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Cover figure: Last mining event at Casa Montero, Madrid (c. 5200 cal BC). Illustration by Juan Álvarez-Cebrián

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Searchers and miners: first signs of Flint exploitation in Madrid's region

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Abstract

Since the 19th century Madrid region has been well known for its Lower and Middle Palaeolithic sites. Fluvial terraces from the main rivers of the region have allowed us to detect a great number of sites. During the past few years, heritage conservation initiatives undertaken by the administration of Madrid's regional government have also facilitated the discovery of new sites, which in the future will undoubtedly improve our knowledge about the activities of Mousterian groups inhabiting this region. In this paper, we present a preliminary report of the site of El Cañaveral (Madrid), whose excavation revealed a large concentration of flint knapping artifacts and debris, as well as information on the sources of flint procurement and its first exploitation steps.

Keywords

Iberia. Madrid. Mousterian. Flint procurement. Numerical dating.

1. Background

Madrid is undoubtedly one of the most thoroughly studied Spanish regions of Palaeolithic occupation. However, it is also a host of great number of scholarly misunderstandings. The earliest human occupation of this region occurred 450,000 years ago, in the Middle Pleistocene, during the Mindel-Riss interglacial (OIS 13-12). This period is characterized by the presence of lithic industry on fluvial terrace levels, as exemplified by the finding from Pinedo site (Querol and Santonja 1979) in Aranjuez (Madrid), Transfesa or San Isidro archaeological sites (Baena *et al.* 2000).

It is somewhat paradoxical that one of the largest gaps in the scholarship on this region is the absence of a reliable regional chronological sequence of the Palaeolithic occupation, due to the scarcity of geo-chronological data. Therefore, the subsequent section is inevitably based on general assumptions and traditional interpretations of the known archaeological record.

2. The dynamic of the Lower to Middle Palaeolithic transition in Madrid

On a regional scale, Acheulean chronocultural assemblages are traditionally defined by the presence of handaxes. However, this criterion should be applied with certain caution. Our actual knowledge of supply and catchment areas suggest that testing pieces, trials, mistakes, or even initial knapping stages may well be taken for bifacial items. On the other hand, the traditional elements used to differentiate Lower Palaeolithic (Acheulean) from Middle Palaeolithic (Mousterian), have been revised thanks to the recent archaeological discoveries and new geochronological data (Gamble 1999).

The Acheulean classification cannot be applied to some collections lacking handaxes, a large number of flaking products (flake debitage) or retouched elements from programmed schemes. The presence of configured material departing from trifacial schemes (Böeda 1994; Baena and Baquedano 2004; Cuartero 2004, i.p.) and the absence of discoid and Levallois débitage characterized by the pre-

Figure 1. Location of El Cañaveral site in the Iberian Península.

sence of multipolar debitage appear to be the best indicators for an Ancient Palaeolithic in our area. The typological repertory of Lower Acheulean in Madrid and façonage chains coexist with assemblages composed by configured tools made of flakes or fragments, turned into scrapers, retouched flakes, denticulates, notches, and knife-like tools among others, with a high frequency (even though variable) of Levallois products, which consist of recurrent centripetal and preferential lineal modalities (Böeda 1988).

During the development of Acheulean moments, the presence of Levallois knapping sequences, initially recurrent, were more frequent within lithic remains. In advanced stages, it is possible to confirm the presence of preferential modalities (uni and bipolar) and Quina retouches (Bourguignon 1996, 1997). Current data suggest that the traditional classification of Acheulean artifacts from Madrid is actually based on some really old collections along with others, typical of the Middle Palaeolithic, in which the presence of bifaces (MTA and MTB) led to their categorization as Acheulean.

It has been pointed out that the scholarship on the transition to the Middle Palaeolithic has been focused on the manner and proportion in which some techniques and typological characteristics appear and gave no serious consideration to the environmental exploitation models or the socioeconomic structures of the population.

However, during these periods some important changes occurred. One of them is the substantial amplification of the raw material selection strategies, unrelated to the supply sources, which do not vary, given the abundance of resources in the territory. The technical changes required by the new operative schemes entailed the demand for better quality raw materials and an improved knowledge of the environment and its productive potential.

In our area, the most characteristic types of items are side-scrapers, denticulates, notches, backed knifes and points. New modes of reduction appear are documented, preferentially Levallois, unipolar, bipolar, Quina- (Boëda 1988, 1989; Turq 1992; Bourguignon 1996, 1997; amongst others), schemes that will be a constant during the subsequent Upper Pleistocene. Although we can detect a continuous pattern during the initial stages, the final moments are difficult to systematize due to the lack of dating information. The dates obtained recently have offered results quite similar to the Upper Unit of 'Soto e Hijos' (Manzanares), (39.000 ± 3500 and 32.000 ± 2500 BP), associated to a highly developed Mousterian, or the so-called

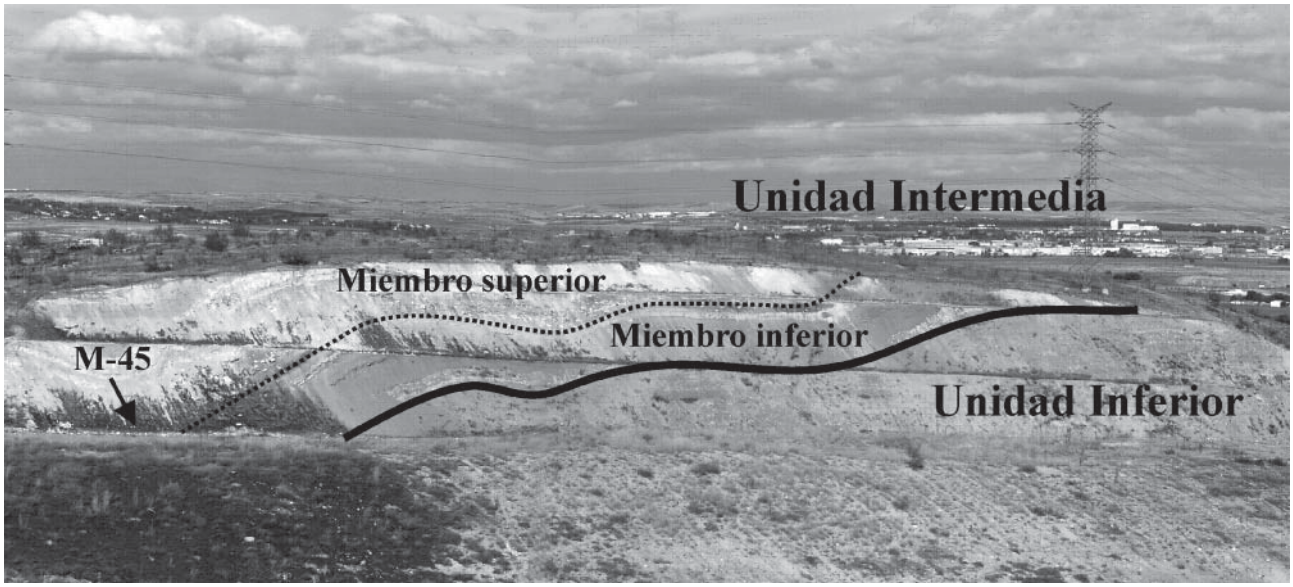

Figura 2. Contact between lower member and upper member of the Middle Unit in the M-45 profiles.

