Inside the Palimpsest: Identifying Short Occupations in the 497D Level of Cova Gran (Iberia)

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1 Identifying Archaeological Short-Term Occupations: Limits and Possibilities

Characterization of hominin evolutionary patterns is embedded with attributes implied in evidence of biosocial organization in settlements. Home base, kill site and quarry site are models that reveal temporal/spatial activities supporting hunter-gatherer biosocial organization (Isaac 1971, 1986; Foley 1981). Settlement concentrates inputs from the landscape and generates outputs that trace movement in space and time and of different range scales, from activities occurring in areas local to or on-site to movements into or away from a particular geographic area. Short-term occupations indicate a settlement pattern resulting from activities that occurred in the short term and incorporate evidence providing information on mobility, site function and site organization (Vallverdú et al. 2005; Bon et al. (eds.) 2009; Picin 2016 and references therein).

Level 497D, at Cova Gran de Santa Linya, illustrates the difficulty in detecting short-term patterns. The slim vertical thickness of the level provides a stratigraphic resolution allowing us to examine and discuss the limits and potential of detecting brief occupations within a palimpsest. Here we present an explicitly archaeo-

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graphic method focussed on analysis of the geometry and relationships between the position of artefacts (*sensu* Clarke 1978), including lithic tools, bone remains and combustion structures. The method combines two lines of analyses with visual representations to infer cycles of installation/abandonment/reuse: evaluation of the vertical dispersion to identify stratification processes indicating different temporal events; and examination of the distribution and interaction of raw materials on the horizontal plane to detect diachronic relationships. These indicators serve to question whether short-term events could have been a regular settlement pattern in prehistoric hunter-gatherer sites.

1.1 Mobility, Settlement and Site Formation Processes

If we regard settlement as a landscape that records the installation and activities of hunter-gatherers, we can relate it to mobility patterns, that is, with fundamental elements associated with the acquisition of basic resources needed to guarantee the biosocial continuity of the group (Dunnell and Dancey 1983; Shott 1986; Kelly 1995; Bettinger et al. 2015).

Various elements which form part of group movements through different temporal/spatial ranges, such as group size, duration of occupation and habitat quality, affect the size of the area exploited. The relationship between size of the area and foraging distance must subsequently affect any decision to move camp to avoid contact with areas already depleted of resources (Grove 2010). While dependence on plants and animals may explain any intention implied in acquiring resources distributed heterogeneously in time and space, it is not the sole factor (Kelly 1992; Whallon 2006; Pearce 2014). Human resilience, understood as the capacity to respond to and recover from internal or external disturbances (Gunderson and Holling 2002), is another factor. Mobility absorbs stressful situations caused by climatic and/or environmental constrictions while enabling formation of networks between subsistence and social systems and improving resource sustainability (Redman 2005; Brädtmoller et al. 2017).

Analysis of the relationship between settlement and mobility is indebted to Binford's (Binford 1979, 1981, 1982) concepts of *forager* and *collector*, applied to appraise on/off site activities occurring in the landscape. Two main categories are defined according to the type of activity determined: location and home base. Location refers to special activity sites, often barely visible, where task groups undertake short-term, extraction activities such as hunting/butchering animals, or replenishing/collecting raw materials. Transport of materials to the home base serves to centralize their distribution among the group and, in doing so, records activity and artefact input from the landscape, while other materials generate output. Residential movement is key to this diagnosis. In the collector model, stockpiling of food facilitates the spacing of residential movement and could imply long journeys to a new emplacement. Dependence on resources in the forager model entails frequent but not necessarily long-distance residential changes. While these systems do not imply necessarily an orthodirectional sense, ethnoarchaeological data indicate that larger groups who settle for extended periods are attributes of collector model and could have evolutionary implications (Grove 2010).

On a functional and organizational level, home base and locations are complementary and interdependent entities, but establishing archaeological links between them is not straightforward (Isaac 1986; Kelly 1995). Likewise, ethnoarchaeological data suggests that it is not always easy to distinguish between home bases and kill sites without contextual information (Bartram et al. 1991; Gregg et al. 1991; O'Connell et al. 1991). Moreover, documentation indicates the dynamic nature of ethnoarchaeological sites whose re-use implies changes in function (Gifford and Behrensmeyer 1977; Gifford 1989). The examples given here remind us that the dichotomy of special purpose/domestic activities may not cover the spectrum of possible relationships between site function and mobility.

Application of these ideas to the archaeological record involves actions with discreet time ranges, integrated within accumulations assumed to have been generated over a long temporal scale that is difficult to determine, even with the aid of radiometric indicators (Stein and Deo 2007). This dichotomy affects interpretation of the spatial/temporal dimensions of activities in the archaeological record (Bailey 2007; Malinsky-Buller et al. 2011; Martínez-Moreno et al. 2015). Furthermore, the concept of palimpsest implies assumption of our limited knowledge of the role of cultural and natural processes (*C-Transform* and *N-Transform*) that influence our perspective of the interpretation of the archaeological record (Schiffer 1972, 1983).

