Systematic Survey in Alicante, Spain. First Results

Alicante'de (İspanya) Sistematik Yüzey Araştırması. İlk Sonuçlar

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It is well known that information obtained from systematic and intensive survey, which uses an "off-site" strategy, is useful to any research studying human activity at a regional level (Dunnell, Dancey, 1983). However, data from this method face difficulties and shortcomings derived from two basic conditions:

- The amount and the extent of changes in the landscape due to both human (farming) and natural (erosion - redeposition) forces.
- The lack of stratified sites to help organize surface collections (especially the prehistoric ones) in to a chronological framework.

- While the first conditions tends to challenge conclusions that about the use of spa-
A systematic survey project in the littoral valleys in the south central Valencian region of L’Alcoià and El Comtat (Alicante, Spain) began in 1987 and was coordinated by one of us (J. Bernabeu). The project was redesigned later, given the initial interest that was generated from findings and the need to study several methodological problems in greater depth, and M.C. Barton and J.E. Aura joined the coordinating team. In its final design, the survey encompassed five environments located in the region known as Les Valls de l’Alcoi or Serpis: the valley of Polop (headwaters of the Alcoi, ca. 750m above sea level), Penáguila (headwaters of the Alcoi, ca. 550m above sea level), middle Serpis (ca 450m above sea level), lower Serpis (Loroha: ca 350m above sea level), and the Vall d’Alcalà (ca. 600m above sea level), which is nearer the coast (Figure 1). The central objective of the project was to find out the effects of the neolithization process on the territory, but, given the wide chronological range of the collections, the objective soon became limited.

In this paper, we present the first finds from the analyses of the collections of Polop and Penáguila, focusing on those prehistoric collections from the Middle Paleolithic to the Bronze Age.

1. Geographical Aspects

The valley of the upper Polop and the region of Benifallet-Penáguila are located within the geographical unit known as Les Valls de l’Alcoi, on the inland of Alicante. It consists of a series of small valleys that converge in a depression, the basin of Buñol which originated from a fault, where the Alcoi or Serpis river flows. Both the valley of Polop and the valley of Penáguila belong to that series of valleys.

The valley of Polop belongs to the headwaters of the Alcoi or Serpis river, and is located about 6km SW of the city of Alcoi (Fig. 2A). The average altitude ranges from 700m to 900m above sea level. It runs from SW to NE, and in the SE is surrounded by

the Sierra del Carrascal-about 1300m-and in the NW by the Lloma de la Fontfreda, which has a maximum altitude of 1100m.

The valley formed a closed drainage system in the late Tertiary or the early Quaternary, and the stagnant waters in it formed a thick sequence of marls. At some point, the drainage of the lakes and the fluvial erosion left one or several high banks in the marls along the river. The main drainage at that time was in the north side, and exited along the present course of the river Barxell (Ferrer, Fumanal, Guitart, 1993; Llaca, 1991).

Following this initial episode of incision, the valley seems to have undergone a significant degradation. However, outwash aprons which developed in several sites and marls were covered by thick land deposits. Possibly, the deposition was not episodic but cyclical, and diverse along the valley. Throughout the survey, some objects probably belonging to a Paleolithic chronology were found 2m beneath the present surface, as part of these sediments. The reddish and well developed CaCo₃ horizons of these land series may represent a long period of stability in the surface, with standing other processes of erosion. A more detailed research would possibly subdivide this Pleistocene filler of the valley floor.

This sequence which cuts and fills, is found in the central part of the valley as early as the late or post-Pleistocene period. Floors developed in this sediment are less reddish and contain a tiny proportion of CaCo₃. On the basis of stratigraphy, the development of floor and the association of artifacts, it seems that these sediments date to the end of the Pleistocene, and the development of floor to the Early or Middle Holocene.

Sometime during the deposition of the Pleistocene series and their subsequent displacement, the drainage system of the valley changed significantly. Primary drainage moved from the North to the South of
the valley, probably because of the capture of the river Barcell by the river Polop and its main tributary, the Barranc del Troncal. For the time being, an accurate chronology and reason for this change are not well understood. However, the contemporary or oldest incision of the upper course of the river Serpis - the streams of the upper Polop being its tributaries - was clearly located after the occupation of the settlement of Niuet in the late Neolithic (Bernabeu et al. 1994). Thus, it is still possible to understand how human activities associated with farming and stockbreeding contributed to the erosive episodes.

The surveyed zone in the valley of Penaguila is called Les Puntes (Fig. 2B). It stretches in the north of the Sierra de la Carrasqueta and the southwest of the river Penaguila, about 850-550m above sea level (Roselló, Bernabé, 1978). It is surrounded by mountains everywhere, except for the Northeast; by the mentioned Carrasqueta, 1330 m, and its offsets in the south and in the southwest; in the south-east les Puntes is surrounded by the offsets of the Carrasqueta and Aitana, which it joins in the East; and by the Serreta, 1051 m, in the Northwest.

In geological terms, it is a structural valley between the calcareous anticlines of the Serreta and the Carrasqueta. Given the enveloping relief around les Puntes, the drainage network is clearly centripetal. Gullies converge into another, or into the main collector, the river Penaguila, (in a 1.25km stretch, to be accurate). Various remnants of flat surfaces are still found between gullies, Les Puntes being a generic toponym which conveys this meaning.

The surface is deeply dissected by the drainage network, with incisions ranging from 30m to more than 70m deep (Roselló, Bernabé, 1978: 91). Surprisingly, many of these gullies are very narrow, when compared to other transverse V-profile gullies in the region; they have no terrace, except some, which have a small recent terrace near the mouth. All of this points to a very recent network embedding age in the Polop valley. The hypothesis is supported by the floor quality; the most evolved floor with a "Bw" alteration horizon and its corresponding "A" horizon, is usually buried under an "A/C" horizon, ("C" being aeolian silt and gully material). Gully waters and wind, instead of eroding this paleosoil, heaped sediments on it.

The Pleistocene drainage network was probably less deep, the deepest of which was found in the sharply sloping zones next to the mountain slopes. Paleocourses are assembled there today. Some of these slightly embedded courses probably disappeared when they reached the plain, while others went on to the main collector, acting not as a barrier to displacement as they do today.

In short, it seems that both valleys have had stable surfaces since at least the end of the Pleistocene. From then on and up until the Middle Holocene, a significant disruption took place, in the incision of water courses. Farming activities, especially ploughing, besides occasional erosion, might have a removed the old sediments which were redeposited into minor gullies, their place in the stratigraphic register was lost. Only ploughing is ubiquitous, however, and we can therefore conclude that the above mentioned conditions do not decrease the possibility of finding remnants of human habitation (which may be attributed to a long sequence in both cases).