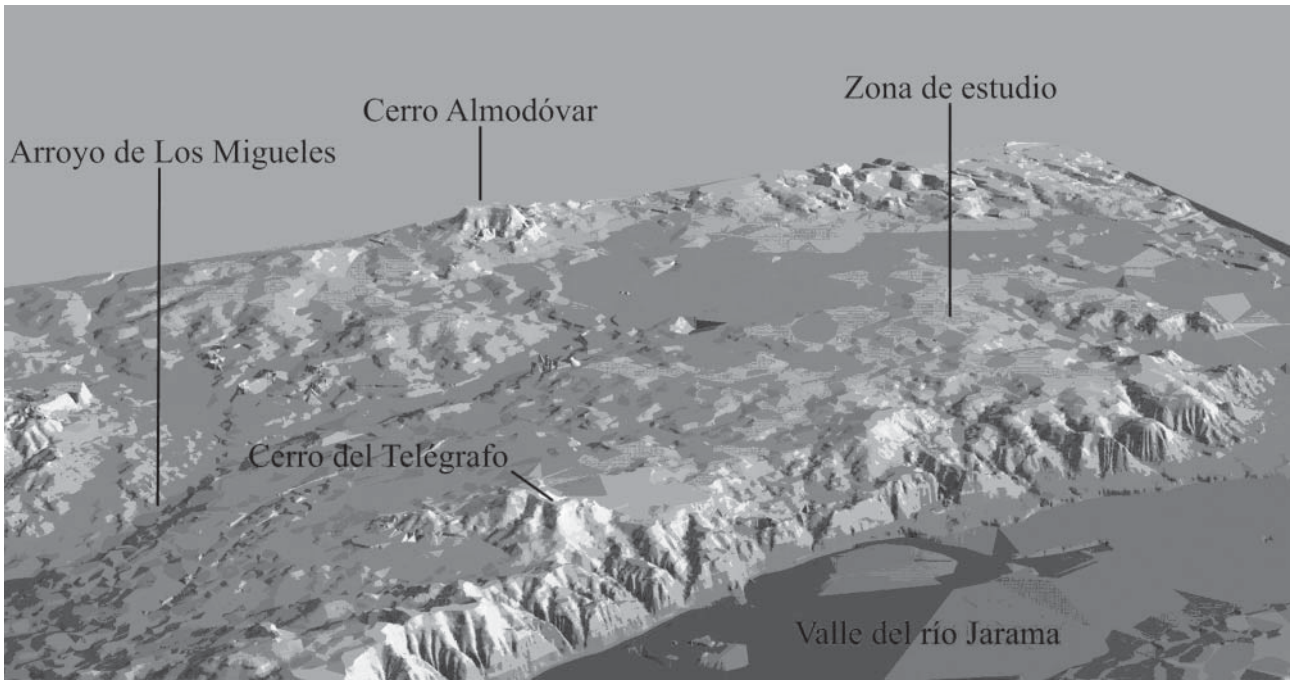

Figure 3. Digital terrain nmodel with the study area.

'12 de Octubre' archaeological site, which goes between 25 and 40 ky BP (López Recio *et al.* 2007). The existence in fluvial contexts of re-deposited materials corresponding to the erosion of the oldest terraces is problematic when assigning a chronology to the industry. Additionally, we have to be cautious when considering the possible continuity between both periods, since our territory could present a model of cultural change much slower than in other peninsular areas.

Numerous archaeological sites have been documented in old river basins of the main and secondary terraces (Rus 1987; Baena *et al.* 2000). Among them, it is worth mentioning La Parra (Pérez de Barradas 1922, 1923,1926; Obermaier and Barradas 1924; Enamorado 1989), López Cañamero (Pérez de Barradas and Wernert 1921a; Pérez de Barradas 1924a; Obermaier 1925; Sánchez 1985), and Atajillo del Sastre (Pérez de Barradas 1923, 1926, 1929; Obermaier and Barradas 1924; Sánchez 1985), Casa del Moreno (Pérez de Barradas and Wernert 1921a ; Pérez de Barradas 1922, 1923, 1924a, 1926, 1929, 1934), El Sotillo (Pérez de Barradas 1922, 1924b,1926, 1929; Pérez de Barradas and Wernert 1930, 1931; Martínez de Merlo 1984; Enamorado 1984b), El Almendro (Pérez de Barradas and Wernert 1919; Pérez de Barradas 1924a, 1926, 1929, 1934), La Torrecilla (Pérez de Barradas 1926, 1929; Cobo et al. 1979; Enamorado 1989), Parador del Sol (Pérez de Barradas 1922, 1924 a, 1926, 1929; Obemaier 1925), Fuente de la Bruja (Pérez de Barrada 1922, 1923, 1926, 1929; Hermández Pacheco 1956). More recently we have some examples in Las Fronteras- Pinto (Baena and Ibañez 1996), La Torrijana-Pinto (personal communication of Belen Márquez and Juan Gómez), El Negralejo (Antonio Geanini's personal communication), Canteras de Vallecas-Camino de Salmedina (Pérez de Barradas *et al.* 1921; Obermaier *et al.* 1921; Baena *et al.* 1997), Los Cenagales (Javier Pastor's personal communication), Pedazo del Muerto (López Covacho *et al*. 1996), la Gavia (Rus 1987; Vega *et al.* 1999), the archaeological sites of 12 de Octubre and the complex terraces of Villaverde-Butraque (López Recio *et al*. 2007), Fábrica de los Ladrillos-Preresa (Joaquin Panera's personal communication) and surface sites such as Ciudad Lineal, Chamartín or San Blas (Rus and Velasco 1993).

The data gathered in all these sites has been used in the attempts to systematize and classify the collections according to the French Mousterian facies (Rus 1987; Rus and Velasco, 1993), resulting in most cases in the assignment

Figure 4. Aerial view of the sondages in the Exclusion Area, next to Vías Colectoras (Cortesy of the Junta de Compensación de la UZP2.01 El Cañaveral).

Figure 5. Aerial view of the sondage area and the Parcela 32 excavation (Cortesy of the Junta de Compensación de la UZP2.01 El Cañaveral).

of the assemblages to the MTA, solely on the basis of the presence of bifaces. However, this procedure must be reconsidered, especially in the case of the oldest collections, where the control of the material's spatial and stratigraphic position was precarious or simply non-existent (Enamorado 1984a, 1984b, 1989; Sánchez 1985).

3. Pleistocene in Madrid during the first decade of XXI century

For the past couple of years our region has experienced a deep transformation that affected interfluvial areas situated between the Manzanares and Jarama basins. For several decades the construction activities have mainly affected the fluvial areas (sand and gravel exploitations), but now, the urban growth has started to affect environments far beyond river basins.

Recently, the development of Urban Enlargement Projects (called *Proyectos de Ampliación Urbanística*, PAU) and important highway constructions, such as M-45, have lead to the discovery of new Pleistocene archaeological sites, while at the same time producing new methodological challenges. Until now, we had never recorded large open areas containing abundant archaeological remains at risk. During these past few years, heritage policy promoted by the Regional Agency responsible for Historical Heritage (*Dirección General de Patrimonio de la Comunidad de Madrid*) has encouraged the development of important research projects inside the areas affected by construction activities and facilitated the recovery of new material enabling the scholars to enhance our knowledge of the prehistory of the region.

Drawing on the support of Cañaveral Compensation Board (Junta de Compensación de Cañaveral), as well as the funding from the research project 1664/00/2007 from the Dirección General de Patrimonio de la Comunidad de Madrid, 'Study and documentation of Pleistocene archaeological sites in Madrilenian Community: watersheds of Manzanares and Jarama's basins', beginning in 2007, we carried out fieldwork study of the archaeological sites of El Cañaveral (Vicálvaro, Madrid). The archeological project has involved the collaboration between private institutions, the University and Administration, which has guaranteed the management and documentation of one of the biggest and most complex cases of an archaeological site recorded in our region.