Dibble et al. (2016) disparage the tendency to search for fine slices of time under the common assumption that ideal archaeological sites are those preserving intact records of contemporary behaviours operating within an ethnographic or human time scale to which the archaeological observer can relate; such assumptions underlie alleged high-resolution sites in which *C-Transform* archaeological modifications are directly associated with human behaviour. The influential interpretive model defined in Pincevent (Leroi-Gourhan and Brezillon 1966) presents a way to understand those pristine sites that follow similar methodological principles, such as the excavation of large surfaces and their spatial/temporal interaction through refitting in order to infer technical, spatial and social patterns (Carbonell (ed.), 2012 and references therein; Vaquero 2012; Vaquero et al. 2017).

Nevertheless, techniques such as soil micromorphology indicate that in the biosphere/lithosphere transition, cycles of sedimentation/resedimentation – *N transforms* – affect the archaeological record (Courty et al. 1989; Goldberg and Macphail 2008; Canti and Huisman 2015). Such observations have been challenged through consideration of geological and biological syn/post-depositional processes that potentially play significant roles in the formation of an archaeological assemblage (Dibble et al. 2016). It is debatable whether the archaeological record can be considered as a static entity or direct interpretation can be advanced on the basis of high-resolution sites. Alternativelly, we consider the structure of the archaeological record the dynamic successions of interacting processes that accumulate from the moment materials were abandoned to their retrieval and present-day study (Schiffer 1972; Bordes 1975; Villa 1982, 2004; Gowlett 1997; Bertran et al. 2017).

At the same time, explaining an archaeological assemblage as the result of behaviour anchored to the ethnographic/human time scale is not without problems of equifinality (Gifford 1991; Kent 1991). Equally, the inferences of high-resolution sites could refer to situations which may not be representative in an evaluation of long-term adaptive patterns (Pettitt 1997). Such considerations affect short-term occupation sites as the methods we use in the study of prehistoric sites may generate non-diagnostic answers. Nevertheless, we believe that mobility patterns, site function and contextual resolution are concepts that can be applied when assessing archaeological categories such as task activities and assemblage resolution.

2 Short-Term Events: A Proactive Analytic Framework

This article does not present a specific 'method' with which to identify short-term events; through examination of the interior of a palimpsest, we propose to check whether it is possible to conclude it was formed of repeated visits. Usually, several techniques of spatial analysis are employed to establish spatial/temporal associations on the horizontal scale and to isolate dispersals and clusters that establish site organization (among others Carr 1987; Simek and Larick 1983). However, analyses claiming to be dynamic can produce static interpretations if they ignore the effect of vertical dispersion or 'internal time' (an attribute that indirectly informs us of the temporal scale of the accumulation) (Martínez-Moreno et al. 2004, 2015).

Analysis of implications arising from the notion of 'internal time' does not offer definitive solutions, which explains the scant interest this perspective has generated (Spikins et al. 2002). Nevertheless, the order provided by XYZ dimensions is key to grouping artefacts that share space/time relationships and are embedded in a stratigraphic sequence. The principle of association refers to the need to record the succession of technical and cultural changes on the vertical scale in order to infer evolutionary patterns and motivate the application of three-dimensional coordination in multi-layered sites (Laplace and Meroc 1954).

Current topographic devices automatically record three-dimensional coordinates of artefacts which, when processed, generate precise infographic models with which to analyse the archaeological record (Dibble and McPherron 1998; Mora 1988; Pallarés 1999; Mora et al. 2001; McPherron et al. 2005). In tandem, geographic information systems (GIS) incorporate basic geo-statistical tests in spatial analysis (Allen et al. 1990; Green 1990; Wheatley and Gillings 2002; Nakoinz and Knitter 2016). We propose to apply these techniques of recording artefact (lithics, bones, hearths) coordinates and contextual elements (fallen stone blocks) and integrate their geometric positions with sedimentary particles that plot the horizontal and vertical dispersion, the area and thickness of an excavated archaeological unit. The integration of the vertical dispersion of artefacts can be compared to the order indicated by the geological sequence (McPherron et al. 2005); in consequence the vertical dispersion of artefacts is key to establishing superposition of archaeological assemblages and indicating phases of abandonment, overcoming criteria that are not always evident, such as sedimentary changes. Faced with post-excavation reconstruction, we support a 'constructive focus' through the constant interaction between archaeological data and visual representation during excavation, enabling detection of errors and resulting in accurate identification of the dispersal of a collection of materials. This perspective updates the definition of archaeological level that identifies horizontal continuity as synonymous with synchrony, because it prioritizes inferences deriving from vertical dispersion (Martínez-Moreno et al. 2015).