2. Regional Sequence

Archaeological research in the central and southern area of Valencia, from the inland region to the coast, has traditionally been intensive. Table 1 is based on the main stratigraphies and their datings, and the regional sequence is adapted to the demands of the project's work. Nine periods have been retained:

Middle Palaeolithic (MP). Apart from evidence concerning the Middle Pleistocene coming from the Cova de Bolomor (Taber-
of the area being studied (Fernández, 1993), the earliest evidence of human habitation in the region dates back to the Middle Paleolithic, ranging from the 80,000 bp U/th- of *Cova del Salt* (Barton & Clark, 1983; Galvan, 1992), to the 39,000 bp C14- of *Cova Beneito* (Iturbe et al., 1993). The sequences in the *Cova del Salt* (Alcoi, Alicante), in the valley of *Polo*, and the nearby *Cova Beneito* (Muro, Alicante), are complete for the period.

**Upper Paleolithic (UP)**. The sequence of *Cova Beneito* documents the evolution of the Upper Paleolithic, from the Aurignacian-ca. 34,000 BP- to the Solutrean-Gravettian-ca. 16,500 BP. (Iturbe et al., 1993). Occupations were always located in caves or shelters, open-air settlements have not yet been documented.

**Late Upper Paleolithic (LUP)**. Broadly speaking, this period matches up with the Upper Magdalenian and the beginning of the Holocene industries (ca. 14,000-10,000 BP) in the regional sequence (Aura, 1995). The percentage of backed bladelets and burins in industries is higher than 60-70%, a defining feature of this moment. The sequences of *Cendres* and *Tossal de la Roca* (Villaverde, 1995; Cacho et al., 1995) are good examples of this.

The differentiation from the **Early Mesolithic (EM)** (ca. 10,000-8,000 BP), which matches the microlaminar Epipaleolithic, is based on the structure designed by Aura and Pérez Ripoll (1995). These authors point out an increase of end-scrapers, notches and denticulates, as well as a remarkable decrease of microlaminar tools and burins in the X millennium BP. Stratified collections belonging to this period scarcely exist (*Tossal de la Roca*)

The **Recent Mesolithic (RM)** or Geometric Epipaleolithic (8,000-6,800 BP) is characterized by the development of geometric microliths, mainly trapezoids and triangles. This period is well documented in the valleys of Alcoi in two sequences: *Tossal de la Roca* (Cacho et al., 1995) and *La Falguera* (Barton et al., 1990), the later in the valley of *Polo*. The late periods of these industries already had ceramics, and coincide with the early signs of farming and stockbreeding in the region.

Open-air sites are scarcely known. Only very recently some new information has indicated the existence of Late Mesolithic open air settlements. Such could be the case of *El Collado* (Oliva, Alicante), located on the present coastline (Aparicio, 1990).

**The Early Neolithic (EN)** falls within the wider impressed ceramics cultural horizon of Western Mediterranean (Bernabeu, 1989). Cardial decoration is representative of the early stages (NIA), while epicardial decoration (non cardial incised and impressed) is representative of more recent periods (NIB). The presence of animals (sheep and goats, cows, pigs and dogs) and plants (wheat, barley, peas and lentils) is documented in most of the settlements fitting the ceramic period, though not in all of them. This discrepancy is a central point in the debate about the neolithization process of the Iberian Peninsula (Bernabeu, 1997; Fortea et al., 1987; Zilhao, 1993; Vincent, 1997).

According to the sequences of *Cova del Or* (Beniarrés) and *Cova de les Cendres* (Teulada-Moraira) , the Early Neolithic chronology is between 6,800 and 5,800 BP. The levels of *La Falguera*, in the valley of *Polo*, belongs to these period, following the preceramic levels of the Geometric Mesolithic.

**The Middle Neolithic** (5,800-4,800 BP) has been identified in the stratigraphies of *Cova de les Cendres*, *Cova de la Falguera* and *Cova de Santa Mayra* (Castells de Castells, Alicante). Even so, the available information about this period is limited.

There is more information about the **Late Neolithic**. Recent research, including excavations of settlements and caves, provide a
wider view of deposition, living and social organization patterns of these groups (Bernabeu et al., 1993; Bernabeu et al., 1994).

The first aspect of these sites suggests an habitation in the valley watersheds. Habitat was organized in to large settlements (ca. 10-14 ha) but actually made up of widely spread domestic structures surrounded by ditches (Bernabeu et al., 1993 and 1994). The necropolis consist of collective burials in caves and shelters around the settlements.

Living is still based on farming and stockbreeding, but several changes in the exploitation of these resources can be observed. The analysis of the sacrifice patterns suggests a better use of secondary products.

Some changes pointing to a new model of settlement in the Bronze Age (3,800-3,200 BP) have been detected along the Bell Beaker (HCT: 4,200-3,800 BP). Metallurgy appears for the first time; previous settlements located in lower lands tend to disappear; individual burials in graves within the habitat appear. A restructuring of the territory into a set of hilltop or mountain-slope settlements can be made out. Inversions in the communal structure appear at this time; terraces or walls become common which imply a new type of social organization, the complexity of which is now being debated (Jover, López, 1995; Fernández, 1993).

3. Methodology

Our project was designed according to the fore mentioned objectives; we followed a strategy of survey and analysis that was not focused on settlements, but rather on stratified sampling units. Environments (Areas) with different characteristics were selected from all of the valleys along the river Acoi. Each area was then subdivided into Sectors and Subsectors.

We used topographic maps (1:10,000 scale) to delimit sectors: gullies, tracks and roads served as the limits, but we always tried to represent the diversity of the geomorphological regions in our final results. Aerial photography (1:9,000) was used to delimit subsectors, the limits of which were forced to match up with farming terraces. Consequently, subsectors have different areas. In this way, each survey unit could be characterized by a three digit code: Area, Sector and Subsector.

3.1. Sampling system and strategy.

The existence of different environments was taken into account in designing the survey in both valleys. Thus, 4 regions were defined in Polop, on the basis of their situation relative to the main fluvial stream (North-South) and their altitude. These four regions were called Upper North (UN), Lower North (LN), Lower South (LS) and Upper South (US). Each of them was subdivided into sectors and subsectors, which are the smallest survey units.

Two regions were defined in the valley of Penágula, on the basis of their altitude, and the following steps were the same as in the case of Polop. The identification of materials is simpler here: BP-2-4 means the valley of Penágula (BP), Sector and Subsector. Table 2 shows the results of this design.