El Cañaveral is a home of several sites belonging to different chronocultural frames. One thing all of them have in common is the great abundance of knapping lithic remains associated with flint outcrops. Our project has fo-

cused on those spaces where the conservation conditions guaranteed the best interpretational possibilities.

4. Geoarchaeological aspects of Madrid region

The geological context of the site is the Madrid basin, a part of a bigger morpho-structural unit called Tajo's basin (Figure1). It has a triangular shape and is bounded by the Central System and Gredos mountains in the NW, the Iberian Range in the NE, and by the mountains of Toledo in the S (Pérez-González 1994).

During the Miocene the basin underwent an evolution caused by various factors, leading to three big sedimentary stages, which were associated with three large stratigraphic units: Lower Unit (Middle Rambliense-Aragoniense), Middle Unit (Middle Aragoniense- Lower Vallesiense) and Upper Unit (Upper Vallesiense-Turoliense) (Calvo *et al.* 1996).

Within the project area, the Tertiary stratigraphic series is represented by the Lower Unit, made up of massive gypsums, sharply folded gypsums with green clays intersections, and the Intermediate Unit is made up by clays, dolomites and flint levels. At the same time, this Intermediate Unit is divided in two components. The Lower component is made of 12 meters of sharp green folded clays with some centimetres interceptions of muddy clays and sandy clays. Above it is the Upper component, made up by sharply folded clays, multicolor clays with some local carbonates and flint nodules levels (Figure 2) (Bárez and Pérez-González 2007). The Intermediate Unit presents frequent deformations caused by a karstification processes of the Lower Unit and some collapse phenomenon as well as the resulting deformation by the 'reflect effect' in the Intermediate Unit. The study of this Tertiary stratigraphic series has been very important, because of it impact on the genesis and the archaeological preservation (Figure 2).

Considering its geomorphology, this area has characteristic features mainly controlled by lithologic and climatic factors, with two clearly distinct domains—Jarama Valley in the East, and the erosive-structural plains in the West. Here, the wide Jarama valley presents a high asymmetry in his transversal cross section, with a lot of stepped terraces in the left bank and a strong erosive character in the right one, with only the lowest terraces (+8m and +12-

Figure 6. Sedimentary packages to postpone the geoarchaeological analysis.

15m). The western boundary of the valley is characterized by the cliffs formed on the gypsums of the Intermediate Unit extending several kilometers and reaching 100 meters of slope.

On top of the cliffs, from the right bank of Jarama to the left cliffs of the Manzanares River, there is a plateau forming a part of the great dividing platform situated between these two rivers (Figure 3). The area of the site is situated in that geomorphologic unit. It is a structural-erosive origin relief conditioned by the presence of flint layers and carbonated clays from the Upper Member of Intermediate Unit, that lead to wide plains in the highest areas, emphasized in the limit with Jarama valley by the presence of gypsum cliffs, while in more depressed areas the Lower Member appear, mainly made up by clays, and frequently is covered by bottom valley sediments.

In the course of the works we were able to recover the evidence of the existence of wide quaternary sedimentary series in the whole prospected area. They have colluvium sediment origin, fluvial and wind with a lot of quartz-feldespat sands in their composition. The thicknesses vary and sometimes reach 9 meters. One of the causes of these various thicknesses is the high quaternary karstic activity development in the Lower Unit of Miocene, that cause Intermediate Unit deformation and the presence of subsident areas in the surface where all the sediments are adapted. We have systematically observed edaphic processes on the roof of sedimentary series, producing type BT argilic horizons and carbonates precipitation horizons (Ck) (fersialitic ground, typical from Mediterranean fields). Eventually, edaphic developments intercalates in the sequences also appeared.

From a Geological perspective, the archaeological sites located along the M-45 present a similar context. Geomorphologically, they are situated on a platform that defines the watershed between the Manzanares and Jarama rivers, where a lot of silica rocks come to the surface (flint, opal, etc). The unusual abundance of these rocks explains the presence of a high density of archaeological sites linked to supply/catchment patterns of raw materials.

The preservation of a great number of these archaeological sites has been made possible by the different sedimentary stages, eolian and colluvian types, which happened during the quaternary, lacking high energy and almost any transport capacity that covered and buried the anthropological activities protecting them from external erosive agents. The numerical dating series obtained by OSL in all areas have registered the activities of human groups in OIS 3 and latter.

5. The archaeological interventions in Pleistocene archaeological sites: El Cañaveral

The archaeological fieldwork carried out in El Cañaveral has been one of the first studies aimed at the excavation of Pleistocene sites of large dimensions and containing great amounts of archaeological materials, undertaken in the context of an salvage project. The excavation of such archaeological sites has its own inherent difficulties, requiring a specific protocol of action, which we proceed to explain below (Baena *et al*. 2008).

The first step consists in a superficial survey of the area, carried out in the sedimentary units whose characteristics suggest greater archaeological potential. We paid special attention to the areas which would undergo future urbanization and where the task of heritage preservation would be particularly urgent.

Drawing on the previous studies of this region, we established an *Archaeological Exclusion Area* to be assessed and studied through manual and mechanic excavation of test pits, which allowed us to proceed to the total or partial clearing of the area. Backhoe pit testing has been essential for identifying the areas of real archaeological interest.

Therefore, we decided to apply a method based on backhoe test pits (ditches of 20m in length) around the areas with known archaeological potential for further examination. The pits were dug until they reached Tertiary levels, allowing us to obtain a complete and broad view of the quaternary sequence (Figures 4 and 5).

Based on the evidence collected on the surface and on the sections of the test pits with possible sedimentary packages containing archaeological remains in good preservation conditions, we then adopted an excavation strategy that could account for the varying qualities of different kinds of sediments. In practice it meant the excavation of natural levels with the techniques commonly used for these chronological periods and sample collection. Occasionally, in the course of the development El Cañaveral construction project, we had to confront emergency circumstances forcing us to take the complete sedimentary packages in order to guarantee the safety of the geoarchaeological evidence. In these exceptional cases we have followed the rule of conserving the series and referenced blocks whenever possible, in order to postpone the geoarchaeological analysis (Figure 6).

6. The archaeological excavation areas of El Cañaveral

One of the main problems we had encountered in the course of the study was the persistent evidence of isolated prospecting activities carried out during the Neolithic as well as an abundant presence of pits and structures of the contemporary period in the entire geoarchaeological unit. The identification of lithic remains result of the contemporary mining activities was done based on sedimentological studies of the deposits, the raw material employed (of very bad quality due to its productive orientation), on the absence of some technical categories (cores and minor size flakes), as well as on the presence of metallic stigmas in

