), putting the Malladetes Gravettian at 29,000–21,000 B.P. (although probably not much earlier than 25,000 B.P. given the stratigraphic position of the Aurignacian date well below the initial Gravettian level).

At Beneito, Gravettian levels are located in the upper part of stratum IV, above the developed Aurignacian levels. In the assemblages from levels B7a and B7b (Table III), endscrapers outnumber burins; backed pieces are well represented, with gravette and microgravette points, backed bladelets, and truncations. Level B6 produced a similar assemblage, differing only in higher burin frequencies and fewer gravette points, but lacking distinctive Protosolutrean elements (Iturbe *et al.*, 1993). Vale Comprido points (see below), suggested by Zilhão and Aubry (1995) to mark the Gravettian–Solutrean transition, have not been reported from level B6 at Beneito, nor are they illustrated in any published reports.

In Andalucía, Bajondillo also produced a Gravettian industry in stratigraphic context below a middle Solutrean industry and above a generic Aurignacian industry. It is characterized by more burins than endscrapers, the presence of gravette and microgravette points, curve backed points, backed bladelets, and a few truncations (Cortés and Simón, 1997a, b). As was the case with the Aurignacian, there are other reported Gravettian industries, but these are from potentially mixed assemblages or uncertain stratigraphic context. Examples include Zájara, Serrón, and Calaveres (see Cacho, 1980; Fortea, 1985).

Discussion

The sample of clearly Gravettian assemblages from Mediterranean Spain is limited. Of these, several (Reclau Viver, Arbreda, Parpalló, and Malladetes) derive in part or completely from relatively early excavations that produced little in the way of associated chronostratigraphic or paleoenvironmental data, and few chronometric dates. This considerably limits the possibilities for tracing temporal change within the Gravettian and its relationship with the Aurignacian and Solutrean, and any synthetic interpretations should be considered provisional at this juncture.

Well-documented Gravettian stratigraphic sequences known to date exhibit a succession of Aurignacian to Gravettian, without interstratification. A single equivocal level at Malladetes seems to be more a case of minimal occupational debris. The morphology of backed elements in the final Aurignacian of both Beneito and Arbreda suggests that these assemblages may be contemporaneous with the earliest Gravettian assemblages at other sites in Mediterranean Spain. In any case, the beginning of Gravettian of Mediterranean Spain predates the Perigordian V (Noailles burin facies) of Cantabria, southeastern France, and northern Italy, and its end coincides with the initial Iberic Solutrean (see below).

The Gravettian of Mediterranean Spain displays little evidence of significant diachronic change, and observed variability seems to pattern more geographically than temporally. Its long duration, as well as its characteristic low burin frequencies, serve to distinguish it from other Gravettian (*sensu* Perigordian IV) industries of southwestern Europe. Given the very few sites with evidence for diachronic change, it is difficult to assess whether or not the developments seen at these sites represent regionwide phenomena. It seems most appropriate at this stage to designate all these assemblages as the Mediterranean facies of a temporally undifferentiated Gravettian industry, marked by assemblages of backed pieces with little typological variation (Gravette points, microgravette points, backed bladelets, and a few other backed points). Single-beveled bone points, awls, and double points make up a bone industry that is neither numerous nor varied.

Paleoenvironmental data from Malladetes (levels VII and X) and Beneito (level IV) indicate that the Gravettian occupation of these sites was largely marked by rigorous climate, characterized by physical weathering in associated deposits (the Malladetes C Phase; see Table I), intercalated with minor climatic ameliorations that may correspond to the Tursac interstadial (Dupré, 1988). The Gravettian level at Bajondillo has been tentatively correlated with the latter climatic phase.

The even more limited evidence for prehistoric economy presents a picture not much different from the Aurignacian. There seem to be some differences in representation of medium and large mammals at sites across the Mediterranean zone. Horse is more common in the northern Mediterranean region, while ibex is more frequent in the central and southern regions. Overall, faunal assemblages throughout Mediterranean Spain seem characterized by an overabundance of one or two larger taxa, while lagomorphs are a consistently significant component (Villaverde and Martínez Valle, 1992).

Finally, it is important to note that the earliest recognized mobile art in Mediterranean Spain is associated with Gravettian occupations at Parpalló and Malladetes. At both sites, limited but significant numbers of limestone plaquettes have been found that are painted and engraved with zoomorphic or, more rarely, abstract images. These designs exemplify styles that are traditionally associated with very early phases of Upper Paleolithic art. These include bodies disproportionately large compared to the heads and feet, pregnant animals, cervicodorsal lines that tend to follow curves, and a rarity of anatomical details or fur. The presence of contemporaneous, similar art forms at both sites indicates the potential for finding other examples of decorated plaquettes or parietal art associated with Gravettian industries elsewhere in Mediterranean Spain. We discuss Paleolithic art in Mediterranean Spain in more detail below.

THE IBERIC SOLUTREAN

The presence of Solutrean points (Figs. 6 and 7) in assemblages between 21,000 and 17,000 B.P. (Table II) marks the appearance of a new lithic technology in Mediterranean Spain. However, geographic variability in Solutrean bifaces suggests a distinction between Cataluña and the rest of the Spanish Mediterranean zone. At least in its northern reaches, the Catalan upper Solutrean is characterized by bifacial shouldered points and others that are not found elsewhere in the Mediterranean zone. These include Serinyadell points (laurel leaves with a lateral or oblique tang) and Catalán or Sant Julià de Ramis points (diamond-shaped, often with basal tangs and incipient barbs) (Fig. 6). The Solutrean in the rest of the Mediterranean zone is characterized by convex base laurel leaf points, tanged and barbed points, and abruptly retouched shouldered points (Fig. 7). These differences between Cataluña and the Mediterranean zone to the south seem to carry across the Iberian peninsula, with the southern point group represented across Andalucía to the Atlantic, in the southern Meseta, in Portugal, possibly in Aragón, and even in southern Cataluña. Noting these geographic patterns, Jordá (1955) proposed that this southern group be termed the Iberic Solutrean (Solutrense de facies Ibérica). Because of this wide distribution and the apparent geographic divisions, the Solutrean presents a valuable opportunity to examine region-level patterns of organization among Paleolithic foragers during and just after the Pleniglacial maximum.

At the outset, the nature of the available dataset needs to be mentioned briefly. Of the known Solutrean assemblages, the largest parts are from late in the sequence; the early Solutrean is represented by considerably fewer assemblages. As with the earlier Upper Paleolithic, there are

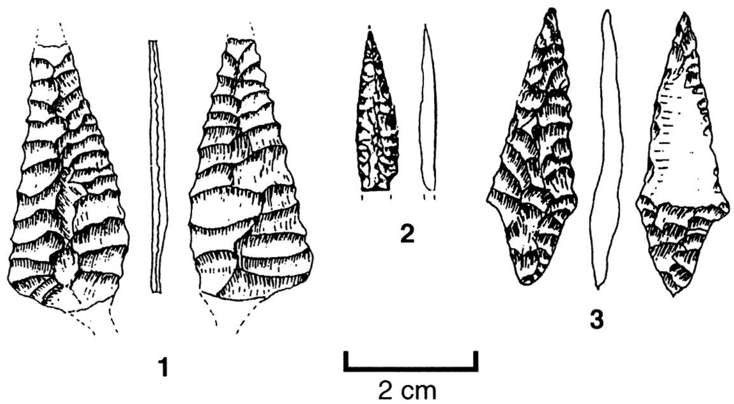

Fig. 6. Catalan Solutrean points from Reclau Viver and L'Arbreda (after Canal, 1989; Soler and Maroto, 1987). 1, Serinyadell type point; 2, Solutrean point à cran; 3, Sant Julià de Ramis type point.

few sites with long stratigraphic sequences that can provide information on diachronic change within the Solutrean. Finally, paleoenvironmental and economic data are fragmentary and often of poor quality, especially in the southern Mediterranean zone. These limitations to the data set are balanced by the relatively large number of known Solutrean sites. Moreover, most of these have been recently excavated and many are currently being studied.

Sites with multiple Solutrean occupations, and the potential for diachronic studies, include Arbreda in Cataluña; Parpalló, Malladetes, and Beneito in Valencia; and Ambrosio, Nerja, and Bajondillo in Andalucía. In addition to these are Solutrean sites with more restricted occupation spans, but whose age can be determined reasonably well. These include Los Ojos, Pantano de Cubillas, and Cubeta de la Paja in Andalucía; Ratlla del Bubo and Barranc Blanc in Valencia; and Reclau Viver, En Pau, and Fées (or Cau des Goges) in Cataluña (Fig. 2).

The Solutrean in Northern Cataluña

Adopting the apparent geographic divisions suggested by biface morphology as a way to address overall variability in the Solutrean, we begin with an overview of the evidence from northern Cataluña. This is exemplified in the Solutrean sequence exposed in recent excavations at Arbreda, and described by Soler and Maroto (1987). Above a Gravettian

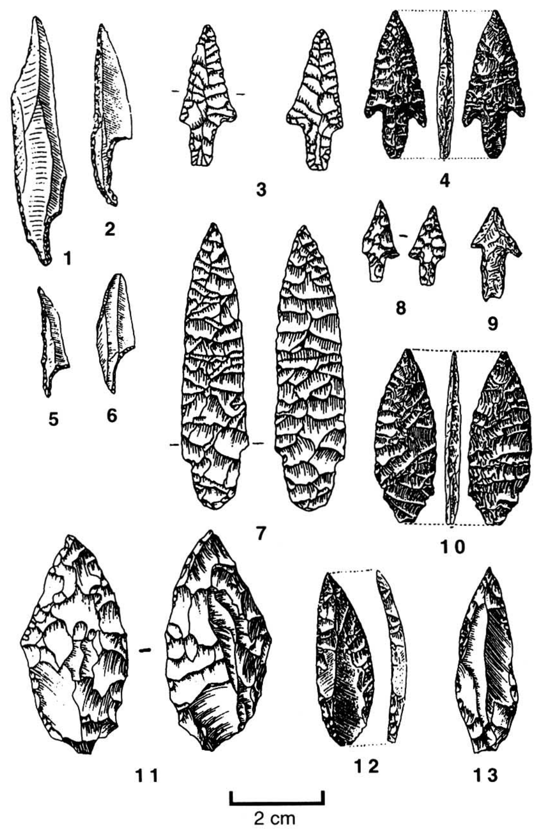

Fig. 7. Valencian and Andalucian Solutrean points from Parpalló, Malladetes, and Cova Ambrosio (after Pericot, 1942; Fortea and Jordá, 1976; Ripoll López, 1988). 1, 2, 5 and 6—abruptly retouched shouldered points; 3, 4, 8, and 9—tanged and barbed Parpallo points; 8—tanged point; 7, 10, and 11—convex base laurel leaf points; 12 and 13—unifacial Solutrean points.

level is a deposit 30 cm thick, without chronometric dates. It contains few pieces, but did produce a characteristic Solutrean shouldered point. Above this is another level, 30-40 cm thick, with a radiocarbon date of 17,320 ± 290 B.P. (Table II). It produced laurel-leaf points with incipient oblique tangs, Serinyadell points, and willow-leaf points. Finally, above this, is a third, thin Solutrean level. It contains a sparse lithic industry, but has produced abruptly retouched shouldered points similar to those more characteristic of the developed Solutrean in the rest of the Mediterranean

Spain. Available typological data suggest that these three levels are best assigned to the upper and final Solutrean, even though Soler (1987, 1994) has described the Arbreda sequence as including lower, middle, and upper or final Solutrean.