Several descriptive sections were included in the field card, the concerned location, geomorphological features, visibility, land-use and finds, with simply a presence/absence recording of basic categories e.g., lithics, polished stone, ceramics (hand-made or wheeled) and structures.

3.2 Analysis techniques.

Flint and pottery

Material remains collected during field work were carefully analysed in the laboratory, the data of which were saved in a database. The data were then statistically processed using SPSS 6.1 program. In both cases, the results were exported to MapInfo (a GIS program) for later processing.
Flint and pottery were assigned several common descriptive methods: place where they were found-subsector; material state of remains: rogado (smooth) for flint, and erosionado (eroded) for pottery; total amount of objects with identical characteristics; number of times the site has been visited.

Regarding flint, rogado (ROD) variable takes into account the presence of ridges -not edges-, blunt-like or not; on the other hand, the existence or absence of a edge damage have also been considered: irregular flakes in the edges and the amount of them (Mec1=no signs; Mec2:25% edges; Mec3=>25%). In ceramics, only the first of these fields regarding the state of the surface has been taken into account (erosionado, EROS).

The next step in flint was the technological classification of the remains (flakes, blades, cores, etc). Morphological rather than metrical criteria have been considered in discriminating laminar products (blades and bladelets), i.e. more or less parallel edges that bear witness to their extraction from a laminar core.

Different fields (size, cortex, heel) give a detailed description of the categories above. Section (trapezoidal, triangular or irregular) and dimensions (if they are complete) fields are added when considering blades and bladelets.

Typological description comes after classification and technological description, once pieces with edge damage have been discriminated.

The ceramics description includes fields for the morphological classification (rim, neck, decoration) besides the already mentioned fields.

4. Taphonomy.

The variability observed in the densities of both lithics and ceramics (we are considering only prehistoric pottery here) is surprising.

One outstanding finding from Polop is the low frequency of ceramic objects (275 fragments) compared to lithic objects; 2676 cut lithic remains. In Penaguilla, on the contrary, ceramic frequency (2066 evidences) are roughly equivalent to that of flint (2658 evidences). Nevertheless, standard deviations clearly show a significantly varied density in both collections. The resulting pattern is characterized by a huge dispersion of material throughout the surveyed zones (Fig. 3; Table 3).

The form and distribution of surface collections may be understood as a consequence of prehistoric activity, but the picture may also be result of other factors. This raises two questions in regards to an understanding of prehistoric behavior:

a) Is the variability of the sampling significantly influenced by the observation (collecting) condition?

Observed densities may no doubt depend on both observation condition and prehistoric activity (Nance, 1994). Some experiences (Terranato, Ammerman, 1996) show that visibility (obscured by such things as vegetation) has a significant influence on the density of sites in a Km². In our case, we had to redesign the analysis, as the analysis was based on a strategy of arbitrary survey units.

Some factors, (e.g. the vegetation layer, the time of the day when the survey was carried out, the seasonal effects of farming and rainfall, as well as erosion and redeposition of the geomorphological processes) played a more or less important role in the variability of the observed densities.

Some of these variables were registered during field work allowing different subsectors to be divided into three categories, according to surface visibility conditions (vegetation, farming and rainfall). Thus, a subsector with little or no surface vegetation which had been recently ploughed, and or surveyed a few days after rainfall, would ha-
ve the highest visibility; on the contrary, the barren survey units, with plentiful and tall vegetation, would have a low degree of visibility.

On the basis of these groups, and considering separately lithics and ceramics density, Student T test was done to compare the average density of each group. Analysis were done in two levels: a) subsectors with remains; b) all subsectors (table 4).

The test shows some significant differences. For instance, differences in subsectors with some remains are significant (p<0.05) in ceramics and among those subsectors with middle or low visibility; if all subsectors are considered, differences between those with low visibility and the rest are significant. However, a different behavior between ceramics and flint was seen: average densities of ceramics were lower between V1-V3 than between V1-V3. Consequently, the following conclusions can be drawn:

- There is not a clear connection between an increase in visibility and higher average artifact density. For such a connection to exist, there should be an increase of average density between V2 and V3, but this is not the case.

- Yet, it is obvious that those subsectors with the lowest visibility have the lowest average densities, particularly in ceramics. This is because the subsectors with no remains are more significant in this group, as Table 5 shows.

- On the basis of previous observations, we can state that the level of remain densities are only partly influenced by visibility.

Other variables must have influenced our observations. Present density may have a significant bearing on, which would explain why materials are found even under low visibility conditions. Consequently, we can conclude that collecting conditions do not alter significantly the representative character of collected collections, that character being stronger, the more the low visibility subsectors are and the lower the present density of remains is. Visibility effects, then, will not distort significantly our analysis.

b) To what extent have postdepositional factors shaped the variability of our samples?

Even if our picture were to match with reality, the question as to what extent this reality matches prehistoric activities remains open. To answer this we must study not only the global structure of the sample, but also its differential distribution among the various survey units.

In order to evaluate the effects of these postdepositional factors (or at least some of them), different variables aimed at measuring the effect of these processes were quantified. Thus, variables such as Mec2, Mec3, undetermined fragments, or fractures (including flakes and fragmented blades) can be considered signs of tillage; variables such as ROD and EROS, on the other hand, seem to indicate natural processes.

Ceramic surface erosion proved useless, as most of the collected fragments, with no exception, had eroded surfaces. For this reason, we will focus exclusively on the lithic analysis (Table 6).

Processes that may have influenced the distribution and composition of surface collections were common in both valleys. For instance traditional ploughing, limited by farming terraces was one such processes. Both valleys seem to have been cultivated for thousands of years, though over varying periods of time. This activity, while uncovering buried materials, reduces the resolution of spatial distribution patterns.
Regarding this subject, the practice of making terraces seems to have had similar displacement consequences that predate the introduction of the plough. In this case, however, materials are not likely to travel long distances, and their diffusion falls quickly with time (Odeil, Cowen, 1987; Cowen, Odell, 1990). Actually, experience suggest that once a given distance has been traveled, the possibility of objects either moving back or away from their original position is balanced (Ammerman, 1985).

Terracing implies moving the land from a higher level and redepositing it on lower terrace. This suggests that materials on the higher terraces should belong to buried materials, those in middle terraces, to the original surface level, and those in the lower area should be mixed. Apart from this, movement of material will always take place within the limits of the terrace. Traces of ploughing, either traditional or mechanical, will also be detected, due in part to mechanical action: such as fractured material, edge damage, and a higher level of undetermined pieces.