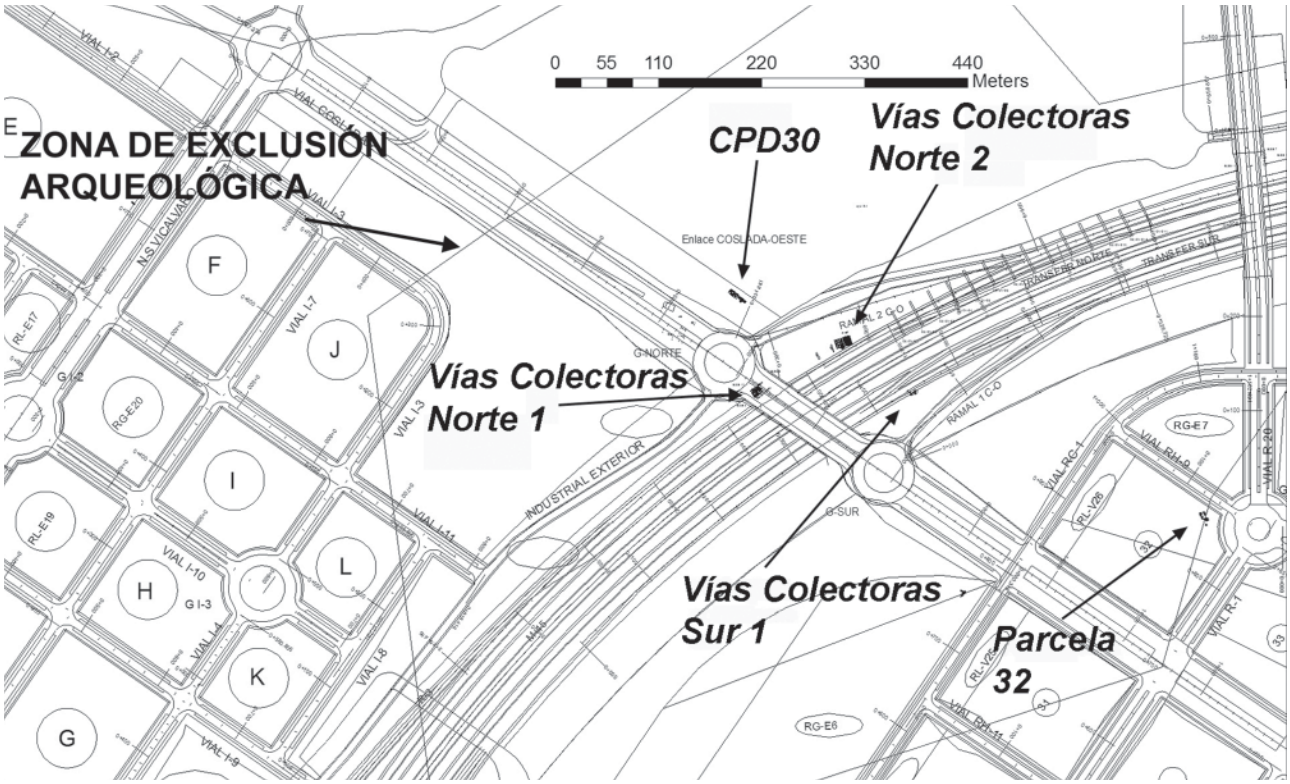

Figura 7. Building map of El Cañaveral with the main excavated areas.

the flake platform. Even more challenging has been the identification of the pits and ditches of Neolithic period, which involved the examination of the repertory and dating of the sedimentary contexts. In addition to this evidence, we have compiled substantial distribution data of excavated areas whose datings and technical features confirm the existence of an important Mousterian occupation in the zone (Figure 7).

1. North-South Vicalvaro Vial Excavation (Cañaveral 1)

In the North – South Vial Vicálvaro, five excavation areas were identified based on the evidence of the lithic industry concentrations visible on the surface. This initial data pointed to the delimited areas where flaking activities took place, corroborated by the finding of a large number of flint nodules carried there from its source (fluvial deposits and specially, coluvionar deposits). However, the presence of raw material was low in comparison to the rest of areas that were discovered later.

Therefore, these first test pits contained not only the evidence of lithic industry but also large concentrations of rough flint nodules, which appears to be the common characteristic of most of the excavated areas.

Vías colectoras

In the surrounding area of the M-45 highway we used a backhoe test pits for identifying sites and excavation areas of special archaeological interest detected during the survey. The result obtained from some test pits was negative, because only boulder lithic materials were located.

On the other hand, in a different set of test pits we located a cemented slimes level under the red clays stratum (paleosoil), containing well-preserved lithic fragments. These findings called for the organization of several rescue excavations.

1.1) Excavation of Estribo Norte de la Estructura 1 (Vías Colectoras Norte 1)

The archaeological intervention had two phases: a mechanical soil clearance and a further delimitation of an area for manual excavation (80 square meters). The sequence recognized presented three archaeological strata over which different soil episodes took place.

In level III, composed of prismatic brown clays, the lithic industry documented seems exceptionally fresh, with only some carbonate concretions. However, the orientations and inclination of the materials point to geological processes of vertical alteration, possibly linked to the formation of the different paleosoils.

It is necessary to emphasize the presence of big massive flint blocks which reveal percussion and knapping activity, being common in levels II and III, in the clays stratum that contact the Tertiary level. We used mechanical means to

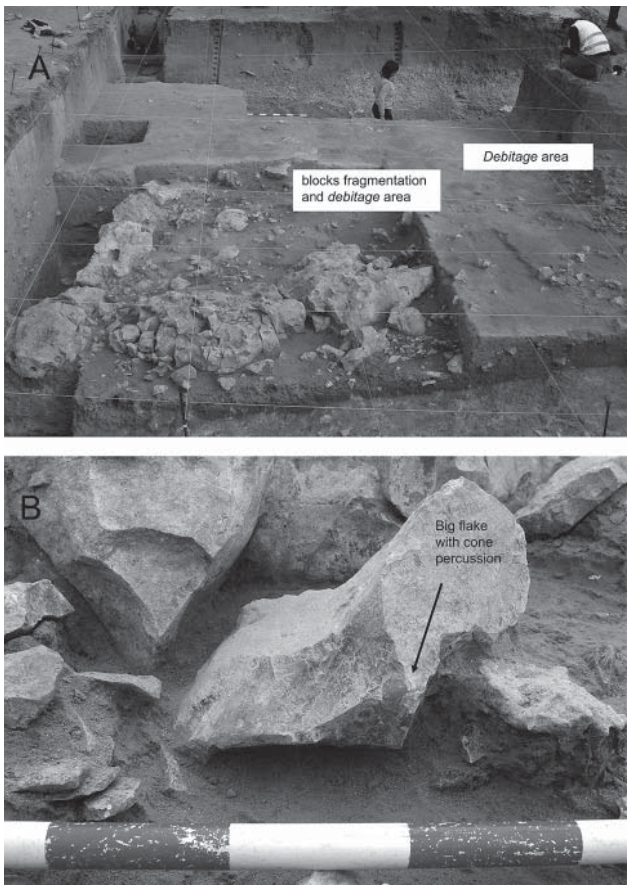

Figure 8. Vías colectoras Norte 1. A. General view of the excavated area with the Flint blocks and the debitage clusters. B. Detail of an in situ refitted big flake with the Flint block.

remove the big flint nodules in order to proceed with the search for refitted materials. Once removed, we confirmed that, under them, there still appeared lithic materials. The question of the processes that led to the genesis of lithic industry deposits under big nodules is still an open one. Several reassemblages of lithic industry have been documented in field. One possible explanation is the presence of high intensity percussion processes, aided by the existence of natural fissures on the rock that allowed the fragmentation of the big blocks, whose smaller pieces later served in other debitage processes in the same area (Figure 8).

1.2) Area 3 excavation (Vias colectoras norte 2)

The area selected for excavation totalled 164 square meters and its sequence included at least one clay layer containing large assemblages of lithic industry represented by a great number of cores and hammer stones.

The distribution of the materials alternates between concentrations with predominantly horizontal layouts and sets of raw materials located along vertical slopes, probably resulting from the edafic processes that took place later. At the same time, it is likely that here the coluvionary deposits were the principal source of raw material and the basis over which the well-preserved traces of knapping activity were superimposed. New coluvionar-eolic episodes affected in a different way the distribution of various knapping zones with the partial dragging of some pieces and the intrusion of new boulder materials (Figure 9).