The occurrence of abruptly retouched shouldered points in association with diamond-shaped points with incipient barbs at Cau de les Goges, and with oblique tanged points at other sites, like Reclau Viver, is generally felt to be characteristic of the upper Solutrean (see also Fullola, 1994). However, similarities between the final Solutrean of Arbreda and other Catalán sites and the developed Solutrean to the south suggests that the regional divisions of the Solutrean become less distinct late in the sequence. Of interest is why shouldered points, and other elements, spread across the entire region of Mediterranean Spain in the later Solutrean. Clues to this change may be found at sites outside the Mediterranean zone (Chaves, for example) and in sites of the French Pyrenees. Before discussing this in more detail, however, an overview of the Iberic Solutrean is useful.

The Iberic Solutrean

Both the beginning and the end of the Iberic Solutrean are controversial. Controversies over the initial appearance of the Iberic Solutrean are a result largely of Smith's (1966) contention that it was a French phenomenon that spread to the Iberian peninsula during the Middle Solutrean. Debates over the end of the Iberic Solutrean have arisen because of its apparent late survival and the replacement of bifacial points with those of antler and bone in its final phases. These controversies and other issues, including the beginning of the Magdalenian, the wide distribution of abruptly retouched shouldered points (like those of the Iberic Solutrean) across southern Europe, and the local development of artistic expression, make this one of the most interesting Upper Paleolithic sequences in Mediterranean Spain.

The Early Iberic Solutrean

Evidence for the beginning of the Iberic Solutrean is found at the sites of Parpalló and Malladetes. At both sites, the initial Solutrean levels are above and typologically distinct from underlying Gravettian occupations and underlie middle Solutrean levels (Table III). These earliest Solutrean levels are dated at ca. 21,000–20,000 B.P. at Parpalló and Malladetes (Table

II), contemporaneous with initial Solutrean occupations in Portugal and southeastern France. This suggests that the beginning of the Solutrean was a widespread phenomenon that extended across southwestern Europe.

Smith's (1966) view that there was no early Solutrean occupation in Mediterranean Spain was developed before the 1971 excavations at Malladetes and the availability of chronometric dates for that site and for Parpalló (Davidson, 1974; Bofinger and Davidson, 1977; Fortea and Jordá, 1976). It also was based on an incorrect interpretation of a supposed shouldered point from the Gravettian levels at Malladetes. This piece is morphologically distinct from shouldered points of the developed Solutrean in Mediterranean Spain but matches others found in Gravettian assemblages.

The initial Solutrean industry at Parpalló and Malladetes is distinguished by the disappearance of backed pieces, a continuation of the numerical predominance of endscrapers over burins seen in the Gravettian, and the presence of unifacial points (Pericot, 1942; Fortea and Jordá, 1976; Villaverde and Fullola, 1990). The only paleoenvironmental data for this period come from stratum IV at Malladetes, where the frequency of plaquettes from gelifraction and low arboreal pollen values indicate relatively cold and dry conditions (Fumanal, 1986; Dupré, 1988).

Zilhão has proposed that the initial Solutrean in Portugal has its origins in the regional Gravettian there. Such *in situ* evolution cannot be confirmed for Parpalló or Malladetes. At Parpalló, the Gravettian industry is impoverished and there is considerable uncertainty about stratigraphic relationship between the thick (>1-m) deposit attributed by Pericot to the Gravettian and the initial Solutrean. At Malladetes, between the Gravettian level VIII and the initial Solutrean of level VI is a deposit with very sparse occupation debris which, as a result, is almost impossible to classify from a typological perspective. Furthermore, the unifacial points of the earliest Solutrean from Parpalló and Malladetes do not seem to include any of the Vale Comprido points that, according to Zilhão, typify the Gravettian–Solutrean transformation in southern Portugal. The points from these Valencian sites do not exhibit dorsal face thinning on the proximal end, nor are they made on triangular blanks, both common features of Vale Comprido points (Fig. 6). Rather, the Valencian points are characterized by invasive retouch on the interior face that sometimes removes the bulb of percussion (Fig. 7). They are found in industries characterized by the rarity of abrupt retouch, indicating important technological differences from Gravettian projectile tip production (Villaverde and Fullola, 1990). In all, this evidence does not suggest a gradual transition from the Gravettian to the Iberic Solutrean. However, with pertinent assemblages from only two sites, a larger sample of sites is needed to understand better the nature of the origin of the Iberic Solutrean.

The Middle Iberic Solutrean

The greater number of sites with levels associated with the middle Iberic Solutrean (*Solutrense medio* or *Solutrense pleno*) allows a better characterization of this period in central and southern Mediterranean Spain. Moreover, sites such as Parpalló and Malladetes have produced much richer assemblages for this period. At Parpalló, for example, early and middle Solutrean deposits are of comparable thickness, but the early Solutrean assemblage comprises 917 total pieces (184 retouched), versus 5588 (1073 retouched) for the middle Solutrean. Similarly, there are 154 engraved or painted plaquettes from the early Solutrean levels, versus 855 from the middle Solutrean. Beyond suggesting a simple population increase, this evidence may indicate a change in settlement strategy associated with more logistically organized economies and reduced mobility. Unfortunately, there are only limited faunal data to support this interpretation and other indicators of mobility and range extent, such as lithic raw material sourcing, are lacking so far.

In terms of its lithic industry, the middle Solutrean of the central and southern Mediterranean zones closely parallels contemporaneous industries of Cantabria and France. It is characterized by the presence of unifacial points, convex base laurel-leaf points, and asymmetrical foliate bifaces (Fig. 7) in assemblages dominated by endscrapers and having few burins. Solutrean elements exceed 15% of the industry for this phase at Parpalló (Fullola, 1979) and 22% at Ambrosio (level IV) (Ripoll López, 1986). This is comparable with the middle Solutrean at Laugerie-Haute, in which the frequencies of such pieces vary between 9 and 24% (Smith, 1966).

At a few sites, like Parpalló, *in situ* development can be traced in the forms of retouched pieces [tanged points, for example (Pericot, 1942; Fullola, 1979)] and in the artwork. For example, many decorated plaquettes show stylistic continuity through the early, middle, and upper Solutrean (Villaverde, 1994).

Middle Solutrean systematics remain poorly developed in Andalucía. At Bajondillo and Nerja, this period is represented by poor assemblages that are classified more on their lack of certain elements than on the presence of chronologically sensitive forms, on the overall composition of their industries, and on their stratigraphic positions. At Bajondillo, underneath thick deposits associated with the developed Solutrean (levels 6–8) is a possible middle Solutrean occupation (level 5) which has produced unifacial and laurel-leaf points (Cortés and Simón, 1997b). At Nerja, levels V10–V8 have produced flat, bifacial tools but lack typical developed Solutrean tools. There is no developed Solutrean at Nerja; an erosional disconformity separates level V8 from upper Magdalenian level V7 (Aura *et al.*, 1997). A middle Solutrean occupation has been suggested at Los Ojos (Toro *et al.*, 1984). However, this assemblage includes unifacial points, laurel-leaf points, and tanged and barbed points, suggesting that it may actually be developed Solutrean (Toro, 1997; Cortés *et al.*, 1996).

Again, detailed reconstruction of regional paleoenvironments is difficult due to the small number of sites with relevant deposits and the preliminary nature of many pertinent data sets. Data from level V of Malladetes indicate a climatic improvement that might correlate with the Laugerie interstadial (Fumanal, 1986; Dupré, 1988). Part of Solutrean level D of Arbreda (Estévez, 1980, 1987a, b) may date to ca. 20,000 B.P. (Villaverde and Martínez-Valle, 1995) and, hence, would be correlated with Malladetes level V (Fortea and Jordá, 1976). Level D is a thick deposit that was excavated in the initial work at the site. It contains a somewhat unusual mix of fauna that includes comparatively warmer-climate taxa such as *Equus hydruntinus*, *Sus scrofa*, and *Rupicapra rupicapra* along with colder climate taxa such as *Microtus arvalis* and *M. oeconomus*, suggesting the possibility of postdepositional mixing or that temporally distinct deposits were combined during the early excavation. At Nerja, charcoal studies suggest relatively warm and humid conditions for layer V8, and chronometric dates for layers V10–V8 put them between 20,000 and 17,000 B.P.

The Developed Iberic Solutrean

The developed Iberic Solutrean lasted for three millennia, from 19,500 to 16,500 B.P. (Table II), with a concomitant delayed appearance of the Magdalenian in the region. The change to more rigorous climatic conditions at the beginning of the developed Iberic Solutrean (*Solutrense evolucionado*) is recorded at several sites. Reindeer antler and remains of *Ovibos moschatus* and *Citellus* sp. are found in deposits with a developed Solutrean industry at Arbreda (Soler and Maroto, 1987; Estévez, 1987), indicating a replacement of temperate fauna by taxa adapted to colder regimes. A contemporaneous deposit at Malladetes (level IV) is composed of plaquettes and lacks evidence of human occupation (Fumanal, 1986). The pollen spectrum from this level, reflecting a more moderate climate, has been interpreted as deriving from downward percolation from the overlying deposit (Dupré, 1988). The developed Solutrean levels at Malladetes seem best correlated with the Laugerie and Lascaux interstadials, with the cold phase of level IV corresponding to the inter-Laugerie/Lascaux stadial (see Table I). The Older Dryas is probably represented by a cooler interval associated with the latest phases of the developed Solutrean, such as in level II at Malladetes and level II at Beneito (Fumanal and Villaverde, n.d.). Levels IV–II at Ratlla del Bubo also seem to correspond to the inter-Laugerie/Lascaux stadial, with level II radiocarbon dated to 17,360 ± 180 B.P. Macrobotanical remains from this series of deposits suggest a cold, arid interval in which *Juniperus sp.* dominates the arboreal pollen, followed by lesser amounts of *Pinus nigra*. The succeeding level I deposits suggest more temperate and humid conditions with higher frequencies of *Fraxinus* and *Pistacia terebinthus* (Badal, 1995).