Erosion, and the subsequent redeposition of materials, work on a higher scale, that may have altered the original distribution of the remains through a displacement of sediments in some zones with sharp slopes. Marly soils have facilitated the movement of materials that erode and redeposit with time, though they never go long distances from their original position. It may even happen in terraced areas, if farming fields were left for a long time. Together with this phenomenon, incision of fluvial streams—a seemingly recent occurrence—might have destroyed the record completely in several areas of the valley (Berbaneu et al. 1994: 10-11).

Given the homogeneity of post depositional factors, comparing the variables from both collections (especially samples that describe the state of the collection best) is surprising.

Pieces that show a slight mechanical alteration (Mec2: ca. 60%) predominate in both collections. The proportion of undetermined fragments and those that are identifiable (flakes and blades/bladelets) is high, but diverse. As a whole, the results show a collection consistent with a surface in use from constant farming. It would be interesting to compare these results with the corresponding results of collections from settlements in order to evaluate the influence of these processes. To this end, we have begun to analyze a collection from the Neolithic settlement of Nivet. From its results we will be able to establish if the values observed in the categories of undetermined fragments and the identifiable fragments can be understood a result of this process itself.

The most significant differences between both collections refer to proportions in the variables Mec1 (pieces with no mechanical alteration), Mec3 (very altered), and smooth (with clear evidence of erosion in their edges). Mec3 and Smooth clearly show higher values in Polop than in BP. The reason of this differential behavior becomes clearer through a more detailed analysis of the distribution of smooth pieces and those which have not been altered by technological or typological categories (Fig. 4).

The distribution of rolled pieces in Polop indicates that they concentrate in categories thought to represent an older chronology (Levallois /discoid cores, Scrapers, end-Scrapers). The proportion of the most recent pieces (blade cores, backed tools, geometric tools, retouched blades/bladelets) are very low or do not exist at all. The situation is the same in the BP collection, though the size of the sample (50 rolled pieces) does not allow a similar detailed analysis.

Categories with no samples of mechanical action tend to concentrate on the most recent pieces in both cases. Some interesting conclusions can be drawn from these observations:
- Firstly, smooth pieces seem to be associated with their own original chronology. Size is not likely to be a variable worth considering, as the cores show: levallois, flakes and blades are nearly the same size, but they have different proportions of eroded or mechanically retouched pieces (Fig. 4, b).

- Secondly, we may assume that these pieces were originally located in sharply sloped areas and, consequently, more likely to have undergone the earlier mentioned eroding processes.

- As a consequence, when we interpret the results of land-use patterns, we must take in consideration that these pieces was found in lower levels, as part of more recent collections.

The surface collection chronology can provide additional information with which to check these assumptions.

5. Chronology of Surface Collections

As we said earlier, the difficulty in organizing a surface collections made up of prehistoric material into some kind of chronological order is possibly one of the reasons why systematic survey projects based on an off-site strategy have made little impact.

We approached this problem by devising a rank system where every subsector was given a probability of belonging to each chronological period. The rank was based on the presence/absence of particular archaeological artifacts.

5.1. Chronology, ranks, and probabilities

From the most characteristic elements, on diachronic level, we developed a chronological evaluation criterion for surface remains. Table 7 states explicitly the criteria used to assign the ranks according to periods. Once these criteria were applied, each subsector received an assigned probability of belonging to every chronological period.

We should stress that, as we move forward along the chronological scale, the resolving capacity of materials is higher, thus the highest ranks (5 and 6) have not the same defining difficulty in all the cases. A comparison of preceramic and ceramic periods for a rank =6 shows that the distinctive factor in the former is defined by the combination of various objects, as well as by the lack of other objects. In the ceramic levels, the presence of a particular remain is sometimes enough to consider the highest probability in assigning a given chronology.

On the other side, some subsectors were visited twice or three times in the intervening years as the field work was carried out. A previous analysis of the chronological ranks has shown that there may be significant differences, if all the available information (all the collected materials) is used between the original survey and the subsequent surveys. In order to minimize errors that may derive from this circumstance, we have used all the available information to assign chronological rank to each subsector; in later calculations, however, only the materials collected in the first field work were taken into account, which guarantees a uniformity in the analyzed sample.

Figure 5 shows the Total Occupied Area for each period in both valleys. Its values are the summed area (Km²) by chronological periods, considering three different degrees of probability.

Figure 5A shows the added values of ranks 3 to 6. Rank 3 is less demanding concerning presence, but as restrictive as ranks 5 and 6 concerning absences.

Figure 5B includes rank 4, whose characteristics are similar to rank 5, although less restrictive, as it demands no absences.

Figure 5C adds up ranks 5 and 6, i.e. the ranks most likely to belong to their respective chronological periods.
In spite of several variations, the essentials in both collections are kept regardless of the value of the rank used to assign each subsector to a particular chronological period. The most remarkable effect of using progressively higher ranks is the reduction of the occupied area for each period, with not a significant change in the observed tendency.

By using all the rank=3 or higher implies an availability of larger samples that, however, do not have a high chronological resolution. Rank 4, which allows for the possibility that collections belong to several different periods, demands the combined presence of various items. That is why we will base our observations on subsectors with a rank>3. It means admitting that the Late Upper Paleolithic periods in both valleys, the Middle Neolithic in Polop, and the Late Mesolithic in Penaguila (BP) are not represented.

Differences between Polop and Penaguila are evident: while preceramic periods, particularly the Middle Paleolithic, in Polop provide the great part of the materials, these same periods are practically nonexistent in Penaguila, whose materials seem to be related to ceramic periods. It corroborates the first impressions after the taphonomic analysis. These impressions, however, may be deceptive. We need some quantification that associates in an unequivocal way the probability that smooth material belongs to the most ancient periods.

The Local Density Index (LDI) measures the density of finds that are likely to belong to a given period, i.e. according to their rank. Their values, besides being an indispensable element (see later) for the understanding of the occupation/exploitation patterns, can be used to check the assumption that rolled materials must be related, in most cases, to the oldest collections. Fig. 6 shows the correlation coefficients (Pearson’s R) between the percentage of smooth material and the LDI for subsectors rank > 3 within each period. The results corroborate the initial assumptions:

- The values in Polop are 0.8 or higher for MP, UP and bell beaker periods, but are only statistically significant (p<0.05 of getting similar values in a random series) for the first two periods.

In BP, this relation only appears for the Upper Paleolithic period (the Middle Paleolithic being poorly defined in BP, as we noted earlier).