Taking this into consideration, we decided to increase the excavation area in order to locate those assemblages whose conditions of conservation were the best. During the excavation we recorded the distribution of oval or circular concentrations of fresh material corresponding to particular areas of debitage as well as hearth remains indicating a temporary occupation of this area. According to techno-typological criteria, the assemblage clearly belongs to the Mousterian period, characterized by a clear predominance of Levallois schemes, and contrasting with an occasional presence of blade schemes, similar to the ones detected inside the Mousterien in other European zones (Tuffreau 1990; Réveillon and Tuffreau 1994; Réveillon and Cliquet 1994; Cuartero *et al.* 2007). The occasional retouched pieces, two Mousterian points and two scrapers (as opposed to 14.000 pieces without retouch) point towards a Middle Palaeolithic chronological attribution, fitting the most classic Mousterian types.

1.3) Excavation of Vias Colectoras South

In this zone, a concentration of lithic industry was mostly composed of nodules, fragments, flakes and cores and some isolated retouched tools, found in their original position, evident from their conservation. Similarly to other test pits, the concentrations of lithic materials appear on deposits just on top of the tertiary formations, where we can see good quality flint blocks with a carbonated cortex, arranged in a natural way, and containing in many cases clear evidence of human manipulation.

Particularly interesting was the location of flint nodules in square D6, where we found large size blocks with large anthropic extractions and flake refittings. This sector contains traces of negative structures (small pits) with visible remains of charred wood (carbonaceous sediment) radially dispersed around some of the nodules. The study of these findings is still in progress, but its preliminary results point to the precence of a set of Neolithic mining episodes, thus cutting through the Mousterian sequence documented in the rest of the area. The numerical dates obtained are as follows: Beta-244210 5750 +/- 50 BP, 2 sigma calibration: Cal BC 4720 to 4470 (Cal BP 6660 to 6420); Beta-244211 6020 +/- 40 BP, 2 sigma calibration: Cal BC 5010 to 4800 (Cal BP 6960 to 6750) and Beta-244209 6490 +/- 50 BP, 2 sigma calibration: Cal BC 5530 to 5360 (Cal BP 7480 to 7310). They suggest the existence of mining activities in the surroundings of the close-by Neolithic flint mine of Casa Montero.

Near this excavated area, we documented some coluvionary levels containing a large volume of lithic remains and collected some samples for dating. Their typological and technological features confirm an Acheulian ascription, which prompted us to recover the maximum quantity of material in these levels.

2) C.P.D. 30

In this zone, neighboring the above-described VCN 2, the test pits showed the existence of important concentrations of very fresh lithic industry, in association with supports altered by atmospheric agents. The pits disclose a level with a great number of cores and some quartzite hammers. In the excavation layout we have also noted somewhat circular concentrations of fresh materials probably corresponding to knapping zones. Based on technotypological parameters, there is still a clear predominance of Levallois schemes associated with some few blade schemes, similar to the ones recovered in other zones of El Cañaveral.

3) Parcela 32 (Cañaveral 3)

The fieldwork in Parcela 32 is still in progress. In this area we located at least three different levels with important concentrations of fresh material. The analyzed features indicated the existence of knapping areas similar to the ones documented in Vías Colectoras Norte. The documented material consists predominantly of flakes, blade flakes and cores, while the retouched material is very poorly represented. The initial study of these materials confirmed the existence of Levallois operative chaines of recurrent centripetal and unipolar modality.

At the same time, we have documented some intense blade exploitation schemes- unipolar modalities (Figure 10). As in previous cases, there is evidence of exploitation of high quality flint and opal sources, where sediment removal and quarrying activities seem to have taken place.

7. Cultural interpretation of the site and the variability of dense artefact contexts

The natural resources found in Madrid region were an attraction for its inhabitants since the earliest periods. The available data shows that these areas played an essential role as flint procurement zones, evidenced by the frequency of the deposits containing traces of knapping activity, that took place near primary sources as well as others in secondary position, similar to what has been named *quarrying facies* (Barandiarán and Vallespí 1982). The comparative study of the documented operative chains, both

Figure 9. General view of the Vías Colectoras Norte 2 (Área 3) excavation and detail of one of the debitage cluster.

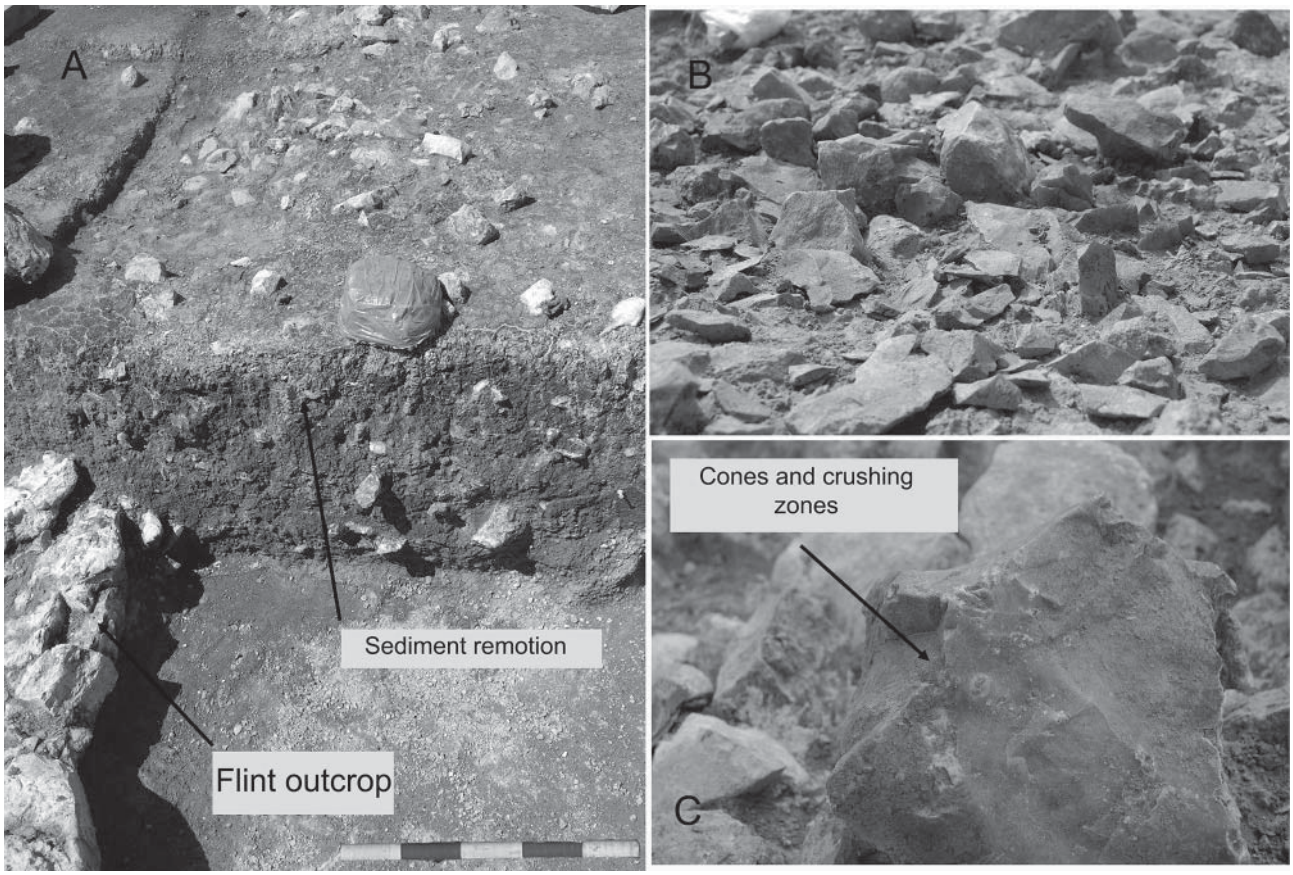

Figure 10. General view of the Parcela 32 (Cañaveral 3) excavation. A, Profile with Flint outcrops showing sediment remotion. B, Detail of lithic distribution. C, In situ cores wit percussion stigmata.

in contexts of abundant lithic resources (interfluvial areas) and in contexts of consumption (close to riverbeds), has turned out to be an essential tool for gaining better understanding of the global strategies developed by the palaeolithic human groups (Geneste 1991).