A similar association between the developed Solutrean and the climatic phases just discussed has been proposed in the southern Mediterranean zone. Deposits with developed Solutrean assemblages (Cejo del Pantano and Ambrosio) are associated with temperate conditions. However, more detailed chronostratigraphic and paleoenvironmental studies are needed to verify these associations (Cortés *et al.*, 1996).

The developed Solutrean is divided into two phases. The first is the upper Solutrean (*Solutrense superior*) and is characterized by classic Solutrean tool assemblages augmented by a regional point style, the tanged and barbed "Parpalló point" (Fig. 7). Because of its similarity to Late Neolithic arrow points, the discovery of this Parpalló type of point in the 1930s initially raised doubts about the Paleolithic age of the Parpalló sequence. Its similarity to these Neolithic projectile tips also led later authors to suggest that it represents the early adoption of the bow. In the second phase, the Solutreo-gravettian (*Solutreogravetiense*), typical Solutrean tools are rare. Mediterranean type shouldered points, made with abrupt retouch on highly standardized blades, develop within the Solutreo-gravettian (see also Table IV).

These two phases of the developed Solutrean exhibit reciprocal frequencies of shouldered and stemmed points. The shouldered forms initially appear, albeit rarely, in the Upper Solutrean, but become increasingly common in the Solutreo-Gravettian. Conversely, Parpalló points are common in the upper Solutrean, but continue into the Solutreo-Gravettian only at reduced frequencies. The common, reciprocal presence of both point forms at numerous sites, many of which have been recently excavated, supports an interpretation *in situ* evolution of developed Solutrean industries across a broad geographic region. In addition to the previously mentioned Valencian sites, abruptly retouched shouldered points or Parpalló type stemmed and barbed points have been found widely throughout Mediterranean Spain and other parts of the Iberian peninsula in developed Solutrean contexts (Table V, Fig. 2).

Following the middle Solutrean [ending ca. 19,000–18,000 B.P. at Parpalló (Table II)], there seems to be a widespread evolution of hunting weapons across Mediterranean Spain, characterized by the progressive re-

Table IV. Developed Solutrean and Magdalenian Industries from Selected Sites in Mediterranean Spain

Site	Level	IG[a]	IB	Ihr	n + d	Prc
Developed Solutrean						
Parpalló[b]	3.75–4.00	42.6	18.7	7.1	3.9	4.5
	4.00–4.25	35.6	16.2	14.3	3.9	4.4
	4.25–4.5	32.2	10.8	13.4	1.6	3.4
	4.50–4.7	32.2	7.1	14.2	0.9	3.6
Pantano de Cubillas[c]	—	10.6	14.7	13.3	7.3	2.7
Ambrosio[d]	niv.I(1963)	20.7	9.3	10.1	29.1	2.9
Beneito[e]	B1–B2	25.8	14.1	13.1	8.6	7.2
Early Magdalenian						
Parpalló[f]	MAA	45.1	8.5	0.8	18.6	9.1
	MAB	16.8	5.1	0.6	23.2	21.1
Middle Magdalenian/Upper Magdelenian A						
Parpalló[f]	T-5	15.5	15.5	14.6	13.4	11.4
Cendresg[g]	XII(1)	6.3	3.8	62.1	-	16.5
Matutano[h]	IV	14.1	35.8	7.6	14.1	15.3
Upper Magdalenian						
Boran Gran[i]	—	11.3	34.7	40.1	0.7	3.1
Bauma de la Peixera[j]	—	11.5	22.3	33.0	4.3	—
Matutano[h]	III	14.1	35.8	7.6	14.1	15.3
	IIC	39.3	19.1	4.4	13.4	12.3
	IIB	38.0	9.8	8.4	15.9	11.9
Parpalló[f]	Talud 1 and 2	19.3	18.2	34.1	8.0	7.1
Cendres[g]	XIB	4.8	15.7	67.5	2.4	8.4
	XIC	3.5	6.6	78.3	1.2	4.3
Tossal de la Roca[k]	IV	6.7	6.0	30.2	20.8	—
	III	20.0	3.0	23.5	11.7	—
	II	11.6	3.6	57.1	14.3	2.6
Caballo[l]	2	23.6	23.6	18.4	15.7	5.3
	4	17.8	28.5	17.8	10.7	7.1
Algarrobo[l]	1	30.0	12.8	23.1	5.1	5.1
	2	15.7	20.2	34.8	7.9	4.5
	3	12.7	25.4	34.9	11.1	3.2
Mejillones[l]		19.3	32.2	16.1	6.4	9.7
Nerja[f]	16	12.4	13.9	39.5	10.0	6.9
	15	12.9	15.2	39.8	9.0	11.7
	14	10.2	14.7	38.6	6.6	13.3
Verdelpino[m]	V	14.9	60.9	12.6	6.8	2.2

[a]IG, endscraper index; IB, burin index; Ihr, microblade index; n + d, notches and denticulates; Pro, continuously retouched pieces.
[b]Rodrigo (1987/1988).
[c]Toro y Ramos (1988).
[d]Ripoll López (1986).
[e]Iturbe *et al.* (1994).
[f]Aura (1995).
[g]Villaverde *et al.* (1997).
[h]Olaria *et al.* (1985).
[i]Sonneville-Bordes (1973).
[j]Fullola *et al.* (1989).
[k]Cacho (1982).
[l]Martinez-Andreu (1989).
[m]Fernandez-Miranda and Moure (1976).

Table V. Examples of Solutrean Sites with Shouldered and/or Stemmed and Barbed Points

Region	Sites
Portuguese Extremadura[a]	Caldeirão, Salemas, Casa da Moura, Almonda, Cascais
Almería[b]	Ambrosio, Morceguillos, Serrón
Granada[b]	Cueva de los Ojos, Pantano de Cubillas
Málaga[b]	Bajondillo, Higuerón, Tajo del Jorox, Boquete de Zafarraya, Complejo del Humo
Cádiz[b]	Cubeta de la Paja, Cuevas de Levante, la Fontanilla
Jaén[b]	Peña de la Grieta
Córdoba[b]	Pirulejo
Murcia[c]	Palomarico, Cejo del Pantano, Cueva de Hernández Ros, Barranco de la Hoz
Albacete[d]	Abrigo del Palomar
Meseta[e]	terraces of Madrid
Gerona[f]	Arbreda[h]
Huesca[g]	Chaves[h]

[a]Zilhão (1994).
[b]Cortés *et al.* (1996).
[c]Martínez Andreu (1995).
[d]Córdoba and Vega (1988).
[e]Pericot and Fullola (1981).
[f]Soler and Maroto (1987)
[g]Utrilla (1989, 1994).
[h]May be more linked with the Salpetrian industry of southeastern France (Utrilla and Mazo, 1995).

placement of bifacial points with abruptly retouched points made on blades. These shouldered points are broadly contemporaneous with shouldered points of the French and Cantabrian Solutrean. With the end of the Iberic Solutrean, this process culminates with the disappearance of shouldered points and their replacement by projectile tips of antler and bone (Fig. 3). The latter are commonly single bevel points with Magdalenian style decoration, similar to those found in Cantabria at the initial appearance of the early Magdalenian (Utrilla, 1981, 1987). The relatively large number of sites with sequences of developed Solutrean assemblages makes it possible to trace this gradual evolution of projectile forms. This diachronic change is accompanied by a substantial increase in backed tools, including bladelets (Villaverde and Peña, 1981; Rodrigo, 1987/1988), and slight regional variation in the frequencies of burins, the latter being most numerous in Andalucian sites (Cortés *et al.*, 1996; Cortés and Simón, 1997a, b).

Although it can be claimed that characteristic developed Solutrean artifacts can be more readily identified that those of earlier periods, this is not the only reason for the increase in known sites, relative to earlier periods. Developed Solutrean sites are also found over a much broader area than any previous phase of the Upper Paleolithic (Tables II and V). Furthermore, the artistic styles that flourished at Parpalló can be traced in other contemporaneous sites with parietal art in southwest Europe [Cosquer in France and Coa in Portugal, for example (Clottes, 1994; Zilão, 1997)]. Together, the evidence presents a picture of the greatest florescence and geographic extent of the Paleolithic in Mediterranean Spain and attests to the successful adaptation of developed Solutrean economies to the regional environments at the beginning of the Tardiglacial.

From an even broader point of view, it is worth noting the similarities between the highly standardized shouldered point forms of the developed Solutrean in Mediterranean Spain and those of other areas of southern Europe, in spite of differences in the regional sequences that precede them. The wide distribution of abruptly retouched shouldered point forms across southwestern Europe is striking. They are found in the Solutrean, Arenian, and Salpetrian of southeastern France, the developed Solutrean of Mediterranean Spain, the upper Solutrean of Portugal, and the early Epigravettian of Italy. These point forms also are roughly contemporaneous with unifacially retouched Solutrean shouldered points.

However, it would be overly simplistic to consider all these Mediterranean industries (the Iberic Solutrean, the Salpetrian, and Italian Epigravettian) as somehow culturally related on the basis of a single point form, especially given the amount of diversity in other aspects of these industries and their histories. For example, the Italian Epigravettian evolves directly out of a Gravettian tradition rather than a middle Solutrean industry, as is the case in Mediterranean Spain. Epigravettian shouldered points are also distinct from Spanish ones in such features as the location of the shoulder and its size relative to the rest of the point (Villaverde and Peña, 1981), and there are significant typological differences between other aspects of these two respective industries (Rodrigo, 1987/1988). Furthermore, the Iberic Solutrean shares a number of elements with industries of Atlantic Spain (Rasilla, 1994; Straus, 1992) and shows a local evolution to Magdalenian industries, something lacking in the Italian Epigravattian. In this respect, the automatic assignment of assemblages from northeastern Spain to the developed Iberic Solutrean on the basis of the presence of shouldered points (Utrilla, 1994) is questionable. Considering they are not associated with Parpalló type points, assemblages such as those at Chaves and Arbreda could be more closely linked with the Salpetrian of southern France than with the Iberic Solutrean of central and southern Mediterranean Spain. Nevertheless, the spread of this common point production and hafting technology into a number of regional lithic traditions suggests that a common set of selective pressures was affecting the evolution of late Pleistocene hunting strategies across southwestern Europe.

Discussion

Typologically, the Solutrean of this region can be divided into two facies: a northern one, which is currently documented only in the Province of Gerona, and central and southern Mediterranean facies of greater geographic extent, possibly extending as far west as southern Portugal. This latter Solutrean facies is designated the Iberic Solutrean.