The consequence is evident: research on the settlement patterns that concern the differential location of settlements can only be carried out with reference to the oldest collections (Middle Paleolithic and, to a lesser extent, Upper Paleolithic).

If, alternatively, we merely describe and interpret globally those characteristics that define the patterns of occupation/exploitation, the picture of the long term tendency will not be significantly distorted as a result of postdeposition alterations.

6. Land-Use Dynamics: Descriptive Values

We use two related variables to describe the pattern and distribution of the surface collections: Frequency/Recurrence and Specialization/Diversification.

6.1. Frequency and Recurrence. Seize and Intensity of Occupation

While the calculation of occupational use area allows one to evaluate the importance of each chronological period to the collection as a whole, it may mislead if these values are used as the occupations Frequency Index (FI). We should note, for instance, that the Middle Paleolithic covers a longer period than all other periods as a whole. Consequently, if we want to get more accurate information about occupation frequency, we need an index that relates the occupied area to the temporal probability of its occupation. In our case, we divided the total extension by the number of millenia in each period, according to the following va-
Similarly, the calculation of the occupied extension tends to minimize the actual differences between various occupation types. It is difficult to establish these types on the basis of surface collections, but material density can be used as an index to provide information about intensity (absolute values) and recurrence of occupation (repeated frequency of occupation at the same place).

This information can be obtained through the Local Density Index (LDI). LDI is found by multiplying the rank of a collection (subsector) by the density of its materials, differentiating between preceramic and ceramic periods. Finally, original values are transformed into Z values, so that they can be compared between different periods and to make their graphic processing on plans easier. Thus, every subsector will have two values: one reflecting the probability of belonging to a particular period (rank); the other trying to reflect the kind of occupation (LDI), which ranges from high to low density.

The Intensive Occupation Area is calculated from LDI values, as the sum per periods of the areas (km²) with rank >3 and LDI>1s. If, as it happens with extension, their values are measured according to the millenia each period covers, the resulting value may be understood as the Recurrence Index (RI) of the occupation, the higher RI, the higher LDI. This index, if combined with frequency, yields an interesting information to describe the trends in the regional occupation/exploitation.

6.2 Specialization and Diversification

Densities and their variation can also provide us with relative information regarding the degree of specialization/diversification in the exploitation of regional resources. However, it would be pretentious of us to insist that all possible activities could be understood from surface collections. Our only interest lies in having information available with which subsectors can be ordered based on their density and variation. This assumes that a set of activities, limited or large are properly reflected in the object density of subsectors.

We understand that the tendency for artifact density and artifact type variation (calculated as the Coefficient of Variation) with time reflects an increase in the kinds of activities and, consequently, an increase in the exploitation of resources. The average density and the Coefficient of Variation have been calculated from of all subsectors with a rank>3.

Differences in the exploitative specialization of resources can be considered at a spatial level. If we divide the calculation of the proportion Intensive Occupation Area and the Total Occupied Area for every period, we get a picture of the evolutionary trend (ELI: Specialized Locational Index). Clearly, the highest specialization will coincide with a value of 1, where all the occupied lands will have a LDI higher than 1. This value, however, must be compared with the Total Occupied Area, so that specialization can be compared with periods in which it shows lower values.

7. Land-Use Dynamics: Some Understandings

Charts in Figure 7 summarize the information about frequency/recurrence and specialization/diversification in both valleys (A, B, and C for Polop, D, E, F for BP). In order to compare average densities and their corresponding variation coefficients at different scales, the absolute values of the former (objects/Km²) were divided by 10,000. The following conclusions can be drawn after the comparison:

7.1. Preceramic periods in Polop can be divided into two groups. In the early stages (Middle Paleolithic) a remarkable feature of
the occupation and exploitation of resources is the sporadic though recurrent pattern of land-use. This pattern persists for the entire 40,000 years of the Middle Palaeolithic. The low frequency of occupation, together with the lower average density per period, and an average variability (VC=1) in the kinds of occupation, suggest a barely diversified pattern in the exploitation of resources. Nevertheless, there is no spatial correlation: a low proportion of intensive occupation causes a diversified spatial distribution (Fig. 8).

The change in tendency seems to appear in the Upper Palaeolithic. Its characteristics are: a gradual increase in frequency, that despite recurrence is kept within moderate limits; a slight increase in the average density of artifacts per period (0.21-0.25 compared to 0.18 in the Middle Palaeolithic) and a lower coefficient of variation quotient; a reduction of the total occupied area and an increase in the ELL, which moves into its highest values in the Early and Late Mesolithic periods (values for the Late Mesolithic should be considered carefully, as only one subsector has a rank=4).

Overall, activity was concentrated in very limited zones that were repeatedly visited, and a wider range of activities were carried out in these zones, as the increase in the average density shows. Outside these sites, the impact of the occupation/exploitation is very limited, and so low in intensity that very few areas from focal points (Figs. 8 and 9). When comparing this picture with that corresponding to the Middle Palaeolithic, there is a remarkable reduction in occupational intensity and a lack of a low intensity evidence.

This is probably the result of a situation in which foragers often repeatedly visited the same places as part of a year round cycle. We are facing then, an increase in diversification, both in the exploitation of resources, and in the location of settlements. There is not much evidence from the Early Neolithic, but it seems to suggest that the tendency did not change significantly from the previous model.

7.2. The dramatic change in the exploitation of resources and in the occupation patterns likely took place in Polop during the Late Neolithic. Frequency and recurrence of occupations change dramatically, as Fig. 7A shows. The increase of average density (the highest one in the valley) and the Coefficient of Variation clearly suggest a higher intensification and diversification; the low Specialized Locational Index, moreover, points to the existence of remarkable occupational diversity, places with a high level of activity, and other more marginal places all, within a context where the proportion of intensive occupation decreases in relation to the total occupied area, which increases in relation to the Early Neolithic.

This suggests a village farming organization, with a stable central occupation, where energy consuming activities were carried out, and the widest range of activities took place. Apart from it, other locations can be found, which are characterized by lower recurrence and diversity, or greater specialization. The map at the top of Fig. 10 shows this situation, with a set of subsectors that are located in the center of the valley, where most of the materials from the period are concentrated. With regards to this period, the HOT suggests a reduction of the occupied area and a clear tendency towards specialization (Figs. 7B and C).

7.3. Preceramic periods in Penaguila (BP) are not that important (as, for instance, the small absolute extension ascribed to the Middle Palaeolithic shows). The pattern of the periods (UP and EM) does not differ from that described in Polop.