In El Cañaveral we have mainly documented the first stages of the operative chain. Procurement, reduction and blank production (*entame and mise in forme*) aimed at the exploitation, together with steps of full production (*débitage*), took place within the same space. Traces of consumption activities (final stages of the operative chain) are very limited or non-existent, pointing to the short duration of human occupations.

As for the first stages of the operative chain, the strategies employed are characterized by the absence of extensive planning. Several models apparently predominate: the procurement of small blocks (up to 10-20cm long), frequently originating from coluvionary deposits; mid-size blocks (20 to 50cm long) coming from similar deposits or produced through fragmentation of big blocks; and the exploitation of big massive nodules (50 to 200cm long) through percussion (possibly throwing), taking advantage from open air outcrops whose exploitation, in some cases, seem to have been favored by the excavation of ditches (figures 10 and 11).

In the first case, the selection is based on the morphologies and dimensions near the volumetric model resulting from the Levallois-discoid *débitage*. In the second case, we observe the use of direct unifacial and unidirectional schemes (Martin Blanco and Djema 2005), or multipolar ones of discoid or Quina appearance (Figure 12), clearly intended for obtaining thick blanks. In both cases, the strategy consists of taking advantage of the block's fissures caused by meteorization, thus generating blanks of middle and small size, as well as fragments without clear knapping signs. The large flakes obtained from big and medium size blocks are equally close to the searched core morphology.

The technical and technological features of the El Cañaveral debitage can be grouped according to three major operative schemes (Figure 13 and 14):

a) Preferential and recurrent Levallois method (unipolar and bipolar modalities), most frequently employed, consists in direct percussion with hard stone hammer. With respect to the cores, we possess a huge number of elements, being dominant those which are initially exploited. Some pieces reveal a high technical and technological *débitage* skill, corresponding in many cases to a more intensified exploitation, characterized by a clearly 'wasteful' strategy, also called *gaspillage* strategy (Ba-

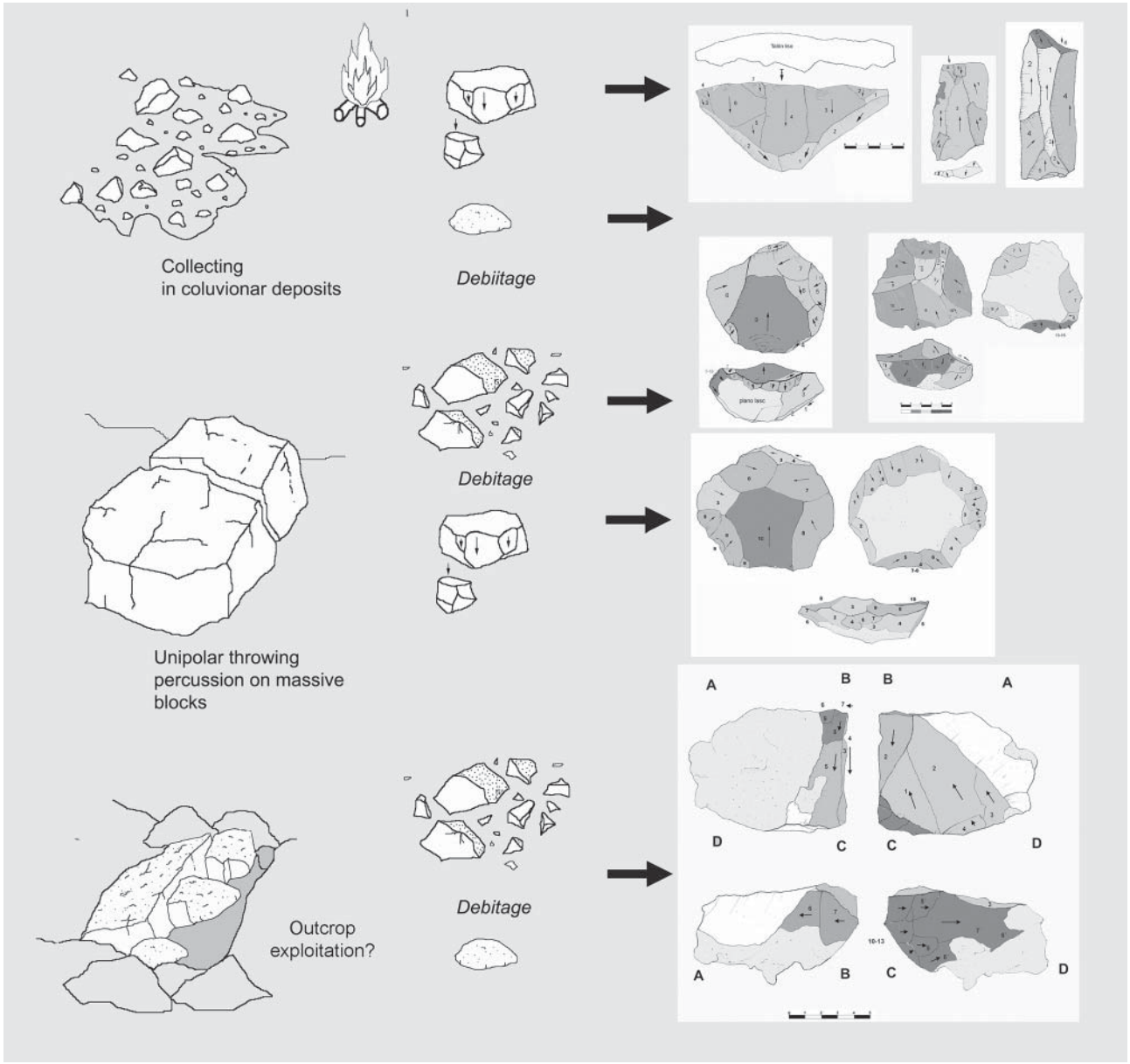

Figure 11. Blank support production strategies in Vías Colectoras. A. Unipolar schemas B. Multipolar/discoid (quina debitage appearance) schemas.

zile 2002) and evidenced by a great abundance of raw material in the zone.

b) At the same time, we have documented the presence of discoid and hierarchical discoid schemes, whose possible final products are pseudolevallois points, backed knives and quadrangular and triangular flakes. Although the nature of the relationship between these schemes and the previous ones (the role of recycling or ramification processes) (Bourguignon *et al.* 2004) is yet to be established, there are numerous cases demonstrating how different methods derive from each other and how different modalities are superimposed in the same core.

c) In other cases, we document unipolar blade schemes, resulting in cores of prismatic morphology, which could be linked to the initial phases of centripetal modalities of exploitation, similar to those described in French contexts (Révillion and Cliquet 1994; Klaric 2000).

Regarding the presence of structural categories, cortical flakes, cores and knapping debris, together with a scarce configuration of tools, are the common features of the entire analyzed areas.