The beginning of the Iberic Solutrean is poorly understood. It is recorded only in the central Mediterranean zone, at the sites of Malladetes and Parpalló. However, the relatively poor Gravettian sample from Parpalló and limited assemblage for the level at Malladetes following the earliest Solutrean make it difficult to trace the relationships among the Iberic Solutrean, the Gravettian, and the earliest expression of Solutrean industries in Spain.

The middle Iberic Solutrean is characterized by high frequencies of typical Solutrean artifacts, showing a process of "Solutreanization" comparable with Solutrean industries in France and Cantabrian Spain. The significant elements of parietal and mobile art that characterize the Iberic Solutrean also first appear prominently in the middle Solutrean.

The unified nature of the Iberic Solutrean and its evolution from the middle Solutrean through the developed Solutrean finds support in the long sequences at Parpalló, Malladetes, and Ambrosio and in the developed Iberic Solutrean assemblages found at numerous sites, distributed widely across the Iberian peninsula. The regional character of the Iberic Solutrean, distinct from the Solutrean of other areas of western Europe, is seen in its points, including convex based laurel leaf, stemmed and barbed (Parpalló type), and abruptly retouched shouldered points.

Finally, the end of the Solutrean is characterized by a change in projectile tips. The characteristic stone points are replaced by bone. These bone points exhibit Magdalenian forms and decoration styles that suggest new links with the Franco-Cantabrian region.

THE MEDITERRANEAN MAGDALENIAN

Systematic knowledge of the Mediterranean Magdalenian has improved considerably in recent years, in terms of both chronostratigraphy and technology. However, there are parts of the Magdalenian sequence that are still comparatively unknown and the sequence as a whole would benefit from a comprehensive treatment in the context of the Upper Paleolithic of the Mediterranean zone. In this respect, the upper Magdalenian is well documented at a number of important sites (many recently excavated or currently being studied) in the central and southern regions of Mediterranean Spain, but the early Magdalenian is less well known.

Current systematics divide the Mediterranean Magdalenian of Spain into two phases, the early Magdalenian (*Magdaleniense antiguo*) and the upper Magdalenian (*Magdaleniense superior*) (Aura, 1995), primarily on the basis of variation in lithic technology (Table IV). The earliest Magdalenian in Mediterranean Spain is documented with certainty only at Parpalló, with the inherent limitations of older excavations affecting interpretations of its relationships with the preceding developed Solutrean and following upper Magdalenian. The early Magdalenian is defined on the basis of the rarity of blade technology and typological similarity to the Badegoulian. The upper Magdalenian is characterized by the importance of blade technology and typological systematics whose variation is dominated by endscraper/burin ratios and by backed bladelet tools. Broadly datable to 13,000–12,000 B.P., it is well represented by numerous assemblages (Table II, Fig. 2). Within these two broad phases, there is both diachronic and synchronic variability, attesting to the industrial complexity of these final stages of the Upper Paleolithic in Mediterranean Spain (Aura, 1995; Aura and Pérez, 1992; Villaverde and Martínez, 1995; Casabó, 1995).

An intermediate horizon, corresponding to the middle Magdalenian elsewhere, has scarcely been documented, and its relationship with the upper Magdalenian is poorly known. Moreover, there is no evidence in the Mediterranean zone for a subsequent Azilian-like industry, like that which followed the final Magdalenian of Cantabria. Instead, recent evidence from several sites indicates that there is a gradual transformation of the Mediterranean upper Magdalenian, in the late Tardiglacial and early Holocene, to an Epimagdalenian, characterized by an impoverishment of the bone tool industry, a reduction in the importance of burins, and a significant microblade industry.

The Early Magdalenian

Found only at Parpalló, the early Magdalenian (the name denotes the lack of typological continuity between this and the upper Magdalenian rather than considerable age) differs in both technology and typology from the final Solutrean (Table IV). While the developed Solutrean is characterized by blade technology, shouldered points, endscrapers, burins, and backed bladelets, the early Magdalenian is typified by a predominantly flake technology, and assemblages dominated by endscrapers, continuously retouched

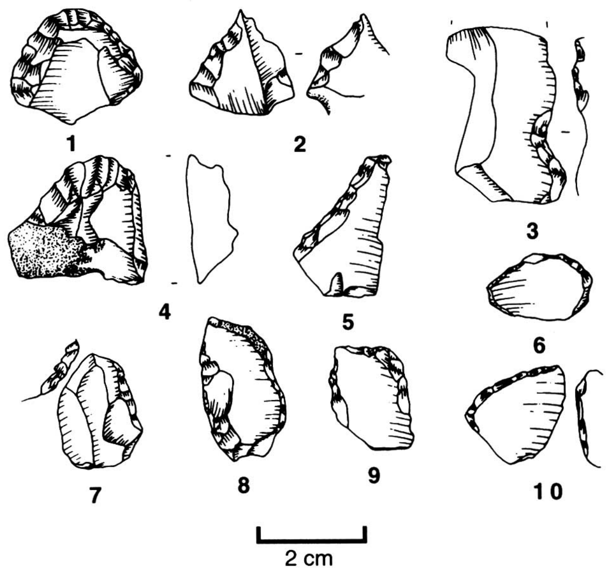

Fig. 8. Early magdalenian tools from Parpalló (after Aura, 1995). 1 and 4, endscrapers; 2, bec; 3, notch; 5 and 7–9, continuously retouched pieces; 6 and 10, raclettes.

pieces, denticulates, and (to a lesser extent) raclettes (Fig. 8). The chronology of the better-dated and typologically similar French Badegoulian industry (18,500–16,500 B.P. and possibly as late as 14,500 B.P. at Cuzoul in Lot) provides an age estimate for the early Magdalenian industry at Parpalló.

The site of Cerrado Novo (Portugal) may also contain an early Magdalenian industry, differing from that of Parpalló primarily in a greater amount of microblade debitage (Zilhão, 1995). This difference may be more apparent than real, however. In a recent study of early Magdalenian endscrapers from Parpalló, Jardón (1996) suggests that nucleiform endscrapers and some other thick endscrapers may have served as bladelet cores rather than endscrapers (see also Barton *et al.*, 1996). This raises the possibility that the apparent lack of bladelet technology at Parpalló is a product of the lack of recognition of such pieces during the excavations that took place in the late 1920s and early 1930s, especially given the higher frequencies of microblade debitage at Cerrado Novo and a few other contemporaneous sites that have been excavated recently. This bias would most likely affect the smallest microblade elements at Parpalló: the frequency of retouched pieces 9–14 mm long is 28.6%, while the frequency of retouched pieces less than 9 mm drops to 2.4% (Aura, 1995).

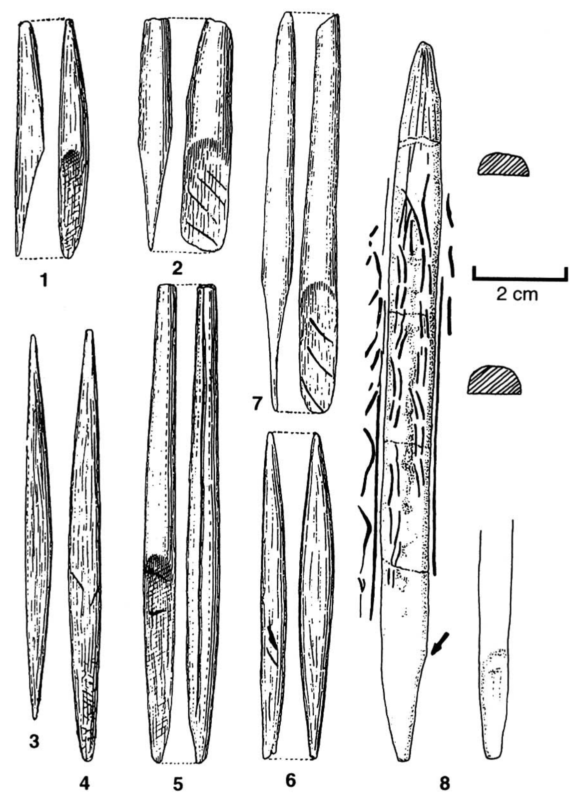

Fig. 9. Mediterranean middle and upper Magdalenian bone and antler points from Parpalló and Cendres (after Villaverde, 1997; Pericot, 1942). 1 and 5—single bevel points; 2, 6, and 7—double beveled points; 3 and 4—double points; 8—baton with lateral bevel.

The early Magdalenian at Parpalló, spanning some 2 m of deposits, has been divided into two subphases, A and B (Table IV). The transition from early Magdalenian A to subphase B is accompanied by a drop in endscraper and burin frequencies and an increase in the number of continuously retouched pieces and raclettes (the latter reaching 8% of retouched pieces). The abundant bone industry varies little throughout the sequence. It consists primarily of double points and single beveled points, with long bevels and circular to oblate cross sections (Fig. 9). The predominance of points with flat cross sections in the early Magdalenian A contrasts with their lesser importance in subphase B (as well as in the final developed Solutrean). This abundant bone industry helps to distinguishes the early Magdalenian (and the developed Solutrean) in Mediterranean Spain from the Italian Epigravettian.

No direct paleoenvironmental data are available for the early Magdalenian. The few dates from Parpalló suggest that it is correlated with the temperate and humid conditions of the Angles and Prebölling interstadial. If so, this might explain the extensive erosion responsible for the loss of comparable deposits at other sites in the Mediterranean region (Aura, 1995; Villaverde and Martínez, 1995; Fumanal and Villaverde, 1997).

The nature of the transition between the terminal early Magdalenian and the initial upper Magdalenian is not yet well understood. Although the early Magdalenian *sensu stricto* is found only at Parpalló, there are also a few other sites with assemblages that are a little older than the 13,000–14,000 B.P. date for the end of the early Magdalenian (Table II) but that differ from the Parpalló industry in both technology and typology (Table IV). Two alternative hypotheses have been proposed to account for these data, and the results of excavations currently in progress will allow us to assess them.

Aura (1995) has proposed that the early Magdalenian B is followed by an as yet poorly known initial phase of the upper Magdalenian. This early phase, beginning at about 14,000 B.P. at Parpalló (see Tables II and IV), is represented by the first upper Magdalenian assemblages from layer 4 of the Talud and possibly layer 5 at Parpalló (though layer 5 may be partially mixed with early Magdalenian material) and by the basal layer (level XIV, formerly designated IV) at Matutano (Olaria *et al.*, 1985; Fumanal, 1995). The lithic industry of this initial upper Magdalenian is distinct from the early Magdalenian in both technology and typology. It is characterized by a diverse bladelet assemblage that includes triangles and backed, truncated bladelets. Harpoons are absent, and the worked bone industry is represented by single-beveled and double-beveled points and batons. Aura (1986, 1995) notes the general lack of known assemblages from the 14,000–13,000 interval in Mediterranean Spain [most Magdalenian assemblages date to between 13,000 and 12,000 B.P. (Table II])]. He also indicates that the above-mentioned Parpalló and Matutano assemblages differ from both the Mediterranean early Magdalenian and the Franco-Cantabrian Magdalenian IV, especially in terms of the bone industry and the lack of art forms. Although they lack harpoons, the Parpalló and Matutano lithic assemblages are more comparable to the Mediterranean upper Magdalenian. For this reason, Aura (1995) designates this industry the "upper Magdalenian A," or "upper Magdalenian without harpoons," to emphasize its break with the preceding early Magdalenian and its continuity with the upper Magdalenian sequence.