The Early Neolithic, however, displays a similar pattern to that described for the Late Neolithic in Polop (Figs. 7D, E and F).

We are inclined to interpret this model as the consequence of a new village system inaugurated by Neolithic groups: radial exploitation focused on areas of highest re-
source density and diversity. This would produce a location pattern characterized by densely occupied central areas, surrounded by other less densely occupied areas. Other locations that reflect more sporadic or specialized occupations may exist in further out or alternatively, there may be new occupations derived from the segmentation of the original group.

Fig. 11 shows the distribution of the subsectors belonging to the Early Neolithic according to LDI values. The spatial organization described above can be clearly seen: a central core, (Sector BP-2; subsectors 4 and 6) where areas with the highest density concentrate, surrounded by others with a decreasing LDI. Another small core, made up of two subsectors further up the river courses (Sector BP-3), points the presence of one of these more specialized occupation points.

7.4. The expanding occupation of the valley, based on the same organizational pattern, reached its most important development in the Late Neolithic (Fig. 12). The densest occupation and greatest intensity of exploitation belong to this period, which shows an expansion of the settlement. Ironically, the next period, basically defined from denticulated sickle tools, has the opposite effect: the occupied area become smaller, and the average density and the variation coefficient dropped (Fig. 7 D and F). This tendency, in more pronounced way, can also be seen in Polop.

This process announces the characteristics of the Bronze Age, when occupations tend to be located on the highest levels in the valleys. A clear change in the farming system takes place at this time (ca. 3.800-3.200 BP): from a farming point of view, increasingly marginal areas were occupied and exploited after the introduction of the plough. From this perspective, we might understand a lack or a small presence of occupation from Bell Baker period and from the Bronze Age, the results of a farming exploitation directed from other sites was considered beyond the surveyed sectors: on the hilltops of the surrounding valleys (Bernabeu et al. 1989).

8. Discussion

The results of comparing two collections belonging to Polop and Penâguila river valleys have been presented in the sections above. Both collections were collected as part of a systematic survey project based on an off-site sampling and analysis strategy.

This kind of survey strategy is unusual in Spain, where locating settlements is the systematic survey project's starting point. In the course of our investigation we have learned that this methodological perspective did not fit the nature of the surface register, often characterized by a continuum of materials with varying densities. Using the settlement as a central focus has raised two serious problems:

- what densities should or should not be considered settlements,
- what densities should be disregarded in the analysis beyond the arbitrary limits imposed by the first problem.

The off-site survey strategy frees us from these problems and allows to examine all available information which we can use to enrich our understanding of region-wide occupation and resource exploitation strategies.

It is not our intention to outline alternative conclusions. Rather we have intended our conclusions to complement others reached by alternative survey techniques and excavation. Ultimately our conclusions will have to be compared against those from excavation. Some of the conclusions are worth discussing:

1. Toponomic analysis has shown that collections in a secondary position are more likely to be associated with older periods in both valleys. However, this does not apply to all subsectors, but it clearly limits
an approach where location is an important variable. Therefore, more detailed analysis of subsectors should be carried out, including variables, such as slope or present-potential erosion of floors.

All variables concerning the impact of constant farming on surface collections must be compared to collections from stratified contexts. Nevertheless, in order to explain the observed variability between Polop and Penáguila (i.e., the proportion of indeterminate fragments (much higher in Polop) and identifiable fragments higher in Penáguila) other variables will have to be studied. For instance, in Polop, the highest proportion of indeterminate fragments may be due to constant farming in places where raw material is located. In Polop, resources are plentiful and accessible through ploughing, which is not the case in Penáguila. If this were true of Penáguila, this category might have been included in all the calculations that indicate use density.

2. Broadly speaking, understandings of regional occupation/exploitation patterns are mutually consistent. However, the different behavioral pattern revealed in Polop and Penáguila concerning the appearance of village organization (Recent Neolithic in Polop, and Early Neolithic in Penáguila) must be explained. The central feature of the debate about the transition to agriculture has been polarized between the so-called indigenous position (diffusion of information) and migration position (diffusion of population).

The dual model (Bernabeu, 1997) suggests that the neolithization process did not end with the assimilation of local Mesolithic groups, even in places where Mesolithic groups came in contact with expanding Neolithic groups. After the initial stages, the stabilization of an agricultural border (caused by ecological and social factors), gave rise to interaction where by Mesolithic groups experienced a neolithization process. A segregation between both communities, which keep different territories throughout the whole process, was the consequence of that situation. Different economic and cultural variables enable us to read this territorial segregation in the peninsular Mediterranean area.

This situation is likely to give a more accurate understanding of the observed pattern in Polop and Penáguila. Thus, settling of Neolithic groups in regions with favorable ecological conditions for the development of early farming systems (Penáguila) favors interaction processes with Mesolithic groups located in the border (Polop), that eventually will end up transforming. Along all this period, not only the use of economic resources, but also the territory occupation and exploitation patterns keep different between both groups, in spite of not being far away one from the other, as it happened in the case we discuss in this paper. The shelter of La Falagueia, with superimposed aceramic and ceramic levels, in the Polop valley is being excavated now, and the information to check this assumption will be provided by this excavation.
BIBLIOGRAPHY


<table>
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<tr>
<th>PERIOD</th>
<th>&quot;C BP</th>
<th>SITE</th>
</tr>
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<tr>
<td>MIDDLE PALOLITHIC (MP)</td>
<td>80,000-39,000</td>
<td>Beneto Cave</td>
</tr>
<tr>
<td>UPPER PALOLITHIC (UP)</td>
<td>35,000-14,000</td>
<td>El Salt, Cave</td>
</tr>
<tr>
<td>LATE UPPER PALOLITHIC (LUP)</td>
<td>14,000-10,000</td>
<td>Tossal de la Roca, Shelter</td>
</tr>
<tr>
<td>EARLY MESOLITHIC (EM)</td>
<td>10,000-8,000</td>
<td>Tossal de la Roca, Shelter</td>
</tr>
<tr>
<td>LATE MESOLITHIC (LM)</td>
<td>8,000-6,800</td>
<td>Cendres</td>
</tr>
<tr>
<td>EARLY NEOLITHIC (EN)</td>
<td>6,800-5,800</td>
<td>La Falguera, Shelter</td>
</tr>
<tr>
<td>MIDDLE NEOLITHIC (MN)</td>
<td>5,800-4,800</td>
<td>Cendres</td>
</tr>
<tr>
<td>LATE NEOLITHIC (LR)</td>
<td>4,800-4,200</td>
<td>Or, Cave</td>
</tr>
<tr>
<td>BELL BEAKER (HCT)</td>
<td>4,200-3,800</td>
<td>Les Jovades, Open air site</td>
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Table 1. Regional framework based upon stratified sites.