The recently obtained magnetic susceptibility data from the minerals contained in the structure's sediments of Area 3 indicate the probable existence of combustion areas. This means that, if these combustion structures are indeed contemporary with the knapping activities, we may be dealing with temporary open air camps, where the main documented activity is the flint procurement. The possible confluence of both events in the same space would imply an exceptional finding within the peninsular context, i.e.,

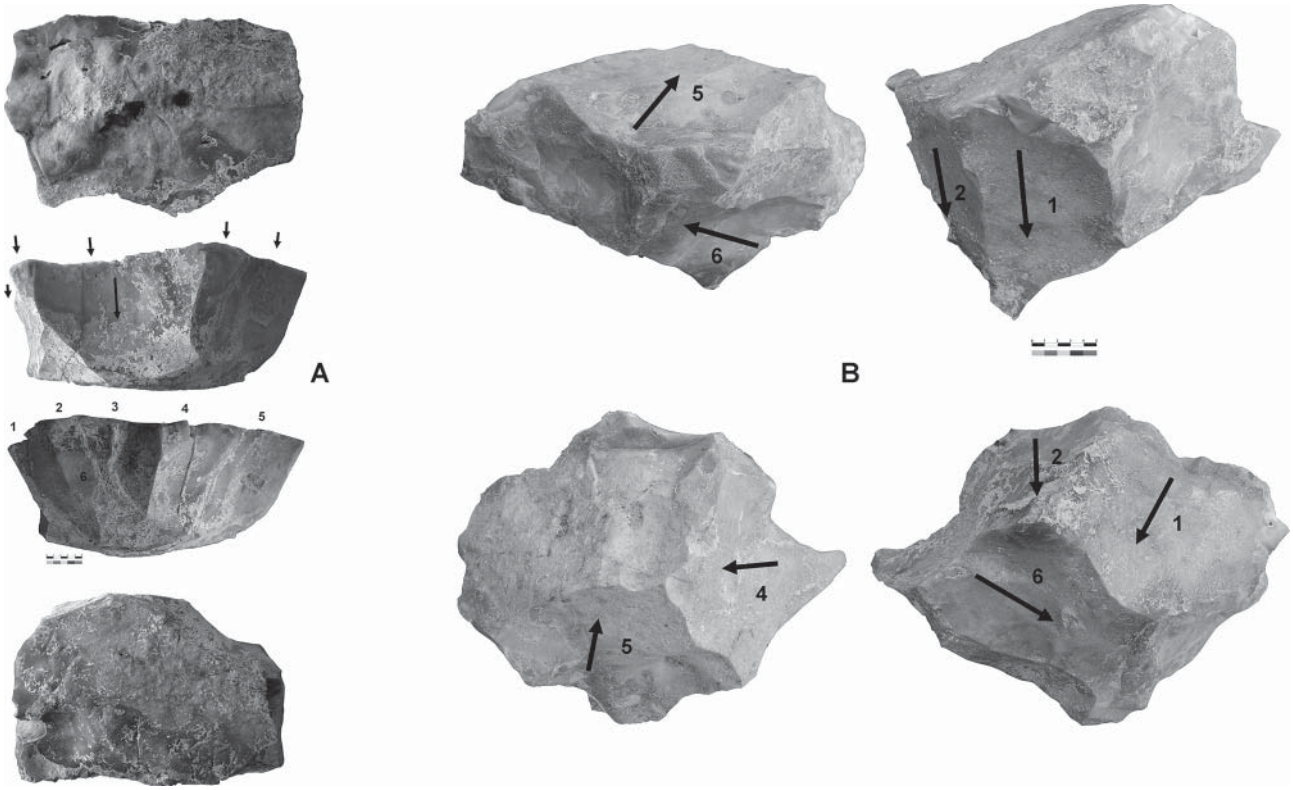

Figure 12. Main catchment strategies documented in different areas at El Cañaveral.

the first evidence of an open air occupation exclusively associated with flint procurement and knapping activities (Baena 1994).

From a technological point of view, the common elements observed in the different excavated areas can be summarized as follows:

- If we take into account the amount of documented cores and compare it with other contexts (e.g., river areas), the morphological variation margin of the exploited blocks is very high. The high degree of variability in methods, modalities and morphologies can be explained by the abundance of resources, or the collective participation of the human group in the processes of procurement and production. Therefore, the features documented in El Cañaveral are coherent within contexts where the procurement of lithic resources and the knapping learning processes take place at the same time.

- The scale of the industries is big. However, there are clear differences between exploitation strategies at different stages (catchment, production of supports, full production). There is no evidence of microlithic production in any of the studied areas.

- The distribution of categories in these contexts is totally different from the one documented in the consumption environments. The absence of tools is particularly interesting especially if we compare it with cave contexts.

- The convergence of different knapping methods in the same item is frequent and could be explained by the recurrent occupation of the sites (recycling in palimpsests), or other recycling strategies that have yet to be analyzed. The above-mentioned overlapping, suggests that, as opposed to the ramification processes documented in other contexts, we may be facing here with reuse processes (as it is documented in the level J of Romaní, Vaquero, in this volume).

The scarcity of scholarship dealing with this kind of sites has complicated our task of making a comparative analysis of the behavioral variability within the Mousterian groups and those of the preceding stages. The data we have gathered so far in El Cañaveral suggest that a higher degree of variability is expressed in certain aspects of these kinds of occupations.

Different modalities of access, extraction and initial processing of the raw material found here are infrequent in lithic assemblages associated with sites of a higher occupational impact. These initial strategies, though relatively simple, reveal a diversity of flake/blank production methods, which are different from the ones developed in later stages.

The variability, that is evident in exploitation methods, is coexistent or interrelated in some of the other areas seemingly connected with the zones of higher material concentration, higher occupational impact, or higher visit rates. Many of the operative schemes showing different