An alternative scheme, developed out of recent work at the Cova de Cendres, groups the same Parpalló and Matutano assemblages with that of Cendres level XII (also below a Magdalenian industry with harpoons) into a "Mediterranean middle Magdalenian," dating roughly to 14,000–13,000 B.P. (Table II) (Villaverde *et al.*, 1996; Villaverde and Martínez, 1996). In addition to the forms described above, its lithic industry (Table IV) is characterized by more endscrapers than burins (including nucleiform and carinated endscrapers), moderate frequencies of unmodified bladelets, and lower frequencies of retouched bladelets than in succeeding upper Magdalenian industries (including the rare presence of inversely retouched bladelets and backed, truncated bladelets). Villaverde suggests that this industry shows similarities to the middle Magdalenian beyond Mediterranean Spain in terms of lithic technology and typology, decorations on bone batons, and mobile art from Parpalló (Villaverde, 1994; Villaverde *et al.*, 1996; Villaverde and Martínez, 1996). Villaverde proposed the name "Mediterranean middle Magdalenian" (*Magdaleniense medio mediterráneo*) to emphasize the links with other middle Magdalenian industries, but also to recognize the distinctiveness of this industry both geographically (i.e., from other middle Magdalenian industries) and chronologically (i.e., from the Mediterranean early and upper Magdalenian). This scheme recognizes continuity between the Mediterranean middle Magdalenian and the upper Magdalenian and a technological/typological break with the early Magdalenian.

To take a broader perspective, it could well be the case that there is considerable geographic variability within the beginning of early Magdalenian, encompassing those sites with more evidence of blade technology (resembling the lower Magdalenian of France and Cantabria) as well as the somewhat different technology represented at Parpalló (resembling the Badegoulian facies of France). Viewed in this way, any Magdalenian assemblage before about 14,000 B.P. would be called lower Magdalenian (*Magdaleniense inferior*). The upper Magdalenian A (i.e., early upper Magdalenian without harpoons) or middle Magdalenian, depending on which designation is used, develops out of the lower Magdalenian bladelet industries in other regions or at yet undiscovered sites in Mediterranean Spain and subsequently evolves into the upper Magdalenian (with characteristic bone harpoons). New work at Tossal de la Roca and Cova de Cendres (Aura, 1996) should help to clarify these relationships.

The Mediterranean Upper Magdalenian

The Mediterranean upper Magdalenian is represented at numerous sites throughout Mediterranean Spain. Besides Parpalló, these include Matutano, Cendres, Tossal de la Roca, Nerja, and Pirulejo, as well as Algarrobo and Caballo (Fig. 2) (Martínez Andreu, 1989). Additionally, there are a large number of other sites with probable upper Magdalenian materials, but whose assemblages are less well defined, consist of relatively few pieces, lack accurate dates, or are in the early stages of excavation. Upper Magdalenian occupation extends over the entire Mediterranean littoral, although the industry in northern Cataluña seems more similar to that of the eastern Pyrenees, in France.

Available radiocarbon dates situate the upper and final Magdalenian between 13,000 and 11,000 B.P. (Table II) (Aura and Pérez, 1995; Aura and Villaverde, 1996). Within this span, the upper Magdalenian can be subdivided into two phases. The first is characterized by lithic assemblages with burin:endscraper ratios usually >1 and a significant and diverse microlithic component (Table IV), which includes triangles and scalenes (Fig. 10). The bone industry includes harpoons, batons, and single and double beveled points (Figs. 8 and 11). The second phase is characterized by lower burin:endscraper ratios (Table IV), less diversity in the microlithic component (though it remains numerically important), and a numerical decline in the bone industry.

Variability in dates associated with the best defined upper Magdalenian sequences make a regionwide synthesis complicated. Deposits at Nerja containing an upper Magdalenian industry with harpoons seem correlated with the Bölling interstadial, Younger Dryas stadial, and Alleröd interstadial on the basis of paleoenvironmental reconstructions. Such a correlation is supported by radiocarbon dates of 12,270 ± 220 B.P. and 11,930 ± 160 B.P. (Table II) for these deposits (Aura, 1995; Aura *et al.*, 1997).

Upper Magdalenian deposits at Cova de Cendres (levels XI–IX) seem to match those of Nerja, with respect to paleoenvironmental evidence. The presence of *Microtus arvalis* and *Pyrrhocorax graculus* among the fauna and dominance of *Pinus negra* and *Juniperus* in the surrounding vegetation community situate the site in the Mesomediterranean or Supramediterranean life zone, rather than the warmer Thermomediterranean zone that characterizes Cendres today, and suggest a mean temperature 4–6°C lower than today. However, associated radiocarbon dates of 13,840 ± 85 and 13,320 ± 170 B.P. (Table II) for levels XI and X, respectively, seem too old for the Younger Dryas, although they still support the assignment of the relevant assemblages to the upper Magdalenian with harpoons. Level XII has produced an assemblage that has been classified as middle Magdalenian, though the associated radiocarbon date of 15,820 ± 150 B.P. (Table II) from the middle of the level also seems too old.

The sequence from the interior of Tossal de la Roca also parallels that of Nerja (Table IV). Level IV of Tossal has been dated at 15,360 ± 1100

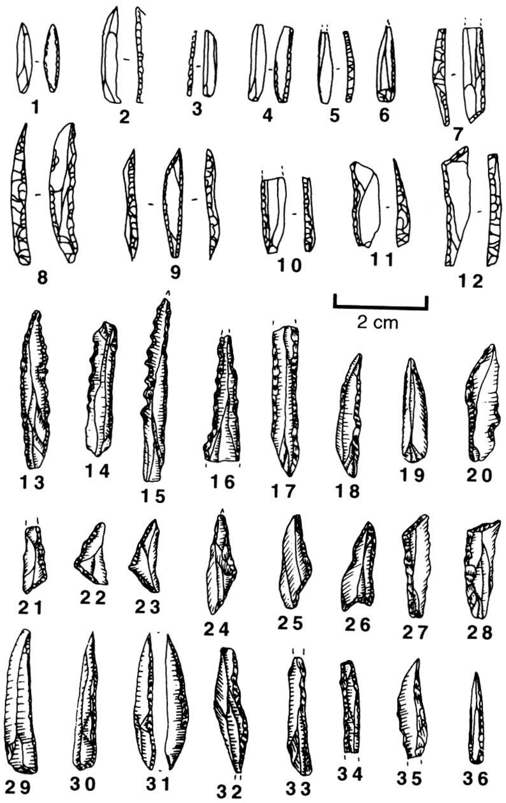

Fig. 10. Mediterranean upper Magdalenian microlithic artifacts (after Aura, 1986, 1995; Villaverde *et al.*, 1997). 1–12, from Cova de Cendres; 13-38, from Parpalló; 29-36 from Cueva de Nerja. 1–5—Inversely retouched bladelets; 6, 19, 29, and 36—pointed bladelets; 8–11, 17, 18, 20, and 32–35—backed bladelets; 7, 12, 27, and 28—truncated backed bladelets; 13-16—denticulated backed bladelets; 21-26—triangles.

B.P. (Table II), suggesting that its industry may be contemporaneous with that of Cendres level IV. On the basis of sedimentological, palynological, and macrobotanical evidence, the deposits of level IV seem to reflect a cold interval. Level III is associated with more moderate climate, while level II is associated with cold conditions. Both level III and level II contain upper Magdalenian assemblages and have produced dates around 12,000 B.P. At the top of the sequence, and separated from level II by an erosional disconformity, level I produced an Epipaleolithic assemblage. Paleoenvi-

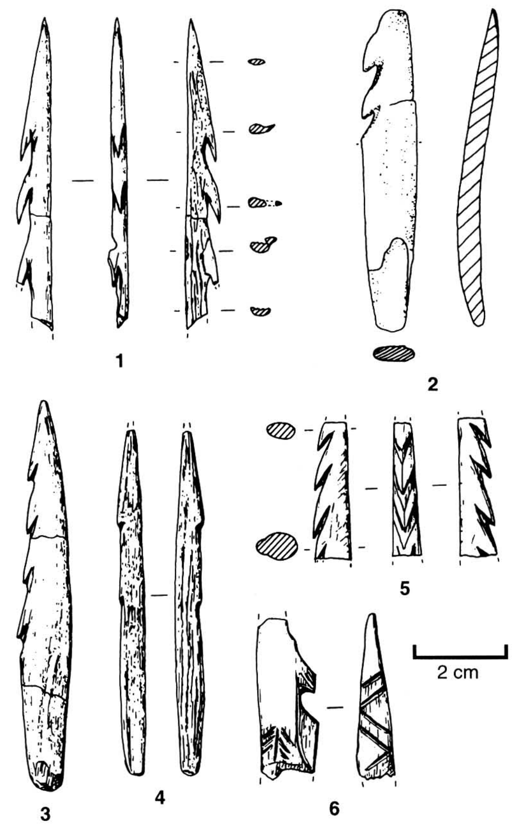

Fig. 11. Bone and antler harpoons from Cueva de Nerja (1 and 5), Cova de Cendres (2), Parpalló (3 and 4), and Matutano (6) (after Aura, 1995; Villaverde *et al.*, 1997).

ronmental data indicate that this Epipaleolithic occupation occurred in the context of a much more moderate climate, possibly that of the early Holocene.

Finally, the sequence from the 1979 *sondage* at Matutano can be divided into a lower and an upper group of levels, separated by a marked erosional disconformity. The paleoenvironmental conditions and industry at the base of the lower group are similar to those represented by level IV at Tossal de la Roca (Table IV); the rest of this lower group alternates between cold and moderate. Dating to around 12,000 B.P., these seem correlated with the Younger Dryas. Evidence from the upper group of levels indicates a much more moderate climate, equivalent to that of the early

Holocene. However, the radiocarbon dates for these levels, between 12,000 and 11,000 B.P., make the deposits too old to be of Preboreal age. A correlation with the more moderate intervals of the Alleröd interstadial is perhaps better.