<table>
<thead>
<tr>
<th></th>
<th>POLOP</th>
<th>PENAGUILA (BP)</th>
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<tbody>
<tr>
<td>Total Area</td>
<td>6.37</td>
<td>8.09</td>
</tr>
<tr>
<td>Random</td>
<td>2.53 (39%)</td>
<td>1.56 (20%)</td>
</tr>
<tr>
<td>No Random</td>
<td>1.19 (18%)</td>
<td>0.56 (7%)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3.72 (57%)</td>
<td>2.12 (27%)</td>
</tr>
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</table>

Table 2. The sq. Km and proportions of surveyed areas in Polop and Penaguila valleys.

<table>
<thead>
<tr>
<th></th>
<th>Lithics</th>
<th>Ceramics</th>
</tr>
</thead>
<tbody>
<tr>
<td>POLOP</td>
<td>Average: 1132.5</td>
<td>Average: 198.5</td>
</tr>
<tr>
<td></td>
<td>S. Deviation: 2974.8</td>
<td>S. Deviation: 1861</td>
</tr>
<tr>
<td></td>
<td>Rank: 0-23968.6</td>
<td>Rank: 0-22969.9</td>
</tr>
<tr>
<td>PENAGUILA (BP)</td>
<td>Average: 1342.6</td>
<td>Average: 1346.1</td>
</tr>
<tr>
<td></td>
<td>S. Deviation: 4448.4</td>
<td>S. Deviation: 5009.1</td>
</tr>
<tr>
<td></td>
<td>Rank: 0-49428.5</td>
<td>Rank: 0-57500</td>
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Table 3. Observed distribution on lithics and ceramics.
<table>
<thead>
<tr>
<th>Visibility Groups</th>
<th>Sample 1</th>
<th>Average</th>
<th>Standard Deviation</th>
<th>T Test</th>
<th>Sample 2</th>
<th>Average</th>
<th>Standard Deviation</th>
<th>T Test</th>
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<tr>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>V1</td>
<td>14</td>
<td>15.9</td>
<td>59.4</td>
<td>-3.11</td>
<td>47</td>
<td>4.7</td>
<td>32.4</td>
<td>-3.08</td>
</tr>
<tr>
<td>V2</td>
<td>27</td>
<td>3263.2</td>
<td>5416.8</td>
<td>&lt;0.01</td>
<td>43</td>
<td>2049.1</td>
<td>4550.9</td>
<td>&lt;0.01</td>
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<tr>
<td>V3</td>
<td>74</td>
<td>7.1</td>
<td>7197.8</td>
<td>0.22</td>
<td>106</td>
<td>1659.5</td>
<td>6100.9</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>V2</td>
<td>27</td>
<td>3263.22</td>
<td>5262.5</td>
<td>0.56</td>
<td>43</td>
<td>2049.116</td>
<td>4550.9</td>
<td>0.43</td>
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<td>V3</td>
<td>74</td>
<td>377.1</td>
<td>7197.8</td>
<td>0.56</td>
<td>106</td>
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<td>6100.9</td>
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<td>Lithics</td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>V1</td>
<td>14</td>
<td>923.3</td>
<td>1242.9</td>
<td>-1.2</td>
<td>47</td>
<td>275.1</td>
<td>766.6</td>
<td>-1.89</td>
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<td>V2</td>
<td>27</td>
<td>4106.8</td>
<td>9806.6</td>
<td>0.23</td>
<td>43</td>
<td>2578.7</td>
<td>7972.9</td>
<td>0.07</td>
</tr>
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<td>V3</td>
<td>74</td>
<td>1883.2</td>
<td>3629.9</td>
<td>0.33</td>
<td>106</td>
<td>1314.6</td>
<td>3148.9</td>
<td>&lt;0.01</td>
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<tr>
<td>V2</td>
<td>27</td>
<td>4106.61</td>
<td>9806.6</td>
<td>1.15</td>
<td>43</td>
<td>2578.7</td>
<td>7972.9</td>
<td>1.01</td>
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<tr>
<td>V3</td>
<td>74</td>
<td>883.2</td>
<td>3629.9</td>
<td>0.26</td>
<td>106</td>
<td>1314.6</td>
<td>3148.9</td>
<td>0.32</td>
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Table 4. The effect of visibility on the observed densities of lithics and ceramics in Penaguila valley. For comparative effects a T Test was calculated separately between Subsectors with finds (sample 1) and all Subsectors (Sample 2).

<table>
<thead>
<tr>
<th></th>
<th>V1</th>
<th>V2</th>
<th>V3</th>
<th>TOTAL</th>
</tr>
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<tbody>
<tr>
<td>0</td>
<td>33 (70%)</td>
<td>16 (37%)</td>
<td>32 (30%)</td>
<td>81 (41%)</td>
</tr>
<tr>
<td>1</td>
<td>14 (59%)</td>
<td>27 (63%)</td>
<td>74 (70%)</td>
<td>115 (59%)</td>
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<tr>
<td>TOTAL</td>
<td>47 (24%)</td>
<td>43 (22%)</td>
<td>106 (54%)</td>
<td>195</td>
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Table 5. Subsectors without (0) and with artifacts (1) by visibility groups: V1= poor; V2= middle; V3= good.

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Smooth</th>
<th>Mec1</th>
<th>Mec2</th>
<th>Mec3</th>
<th>F.Indet.</th>
<th>Fracturas</th>
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<tr>
<td>POLOP</td>
<td>2672</td>
<td>355</td>
<td>397</td>
<td>1590</td>
<td>685</td>
<td>1464</td>
<td>755</td>
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<tr>
<td></td>
<td></td>
<td>(0.12)</td>
<td>(0.15)</td>
<td>(0.60)</td>
<td>(0.25)</td>
<td>(0.55)</td>
<td>(0.23)</td>
</tr>
<tr>
<td>BP</td>
<td>2658</td>
<td>50</td>
<td>623</td>
<td>1696</td>
<td>339</td>
<td>967</td>
<td>1186</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.02)</td>
<td>(0.23)</td>
<td>(0.64)</td>
<td>(0.13)</td>
<td>(0.36)</td>
<td>(0.44)</td>
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Table 6. Absolute values and proportions of the taphonomic variables in Polop and Penaguila (BP) collections.
Table 7. Chronological periods and associated ranks. P= Presence; A= Absence.