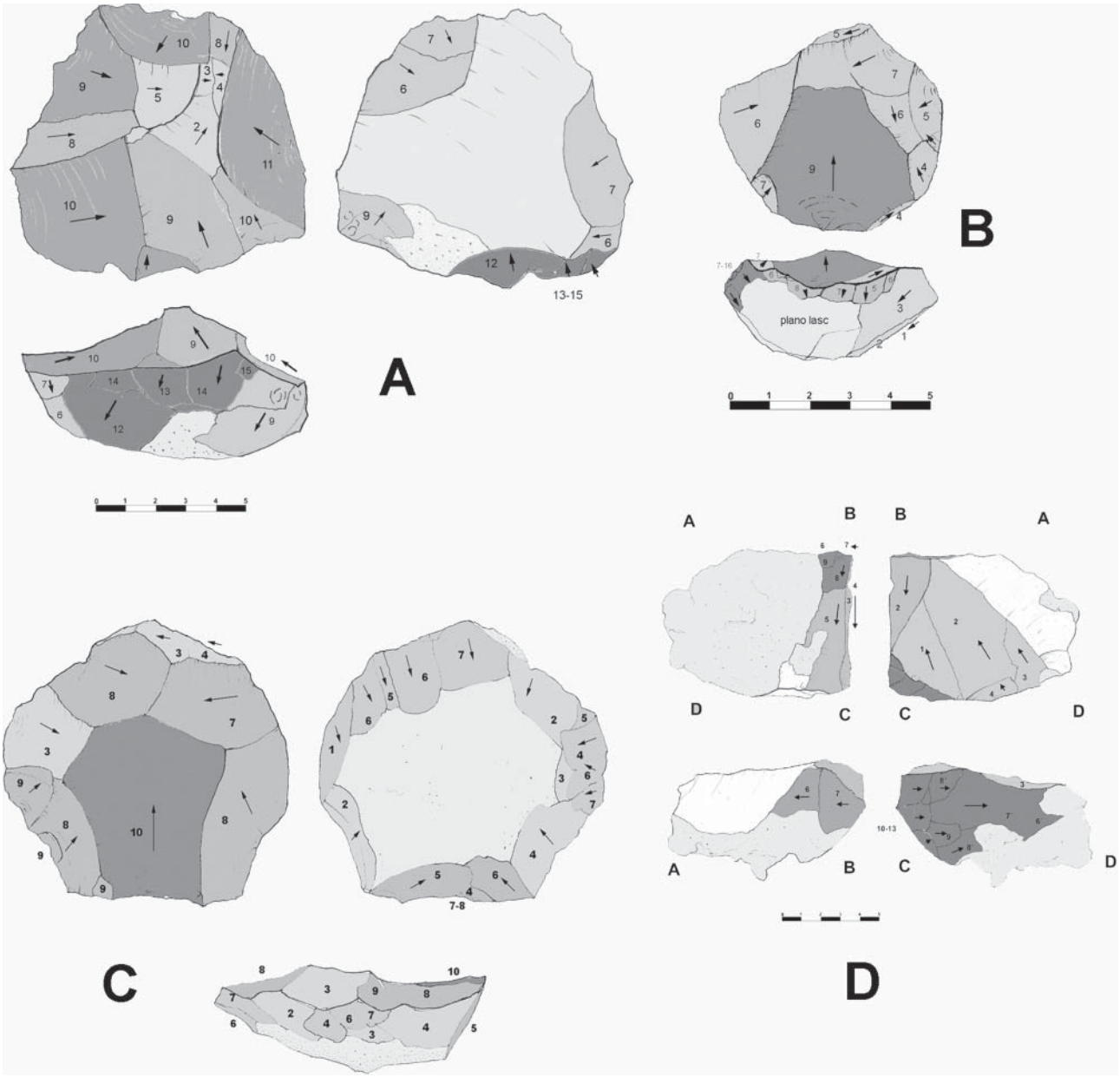

Figure 13. Diacritic schemas in cores. A, levallois recurrent centripetal core from Área 4 close to Vías Colectoras Norte 1. B y C, levallois (lineal and preferential) cores from Vías Colectoras Norte 2. D, blade core from Parcela 32.

degrees of hierarchization or alternation in the extractions call for a more detailed evaluation.

Additionally, in these places we see different degrees of technical skill, possibly linked to learning behavior. This prompts us to consider knapping activity as a group behavior and the procurement area an optimal place for the acquisition of technical and technological skills.

The virtual absence of variability in typological or raw material composition prods us to seriously consider some interesting nuances, such as the few pieces of foreign material (fundamentally quartz and quartzite), collected in riverbeds or terraces of the Jarama and Manzanares rivers, associated with the knapping tools. In the few cases that these materials are not linked to knapping elements, we identify cores and flakes that, as with the scarce retouched pieces made on flint, can be related with discarded products, rejected in the moment of arrival to the area, in the context of a tool kit renovation.

The characteristics of El Cañaveral have some commonalities with other sites such as Perales del Rio (Cobo *et al.* 1979; Gamazo and Merlo 1983; Baena 1992), Las Fronteras (Baena *et al.* 2002) or Los Berrocales (Iván Manzano's personal communication), where the existence of Mousterian occupations associated with the procurement and exploitation of lithic resources in areas distant from the fluvial basins has been confirmed. Similar cases have been recorded in other areas of the Iberian peninsula (Ebro's ba-

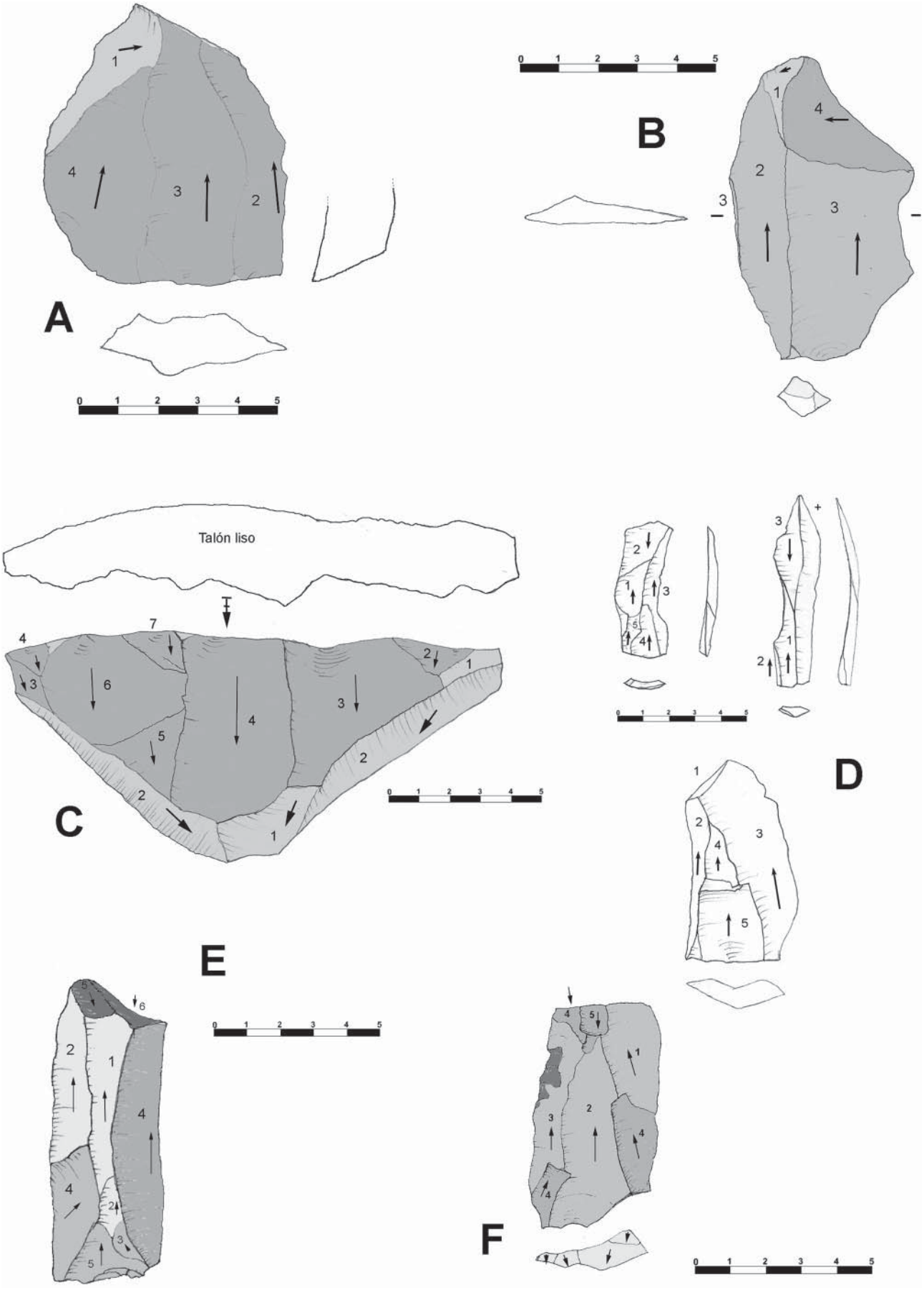

Figure 14. Diacritic schemas in flakes. A, B and C, unipolar schemas from Área 4 close to Vías Colectoras Norte 1, D, blade schemas from Parcela 32, E y F, unipolar or bipolar schemas from Vías Colectoras Norte 2.

sin: Montes 1988; Utrilla and Tilo 2001-2002; Casa de la Mina II in Ciudad Real: Sanguino *et al.* 1994; Valgrande in Salamanca: Santonja 1986; La Coca in Alicante: Fernández Péris 1998; Cerro de San Cristóbal in Toledo: López Recio and Baena 2001; Páramos del Duero: Díez Martín 2000), or in Central European contexts (Roebroeks 1988; Geneste 1988; Van Kolfschoten *et al.* 1993; Moncel and Perreve 1999; Slimak *et al.* 2005; among others). These studies demonstrate certain uniformity in the changes experienced by the groups of the end of the Mousterian in the context of increasing specialization.

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