If the chronological framework suggested by these sites is accurate, then the processes that transformed the Mediterranean Magdalenian into the regional Epipaleolithic seem to have begun well before the end of the Pleistocene, with a final upper Magdalenian characterized by a loss of variability in the bone industry and in microliths, a reduction in burin frequency, and a significant increase in the frequency of "expedient" tools.

The most relevant data for the northern part of Cataluña are from the site of la Bora Gran (Pericot and Maluquer, 1951; Sonneville-Bordes, 1973), which produced an upper Magdalenian assemblage with single- and double-barbed harpoons that show stylistic similarities to those of the Pyrenean region. In southern Cataluña is a group of sites whose industries, while lacking detailed publication of the most recent excavations, seem to much more closely parallel those of the Mediterranean zones to the south. This is the case at la Mallada, els Colls, and, in general, el Parco, where the bone industry is associated with a lithic assemblage that includes abundant burins and backed bladelets. Preliminary descriptions of the el Parco assemblage also suggest similarities to central Mediterranean assemblages and clarification must await publication of the results of the most recent excavations (for an overview of these sites, see Fullola, 1992; Fullola *et al.*, 1993; 1996).

It is difficult to trace precisely the transition from the upper Magdalenian to those industries traditionally classified as microlithic Epipaleolithic (e.g., those from Malladetes and Sant Gregori) given the variability in assemblages dated to 12,000–10,500 B.P. (Aura, 1995; Aura and Pérez Ripoll, 1995). Epipaleolithic assemblages dated to slightly before 11,000 B.P. shows a decrease in burin frequency, increases in the frequency of notches and denticulates, and a reduction in the diversity of the microlithic component (Table IV). Similarly, recent evidence from assemblages dated to around 12,000 B.P. shows a drop in burin frequency and changes in both lithic and bone technology relative to the late upper Magdalenian. In spite of these changes, there is still considerable continuity between the upper Magdalenian and the Epipaleolithic. In fact, the latter reasonably could be termed the Epimagdalenian. Economic and artistic data support a general continuity in adaptive strategy that differs markedly from the processes observed in Cantabria with the transition from the final Magdalenian to the Azilian (González Sainz, 1989; Fernández Tresguerres, 1995).

Discussion

The earliest phase of the Magdalenian of Mediterranean Spain, including the transition from the developed Solutrean to the early Magdalenian, is documented with certainty only at the site of Parpalló. This makes it difficult to characterize the paleoenvironments associated with the first Magdalenian industries and to develop a detailed chronology for their initial appearance. However, the broad outlines of the development of the Magdalenian can be seen in the rich lithic and bone industry that comes from the >2 m of relevant deposits at Parpalló. It is possible that the Badegoulian-like component of the Parpalló early Magdalenian could be contemporary with blade-dominated assemblages from several other sites in the region that are older than 14,000 B.P., and that all could be classified as lower Magdalenian.

The current version of Magdalenian systematics, which divides this industry into "early" and "upper" phases, will probably need to be revised. This is needed not only because of the diversity that is beginning to appear for the older phase, but also because of the recognition of microlithic assemblages, associated with an abundant bone industry that lacks harpoons, that have recently been found near the base of several Magdalenian sequences currently under excavation, potentially dating to between 14,000 and 13,000 B.P. The latter industry seems linked developmentally with regional upper Magdalenian industries that have harpoons and generally date to after 13,000 B.P. Although provisionally designated the "Mediterranean upper Magdalenian A," it might be better termed the "Mediterranean middle Magdalenian" in future revisions of the regional systematics. The current uncertainty as to the chronological and typological associations of this microlithic Magdalenian without harpoons is amplified by its lack of middle Magdalenian bone artifacts with morphologies and decorative styles typical of the middle Magdalenian, where it is better defined—in Cantabria or the Pyrenees, for example. This regional distinctiveness is mirrored in the styles and themes found on decorated plaquettes from the corresponding levels at Parpalló.

Evolutionary changes in assemblage typometrics during the upper and final Magdalenian of Mediterranean Spain (excluding Cataluña) closely parallel corresponding changes in the Cantabrian Magdalenian. Nevertheless, the lack of double-barbed harpoons and the presence of distinctive harpoon bases in the Mediterranean zone point to the maintenance of regional differences between the Mediterranean zone and Cantabria. Furthermore, there is no Mediterranean Azilian or comparable industry. Rather, after 12,000 B.P., final Paleolithic industries display a progressive loss of the bone industry, along with changes in burin frequencies and the microlithic component. The overall similarity of these Mediterranean Epipaleolithic industries to the preceding final Magdalenian is such that they could readily be described as Epimagdalenian.

In Mediterranean Spain, as in Cantabria, the Pyrenees, and southeastern France, there is an *in situ* development of the regional Epipaleolithic that broadly parallel contemporary changes throughout the circum-Mediterranean region. However, there are clear differences between the evolution of industries in Mediterranean Spain and those in other parts of southwestern Europe, especially Italy, whose late Paleolithic industries have often been linked with those of Mediterranean Spain.

LATE PLEISTOCENE SUBSISTENCE ECONOMY

Excavations at Solutrean and Magdalenian sites from the 1980s onward have provided an increasing amount of data pertaining to late Upper Paleolithic subsistence economy in Mediterranean Spain. This complements the important work by Davidson (1989) in the Comarca of Safor that focused primarily on Parpalló and Malladetes. In spite of such promising studies, a comprehensive picture of late Paleolithic economy across Mediterranean Spain remains elusive.

The paleoeconomic record is deficient for early Magdalenian, both because this phase is only represented at a single site, Parpalló, and because faunal material from these early Magdalenian deposits was lost. This preservation bias probably is one of the causes for the anomalous frequency of lagomorph remains compared with the faunal patterns from other, more recently excavated sites in this region.

For the rest of the Magdalenian, most of the available economic information comes from the central Mediterranean zone, where data from Beneito (Iturbe *et al.*, 1994), Ratlla del Bubo, Cendres, Blaus (Martínez Valle, 1996), Tossal de la Roca (Pérez Ripoll and Martínez Valle, 1988), and Matutano (Olaria *et al.*, 1996) augment Davidson's (1989) study of Parpalló, Malladetes, and Volcán del Faro. Data are much more limited for the rest of Mediterranean Spain. In the north, economic data derive primarily from reanalyses of old collections from Arbreda, Reclau Viver, Romaní, and Bora Gran (Estévez, 1980, 1987a) but also include some information from recent excavations at Cingle Vermell and Castell Sa Sala (Estévez, 1987a, b; Vila *et al.*, 1985). In Andalucía late Glacial paleoeconomic data are available only from Ambrosio (Sánchez, 1988) and Cueva de Nerja (Aura and Pérez Ripoll, 1992; Pérez Ripoll, 1996). This geographic inequality in available data sets does not preclude the recognition of broad parallels in paleoeconomy across the different regions of Mediterranean Spain, but it does make an accurate synthesis difficult for the entire Mediterranean zone. Furthermore, there is yet little information on the seasonality of occupation of late Glacial sites or the specifics of hunting methods and carcass processing. Even though extant data sets permit general reconstruction of the dynamics of prehistoric economies, the lack of such important components limits the development of detailed models. Within these limitations, we examine the paleoeconomic record from a diachronic perspective, focusing on the central and southern zones of Mediterranean Spain to identify late Paleolithic faunal exploitation patterns.

Small Game

The role of lagomorphs in the economy of Mediterranean Spain is distinct from that in other regions, such as Cantabria, and has been the source of some controversy. We previously noted that taphonomic studies suggest humans played a minimal role in the accumulation of lagomorph remains during the Middle Paleolithic. This pattern seems to change in the Upper Paleolithic, with lagomorphs becoming a more important subsistence resource at Aurignacian and Gravettian sites like Cova Beneito (Villaverde and Martínez, 1992; Villaverde *et al.*, 1996; Martínez Valle, 1996).

A variety of studies provides the basis for assessing the extent to which prehistoric humans were responsible for the accumulation of lagomorph remains. For prehistoric faunal assemblages, these include analyses of fracture patterns, butchering marks, and carnivore teeth marks. These are augmented by studies of the differential representation of body parts and mortality profiles for accumulations of lagomorph remains in the dens of modern carnivores that frequent caves and rockshelters, primarily raptors, lynxes, wild cats, and foxes. This work strongly indicates an anthropic origin for the major accumulations of lagomorph remains in regional Upper Paleolithic sites, including those of Solutrean and Magdalenian age (Pérez Ripoll, 1992; Villaverde and Martínez Valle, 1995; Martínez Valle, 1996; Sanchís, n.d.). The high frequencies of lagomorph remains in archaeological deposits of this period indicate the important subsistence role of these animals. Although they are small and relatively low in fat content, lagomorphs are available all year, have a high reproductive rate, and are gregarious and territorial.

Of course, the role of lagomorphs must be assessed in the context of the rest of the faunal record, especially in relation to other taxa which were the focus of hunting activities during this period. Especially important is the consideration of the relative protein contribution per minimum number of individuals. For example, 1 red deer provides the protein equivalent of

150 rabbits, and 1 ibex the equivalent of 100 rabbits. Nevertheless, the importance of lagomorphs as a complement to larger game provides important clues for models of Upper Paleolithic settlement and land use.

Another aspect of the late Paleolithic emphasis on small game is the increased importance of bird remains in faunal assemblages. A high percentage of partridge (*Alex rufo*) remains exhibits butchering marks in the Magdalenian levels at Cova del Blaus (Martínez Valle, 1996). Similar patterns have been observed in contemporaneous assemblages from other sites and for a greater number of taxa. Birds are also depicted in the late Paleolithic mobile art from various areas throughout southwestern Europe (Buisson and Plisson, 1987; Cremades, 1994), including Parpalló, where plaquettes decorated have been found with representations of waterfowl and partridge (Villaverde, 1994).

Large Game

Red deer and ibex are the most important herbivore taxa, in economic terms, for the regional Upper Paleolithic and were, therefore, the primary focus of hunting strategies. The relative frequencies of these two taxa in faunal assemblages permits a preliminary assessment of the evolution of economic activity in societies of late Glacial hunters and the development of corresponding land use models.