<table>
<thead>
<tr>
<th>Period</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
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<tbody>
<tr>
<td><strong>LATE</strong></td>
<td>P: Pilecha + Labs. + Hinv.</td>
<td>P: Pilecha + (Hinv or Lebo)</td>
<td>P: Pilecha or hinv or Labs.</td>
<td>P: Blade Tech. + (Hret, Tidro, ehoz, Ceramic or G1)</td>
<td>P: Blade tech + (Hret, Tidro, ehoz, Pottery or G1)</td>
<td>P: Lithics, pottery</td>
<td>A: Artifacts</td>
</tr>
<tr>
<td><strong>MIDDLE</strong></td>
<td>P: Esgr.</td>
<td>P: (Hinv or G2) + (Epi or Peina)</td>
<td>P: (Hinv or G2) + (Epi or Peina)</td>
<td>P: Blade tech. + (Hret, ehoz, Pottery or G1)</td>
<td>P: Blade tech. + (Hret, ehoz, Pottery or G1)</td>
<td>P: Lithics, pottery</td>
<td>P: Lithics, pottery</td>
</tr>
<tr>
<td><strong>EARLY</strong></td>
<td>P: Card.</td>
<td>P: Epi+ (G1 or Trc); (Hret, Tidro or ehoz) + (G1 or Trc) + Pottery</td>
<td>P: Epi+ (G1 or Trc); (Hret, Tidro or ehoz) + (G1 or Trc) + Pottery</td>
<td>P: Blade tech. + (Tidro, Hret, ehoz, Pottery or G1)</td>
<td>P: Blade tech. + (Tidro, Hret, ehoz, Pottery or G1)</td>
<td>P: Lithics, pottery</td>
<td>P: Lithics, pottery</td>
</tr>
<tr>
<td><strong>LATE MESOLITHIC</strong></td>
<td>P: (G1 o M1) + dorso + (Rsp or Trc)</td>
<td>P: (G1 o M1) + Rsp + (Dorso or Trc)</td>
<td>P: (G1 o M1) + Rsp + (Dorso or Trc)</td>
<td>P: Blade Tech. + (G1, Trc or Rsp)</td>
<td>P: Blade tech. + (G1, Trc or Rsp)</td>
<td>P: Lithics</td>
<td>P: Lithics</td>
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<tr>
<td><strong>EARLY</strong></td>
<td>P: Dorso + Rsp + myd.</td>
<td>P: (Dorso or Rsp) + MyD.</td>
<td>P: (Dorso or Rsp) + MyD.</td>
<td>P: Blade tech or Rsp or Dorso.</td>
<td>P: Blade tech or Rsp or Dorso.</td>
<td>P: Lithics</td>
<td>P: Lithics</td>
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<tr>
<td><strong>MESOLITHIC</strong></td>
<td>A:G1,G2,hoz,Tidro, Pottery, Pilecha</td>
<td>A:G1,G2,hoz, Tidro, Pottery, Pilecha</td>
<td>A:G1,G2,hoz, Tidro, Pottery, Pilecha</td>
<td>A:G1,G2,hoz, Tidro, Pottery, Pilecha</td>
<td>A:G1,G2,hoz, Tidro, Pottery, Pilecha</td>
<td>A: Lithics</td>
<td>A: Lithics</td>
</tr>
<tr>
<td><strong>LATE UPPER</strong></td>
<td>P: Rsp + Brl + Dorso</td>
<td>P: Dorso + (Brl or Rep.)</td>
<td>P: Dorso + (Brl or Rep.)</td>
<td>P: Blade tech. or Rep. Brl or Dorso.</td>
<td>P: Blade tech. or Rep. Brl or Dorso.</td>
<td>P: Lithics</td>
<td>P: Lithics</td>
</tr>
<tr>
<td><strong>PALEOLITHIC</strong></td>
<td>A:G1,G2,hoz,Tidro, Pottery, Pilecha</td>
<td>A:G1,G2,hoz,Tidro, Pottery, Pilecha</td>
<td>A:G1,G2,hoz,Tidro, Pottery, Pilecha</td>
<td>A:G1,G2,hoz,Tidro, Pottery, Pilecha</td>
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<td>A: Lithics</td>
<td>A: Lithics</td>
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<td><strong>UPPER</strong></td>
<td>P: Blade tech. + Rsp + Brl</td>
<td>P: Blade tech. + (Rsp or Brl)</td>
<td>P: Blade tech. + (Rsp or Brl)</td>
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<td>P: Blade tech or Rsp or Brl</td>
<td>P: Lithics</td>
<td>P: Lithics</td>
</tr>
<tr>
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<td>A:G1,G2,hoz,Tidro, Pottery</td>
<td>A:G1,G2,hoz,Tidro, Pottery</td>
<td>A:G1,G2,hoz,Tidro, Pottery</td>
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<td>A: Lithics</td>
<td>A: Lithics</td>
</tr>
<tr>
<td><strong>MIDDLE</strong></td>
<td>P: Flake tech + Myd + Must.</td>
<td>P: Flake tech. + (Must. or myd)</td>
<td>P: Flake tech. + (Must. or myd)</td>
<td>P: Flake tech. + (Must. or myd)</td>
<td>P: Flake tech. + (Must. or myd)</td>
<td>P: Lithics</td>
<td>P: Lithics</td>
</tr>
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</table>
Figure 1: Survey area project.
Figure 2: Polop (A) and Penáguila (B) valleys. Surveyed sectors in grey.
Figure 3: Subsectors by densities in Polop and Penáguila (BP) valleys.
Figure 4: Smooth ridges (ROD) and edge damage (MEC) by technological and typological categories in BP (A) and Polop (B).
Figure 5: Summed areas by period of Polop (Plp) and Penáguila (BP) using subsectors with rank>3 (A), rank>4 (B) or rank>5 (C).
Figure 6: Correlation coefficients between smooth ridges and chronological periods in Polop (PlpRod) and Penáguila (BPRod)
Figure 7: Comparative values of different indexes from collections of Polop (Pip) and Penáguila (BP). See text (points 5 and 6) for explanation. Fl= Frequency Index; RI= Recurrence Index; Extnt= Total Occupied Area; ELI= Especialized Locational Index; CV= Coefficient of Variability; Xden= mean of artifact density.
Figure 8: Polop valley.
Figure 9: Polop valley.
Figure 10: Polop valley.

Figure 11: Penáguila valley. Subsectors with rank>3 by LDI values. Early Neolithic.
Figur 12: Penáguilla valley. Subsectors with rank>3 by LDI values. Late Neolithic.