Upper Magdalenian levels generally display a faunal spectrum characteristic of highly specialized hunting. A single species (red deer or ibex) dominates the ungulate taxa in these deposits, with values for total elements exceeding 65% of the identifiable remains. Faunal assemblages from Cendres (Villaverde and Martínez Valle, 1995; Villaverde *et al.*, 1996), Tossal de la Roca (Pérez Ripoll and Martínez Valle, 1988), and Nerja (Aura and Pérez Ripoll, 1992) are illustrative in this respect. In Cendres level XI, red deer make up 91% of the ungulate remains, indicating a clear selection of this taxon. This assemblage is dominated by young males, about 3 years of age, and shows evidence of intensive processing (including the fracture of bones, such as third phalanges, with little marrow). Red deer also dominate the ungulate fauna (at about 85%) in level X of Cendres but display a somewhat different mortality profile that includes adults of more diverse ages, does, and even juveniles under 20 months. A similar situation obtains in the upper Magdalenian levels III and II at Tossal, except that ibex, rather than deer, is dominant. In level III, for example, 89.4% of the ungulate remains are ibex. In the two upper Magdalenian levels at Nerja, also, ibex accounts for 87.2 and 88.1% of the ungulate remains.

Greater faunal diversity is seen in levels that immediately predate the upper Magdalenian with harpoons. Although red deer is still the dominant ungulate in level IV at Tossal de la Roca, it occurs at a lower frequency than in level III. Similarly, ibex and horse are more equally codominant in level XII at Cendres, and parallels are also seen in faunal assemblages from levels IV and III at Matutano. The upper Magdalenian levels at Parpalló also have produced deer and ibex remains in more equal proportions, in the context of a generally more diverse faunal spectrum. The reason for this persistence of a more diverse faunal exploitation pattern into the upper Magdalenian at Parpalló may be due in part to the special circumstances of the site. Within its catchment, both montane and coastal plain zones can be exploited. Furthermore, thousands of decorated plaquettes found at the site suggests that it may have played a role distinct from the other sites investigated.

The pattern of highly specialized hunting continues through the upper and final Magdalenian at sites like Tossal de la Roca, Matutano, and Blaus and into the early Holocene. The few changes in hunting strategies that appear with the coming of Holocene include a slight broadening of diet breadth in terms of the taxa represented, the addition of warm-climate taxa such as *Rupicapra rupicapra*, *Sus scrofa*, *and Equus hydruntinus* (though only at low frequencies), and a diversification of small game taken (hares, hedgehogs, birds, mollusks, and fish, in addition to rabbits).

The animals most favored by upper Magdalenian and later hunters tend not to migrate over significant distances. This suggests that these terminal Pleistocene and early Holocene foragers were well adapted to the topographic conditions of the Mediterranean zone of the Iberian peninsula, in which significant altitudinal variation over short distances separates the littoral plain from the mountains. In such circumstances, it is not necessary to invoke the long distance mobility proposed by Davidson (1989; Bailey and Davidson, 1983). Rather these foragers could employ a more logistical strategy to exploit the variety of habitats that characterize Mediterranean Spain. The long history of intensive exploitation of rabbit, including extraction of the small amount of marrow in the long bones, also differentiates the central and southern regions of Mediterranean Spain from areas to the north, in which late Paleolithic hunting centered on migratory ungulates.

Marine Resources

Most discussions of Upper Paleolithic economy focus on terrestrial resources. While it is generally thought that marine resources were important in coastal areas like Mediterranean Spain, virtually all relevant late Glacial sites have been submerged by the post-Glacial sea level rise.

Both Cendres and Nerja lie on the modern coast. At Cendres, lowered Glacial sea level exposed the broad continental shelf as a littoral plain (Fumanal *et al.*, 1993; Hernández-Molina *et al.*, 1994) separating the cave from the sea. Hence, marine fauna were of marginal subsistence importance at Cendres, where there are only anecdotal reports of the presence of fish and mollusks in the deposits and *Monachus monachus* is represented only by a few bones.

The situation at Nerja is quite different. The cave is currently situated ca. 1 km from the Mediterranean, at an elevation of 158 m amsl. Because of the narrowness of the continental shelf at this locale, Nerja's location relative to the late Pleistocene Mediterranean differed little from that of today, putting the sea within the site's regular catchment (Aura, 1989; Aura *et al.*, 1989). The faunal assemblage at Nerja testifies to the importance of marine resources in late Glacial coastal sites. The number of fish remains (Sparidae, Labridae, Gadidae, Murenidae, and Serranidae) is double to triple the number of terrestrial taxa. The presence of small bone artifacts interpreted as gorges also attests to the importance of fishing (Aura, 1989, 1995) There is abundant evidence of bivalve use; shells of *Tapes decussatus*, *Cerastoderma edule*, and *Mytilus edulis* have been identified. Remains of *Monachus monachus* have been recovered from the late Paleolithic deposits at Nerja and depictions of monk seals are also painted on the cave walls, indicating the increasing importance of the hunting of marine mammals through the end of the Paleolithic (Pérez Ripoll, 1997).

Many of the differences in the faunal records of Cendres and Nerja can be explained by the topography of the continental shelf adjacent to each site. Indeed, slight changes in avifauna at Cendres in the late Tardiglacial indicate incipient use of littoral taxa as the sea level rose and the coastline began to approach the site (Martínez Valle, 1996). In assessing subsistence economy at these sites, it is necessary to consider the potential for littoral areas to fall within the yearly foraging range. The patterns seen at Cendres and Nerja underscore the extent to which the subsistence practices late Paleolithic inhabitants of these sites centered around locally available resources.

Plant Use

Although it is generally assumed that vegetal resources played an important role in Paleolithic subsistence, plant remains from Pleistocene sites are rare. The Solutrean and Magdalenian levels at Cueva de Nerja have produced important evidence for the use of plant foods by Paleolithic foragers. Carbonized pine cone fragments (from *Pinus negra*) are very common in these deposits and have been interpreted by Badal (1997) as the residue from heating pine cones to release the nuts for consumption.

Discussion

The hunting pattern described above for the late Paleolithic—specialization on red deer or ibex, complemented by diverse small game (including lagomorphs, birds, mollusks, fish, and other small animals)—differs from that of the earlier Upper Paleolithic. Earlier faunal assemblages show less specialization in terms of large ungulates, and small game is generally limited to rabbits. Furthermore, age profiles for deer and ibex show higher frequencies of young adults in the late Paleolithic compared with earlier periods. Still, the data are much richer for the upper Magdalenian than for earlier periods and these comparisons must be considered provisional, especially given the increasing difficulty in supporting the seasonality of occupations proposed by Davidson (1989) for sites such as Parpalló, Malladetes, and Volcán del Faro (Villaverde and Martínez Valle, 1995).

During the middle and upper Solutrean, data from a variety of sites—including Parpalló, Malladetes, Beneito, Nerja, and Ambrosio—suggest that hunters exploited a more diverse faunal spectrum or at least were less specific with respect to the age of their prey. At Beneito, for example, deer and ibex are codominant among ungulates represented, and horse is present in moderate quantities. There is also evidence, in the form of butchering marks, for hunting of lynx at Beneito (Martínez Valle, 1996). The same pattern is found at Parpalló, with aurochs and horse at moderate frequencies and wild boar at lower frequencies (Davidson, 1989). Although ibex dominates the Solutrean faunal assemblages at Malladetes, aurochs, horse, and wild boar are also represented (Davidson, 1989). At Ambrosio, on the other hand, the high frequency of ibex remains in Solutrean levels is similar to that in deposits without evidence of human occupation, suggesting that this is a result of nonhuman carnivore activity at least in part (Villaverde and Martínez Valle, 1995). Although the Solutrean fauna at Nerja is dominated by ibex, red deer is also common, and horse is present near the base of the Solutrean levels. Furthermore, the mortality profiles of these ungulates is less focused on young adults than is the case for the Magdalenian levels (Pérez Ripoll, 1996).

During the developed Solutrean and the early Magdalenian, the majority of known sites display a simplification in the faunal record. Large ungulates are virtually limited to red deer and ibex, with one or the other represented at a considerably higher frequency than the other. However, data for these periods are scarce, and best known from the Beneito sequence, where the dominant ungulate taxon, ibex, is represented by an age profile focused on adult animals (3–6 years of age). This suggests the beginning of the patterns seen more strongly emphasized in the upper Magdalenian.

In spite of the need for more detailed study of Upper Paleolithic faunal assemblages, including more information on age profiles, sex of prey, seasonality of hunting, and processing of body parts, it is possible to make some broad observations about changing in hunting practices during the Upper Paleolithic of Mediterranean Spain. There seems to have been a tendency toward increasingly specialized hunting, based in seasonal occupations and focusing on a single species. This is accompanied by the taking of diverse small game at frequencies high enough to be important in formulating models of Upper Paleolithic economy in Mediterranean Spain.

PALEOLITHIC ART IN MEDITERRANEAN SPAIN

As a result of numerous recent discoveries and ongoing studies of Paleolithic imagery in Mediterranean Spain, our understanding of this complex phenomenon is in a state of flux. Our discussion treats some of the more notable examples of this current work and focuses on aspects of the theoretical implications of regional Paleolithic art, including its geographic distribution, chronology, and possible meaning. We also assess its broader relationship with European Paleolithic art, including the long-proposed eastern and western division of Paleolithic art styles (e.g., Graziosi, 1964).

In recent years, numerous discoveries of Paleolithic parietal art have been made in Mediterranean Spain as well as in other parts of the Iberian peninsula (Fig. 2). Until recently, such art was only known from Málaga, in the southern region—primarily from the sites of Pileta, Trinidad de Ardales, and Nerja [see Sanchidrián (1994) for background on Andalucian parietal art]. In recent decades, many more art localities have been discovered, representing a much broader geographic extent, and in which a greater diversity of media are employed for imagery.

Some of the most exciting discoveries in Mediterranean Spain are examples of Paleolithic art in open or near open contexts (including open air localities and shallow rockshelters), sometimes associated with archaeological deposits. Southwestern European examples of open-air, Paleolithic, parietal art beyond the Iberian peninsula are rare. Besides Fornos Haut in France (Sacchi *et al.*, 1986–1987), the Iberian peninsula sites of Domingo García (Martín and Moure, 1981; Ripoll and Muncio, 1992), Siega Verde

(Balbín *et al.*, 1994, 1995), and Valle del Cõa (Zilhão, 1997) are among the few known localities. In this context, several recent finds in Mediterranean Spain are of considerable interest. These include a Paleolithic style engraved horse at Piedras Blancas, Almería (Martínez, 1994) and a painted horse in a small rockshelter (only 3 m deep) at Cueva de Jorge, in Murcia (Salmerón and Lomba *et al.*, 1996). Another recent discovery is a set of paintings and engravings found at Cueva Ambrosio (Ripoll *et al.*, 1994), buried by stratified Paleolithic deposits and, in the case of one decorated wall, associated with a habitation area in the shelter.

Such localities where parietal art is found in open air contexts or shallow rockshelters, shows the diversity of settings for this imagery. Such variability is evident for much of the Upper Paleolithic (the sites just mentioned range in age from upper Solutrean through Magdalenian) and is not limited to Mediterranean Spain [examples elsewhere include Lluera in Cantabria and Placard in France (Fortea, 1989; Clottes *et al.*, 1990, 1991)]. Such localities belie the long held idea that Upper Paleolithic parietal art is primarily a feature of deep caves.

The implications of recent Paleolithic art discoveries in the Iberian peninsula are considerable. First, the location of Paleolithic parietal art in open-air or near-open-air localities was probably much more common than has generally been thought (see also Bednarik, 1993; Zilhão *et al.*, 1997). These new finds in Mediterranean Spain suggest that the lack of recognition of the importance of such geographic contexts for Paleolithic parietal art probably is more a function of preservation (related to characteristics of the rock medium) and the lack of systematic, intensive archaeological survey to search for such locales than due to Paleolithic preference for deep caves.

Furthermore, it has long been held that the Franco-Cantabrian area (i.e., southern France and Cantabria, including the Pyrenees) is the primary location for Upper Paleolithic parietal art in western Eurasia. The extent and richness of recently discovered art sites through the Iberian peninsula show that art by Pleistocene humans was much more widespread. There are 24 known Upper Paleolithic parietal art localities within just the Mediterranean zone of Spain (see Fig. 2). To these can be added important discoveries in the Valle del Duero (including Cõa, Siega Verde, and Domingo García), a growing list of localities from the Meseta (for an overview, see Balbín and Alcolea, 1992), and newly discovered sites in Extremadura (Ripoll and Collado, 1996) and Guadalajara (Alcolea *et al.*, 1987, 1995). The art found at these sites is both rich and diverse. For example, there are more than 1800 animal representations at Siega Verde and in the Valle do Cõa alone. From Parpalló, 5034 painted and engraved plaquettes (with 6245 decorated surfaces) have been discovered, representing 766 zoomorphic figures and 11,306 abstract designs (with another 5481 less well-defined marks) (Villaverde, 1994).

Moreover, there are broad similarities between the stylistic seriation developed using the Parpalló plaquettes (Villaverde, 1994), buried in stratigraphic context, and the chronosequence of styles in the Cõa Valley (Zilhão, 1997), constructed using superimposed designs. This suggests the existence of broad patterns of social interaction driving pan-peninsular similarities in stylistic evolution (and similarities in other behavioral residues, such as lithic assemblages) that cross-cut regional differences in art styles as well as other aspects of material culture. For example, the same four animals—deer (more does than stags), horses, ibex, and aurochs—make up the majority of zoomorphic representations at Parpalló, Cõa, and Siega Verde. On the other hand, regional differences are expressed in the abundance of abstract designs on the Valencian plaquettes at the Andalucian localities, versus their rarity at Cõa and Siega Verde.

Given the difficulty in dating (both relative and chronometric) most Upper Paleolithic parietal art, all but the most recent attempts at explaining its evolution seem open to question. Of particular relevance is the recent realization of the importance of art during the Solutrean in the Iberian peninsula. For example, 56% of the Parpalló plaquettes date to the Solutrean. These Solutrean plaquettes include 386 of the zoomorphic representations and some of the most elaborate painting, with bichrome designs combined with engravings.

Several recent studies have linked spatial patterning in parietal and mobile art to demographic changes, driven in part by late Pleistocene climatic change, and the changing nature of social interaction among European Upper Paleolithic foragers (Jochim, 1983; Barton *et al.*, 1994; Clark *et al.*, 1996). Barton *et al.* (1994) and Clark *et al.* (1996) have further suggested that parietal art played a role in maintaining territorial boundaries between Paleolithic forager groups whose populations in southern European refugia were larger and denser during the glacial maximum than during preceding periods. The locations of parietal art of the Duero valley suggest that these functions could be expanded to include animal migration paths and regular corridors for human movement (see also Bradley *et al.*, 1994). Such data support a view that Paleolithic art is not a singular phenomenon but comprises a diversity of meanings related in various ways to designs, media, form of execution, and distribution in time and space (Ucko and Rosenfeld, 1967).

With respect to the articulation of Upper Paleolithic art with art from the rest of southwestern Europe, the idea that there is a clear-cut division between "Franco-Cantabrian" art and "Mediterranean-region" art seems overly simplistic. This division was proposed in the 1970s to explain apparent regional variation in parietal art styles and lithic industries but now seems inadequate to characterize either one in the light of currently available information, especially as relatively little attention was paid to mobile art in the Franco-Cantabrian area. As proposed by Graziosi (1964) this dichotomy was based on stylistically distinct representation of bulls' heads (with parallels noted at the Mediterranean sites of Parpalló, Pileta, and Levanzo) and the abundance of geometric abstract designs on Magdalenian plaquettes from Parpalló and in mobile art from other Mediterranean sites like Romanelli, Barma Grande, and Polesini.

The larger sample of art localities now available no longer supports this distinction. The "Mediterranean" style of representation for bovid heads—formed by linear strokes, with few anatomical details in the interior of figures—is now known to be widely distributed in Franco-Cantabrian Magdalenian art (Fortea, 1978). More generally, there are clear similarities in the styles of zoomorphic figures on Solutrean and Magdalenian plaquettes from Parpalló, Andalucian rock art sites, the open-air sites of Siega Verde and Cõa, and both parietal and mobile art from the Franco-Cantabrian zone (Villaverde, 1994). Similar parallels across this broad region are found in abstract designs.

Within these broad, pan-regional patterns, art styles of Mediterranean Spain show evidence of the increasing regionalization that also characterizes the later Upper Paleolithic art of southwestern Europe. In its initial appearance, regional differences are minimal in Mediterranean Upper Paleolithic art. Early representational forms, roughly coterminous with the Upper Solutrean, are characterized by stylized figures—with respect to both body outline and size—in which extremities are minimized and heads emphasized and by simplicity in the execution of anatomical details (for example, the economical strokes that differentiate sheep from deer or differentiate ibex and aurochs horns). Following the upper Solutrean, there is a general trend for more accurate representation of body proportions and anatomical details. Simultaneously, however, regional variation in representational art becomes increasingly apparent in both parietal and mobile forms (Gamble, 1986; Sieveking, 1988, 1991).

The apparent geographic covariation of regional parietal art styles with aspects of lithic industries and decorative styles in bone and antler artifacts that is beginning to appear in the Iberian Upper Paleolithic record suggests that this spatial patterning may represent the territories of social entities at a coarse scale of resolution (see Barton, 1997b). Such covarience in the residues of such diverse behaviors also lends support to proposals by Conkey (1989) and Mithen (1992, 1996) that a hallmark of the Upper Paleolithic and morphologically modern humans was the novel ability to integrate the information from distinct cognitive domains such as art forms, lithic technology, subsistence activities, and social organization.

CONCLUSIONS

Attempting to review over 30,000 years of human prehistory, across more than 1.6 million km^2, is a daunting task. We have tried to provide balanced coverage of archaeological research across this considerable extent of space and time, but undoubtedly we have focused more attention on some areas, while others may have been slighted. Furthermore, the amount of active research guarantees that some of the information and interpretations presented here will soon be outdated. Nevertheless, we hope that this overview provides an accessible and coherent account of the Paleolithic of Mediterranean Spain.

While the geographic and temporal scope of this paper encompasses a great deal of variability in the archaeological record, several features stand out in the Upper Paleolithic of Mediterranean Spain. This region seems to hold a unique record for the Middle–Upper Paleolithic transition. This transition seems to have taken place later in central and southern Mediterranean Spain than elsewhere in Europe, and perhaps later than anywhere else in the world. There also seems to be evidence of variability in the way in which this transition occurred, with some areas showing distinct breaks in the archaeological record between the Middle and the Upper Paleolithic and others evidencing more continuity. Taphonomic studies of faunal and artifact assemblages provide the basis for a model of changing economic behavior across the Middle–Upper Paleolithic transition that begins to shed light on the nature of the changes in human behaviors that took place at this time. Only by understanding such behavioral changes and their effects can we begin to explain the significance of diachronic change in lithic technology and the evolutionary basis for biological change that mark the beginning of the Upper Paleolithic.

The primary record of human behavior for the Upper Paleolithic of Mediterranean Spain is in the form of lithic industries. These show recognizable parallels with the Upper Paleolithic of western Europe as well as characteristics that make them distinctive. The Iberian peninsula is geographically unique in several respects that affect the distribution and nature of human activities and, hence, the residues of those activities. The Pyrenees were a formidable biogeographic barrier between the peninsula and the rest of Eurasia throughout the Upper Pleistocene. However, they do not completely isolate Spain as a water barrier might. In fact, during the glacial maximum, the expanded littoral plain resulting from the lowered sea level may have afforded easier passage between the peninsula and the rest of the continent than during the high sea stands of interglacials. Such temporally variable access may help to explain the differing amounts of divergence and convergence between the Upper Paleolithic of Mediterranean Spain and other industries in western Europe.

The landscape of Mediterranean Spain also played an important role in shaping the human behaviors responsible for lithic industries. Its southern location, extremely variable topography, and proximity to the Atlantic Ocean produced a series of microenvironments that are replicated nowhere else in Eurasia. Early in the Upper Paleolithic, there is evidence that human populations embarked on settlement and economic strategies focused on lowered mobility and locally available resources. This contrasts markedly with the long-distance mobility that characterized many other Upper Paleolithic economies across Eurasia. Moreover, there is evidence of much more significant use of diverse resources, including small game and marine resources, than is the case in most other Upper Paleolithic sites of the continent. This settlement and economic strategy was flexible enough to survive the environmental changes at the end of the Pleistocene and continue successfully into the mid-Holocene. Indeed, variability in Upper Paleolithic economic systems of Mediterranean Spain seems only indirectly linked to Upper Pleistocene climatic shifts. The comparatively mild effects of late Pleistocene environmental changes in the Mediterranean zone of the Iberian peninsula make it possible (and necessary) to investigate a broader suite of components of cultural and natural landscapes to which Paleolithic socioeconomic systems responded than is possible in other areas of Europe, where the dramatic ebb and flow of continental glaciation and associated steppe–tundra biota tend to mask the effects of more subtle causes of cultural change.

In addition to the economic data that form the most common component of the archaeological record, recent research in Mediterranean Spain has provided a better glimpse into other aspects of the human experience with the discovery of many new parietal and mobile art localities. These discoveries show that public artistic expression was not restricted to the Franco-Cantabrian area but was probably very widespread, at least within pleniglacial refugia. Of special importance is the fact that many of these are not in the deep caves that have long been considered the primary locus of Paleolithic art in Europe. Distributional and stylistic studies of this expanded data set are providing insight into the role of art in Paleolithic societies and may also offer new avenues of accessing prehistoric social organization and social relationships.

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