Our approach to the analysis of 497D uses visualscape (Llobera 2003), exploratory, graphic representations to assess cycles of installation/abandonment/reuse on the vertical scale and isolate stratigraphic events within a level. Although vertical references are combined, they prevail over information on the horizontal distribution. A first step in analysis entails visualization of relationships on the vertical scale through selection of vertical plots that illustrate the geometry and stratigraphic phenomena within the level. Artefact, hearth and stone block coordinates are projected in 20 cm slices, a tomographic approach separating level volume by orthogonal and oblique cross-sections. These latter are alignments defined from a selected angle that connects spaces impossible to examine through orthogonal projections (Roy 2015). A second analysis visualizes horizontal dispersion using geo-statistical tests to detect spatial distribution of raw material units (RMU) (Roy 2016). Application of this approach in the 497D archaeological unit has implications affecting discussion on palimpsest vs high-resolution sites (Gowlett 1997).

3 Artefacts, Hearths, Blocks: Preliminary Characterization of Level 497D

General information on Cova Gran can be found in earlier articles (Benito-Calvo et al. 2009, 2011; Martínez-Moreno et al. 2010; Mora et al. 2011, 2016; Polo-Díaz et al. 2016). Level 497D, located in sector R, consists of two lithostratigraphic units: S1 and 497. Unit S1 is a 2-m-thick sequence of heterometric blocks from the rockshelter roof; Unit 497 is 0.5-m-thick deposit of granular sediments affected by surface runoff. Level 497D is positioned on the roof of Unit S1, between the ceiling of Unit S1-05 and towards the base of layer S1-10 (Polo-Díaz et al. 2016). S1-05 is a clast-supported angular breccia, with a reddish, silty clay matrix (5YR 6/4) formed of lateral inputs and fallen debris from the rockshelter roof. S1-05 is a clast-supported angular breccia, with abundant limestone boulders, indicating roof collapse processes. Soil micromorphology of the archaeological level 497D shows it is a 6–7-cm-thick deposit consisting of sub-rounded, light brown (7.5 YR 6/4) and blackish sediment aggregates and scattered remains of reworked burnt plants and bone tissue. Under the microscope, the light brown and blackish aggregates indicate exposure of the surface but display distinctive traits suggesting their anthropogenic origin and little sign of syn-/post-depositional processes (Polo-Díaz et al. 2016).

The level forms a spatial/temporal group of bones, hearths and blocks. The lithic assemblage of 4955 pieces involved the transport of 20.9 kg of chert from several sources (Mora et al. 2016). The 696 bones recovered were poorly preserved in general but identifiable as *Cervus elaphus*, *Bos bison*, *Capra pyrenaica*, *Stephanorhinus hemitoechus*, *Equus ferus*, *Vulpes vulpes*, *Oryctolagus cuniculus* and *Aves* sp. providing an estimated minimum of two deer and two goats. The remaining medium/large ungulates indicate at least one individual, although more than 100 unidentifiable fragments suggest transport of a larger number of prey) (Samper Carro 2015; Samper Carro et al. in preparation).

Aspects of behaviour and lifestyle during the settlement were inferred from hearths (Stevenson 1991; Picornell et al. 2017; Mallol and Henry 2017 and references therein). The composition and colour of the floor, internal morphology of the burned area, charcoals, burned lithics and bones are very variable attributes, and in order to better understand the character of the settlement, a combination of experimental models is advisable (Petraglia 2002; Soler Mayor 2003; Goldberg and Macphail 2008; Mallol et al. 2013a, b; Pérez et al. 2017). Likewise, substantial biochemical analysis revealed the effect of fire on the sediment (Mentzer 2014 and references therein). Soil micromorphology confirms the in situ preservation of the 497D hearths, which revealed a light brown ashy accumulation at the top and a mixture of dark, partially burnt, organic and geogenic debris at the bottom. The high proportion of rock fragments and sediment aggregates together with the low concentration of charcoal observed in the dark layer are interpreted as the result of thermal alteration of a palaeosurface. Burnt patches, rich in faecal spherulites and plant remains similar to dung aggregates, documented in the combustion structure, suggest the presence of live fauna at the site prior to the combustion episode. The microstratigraphic position of excrement residues could be considered an indicator of discontinuity in the human occupation of the site (Polo-Díaz et al. 2016).

The hearths form discrete areas with changes in colour demarcating thermoaltered surfaces with black/brown sediments and a few macroscopic carbons, in clear contrast to the colour of the level (Mallol et al. 2013a, b). The internal clasts of hearths display fractures, fissures and cracks and are red and/or black; similar alterations are revealed through soil micromorphology and indicate direct exposure to fire.

Attributes of the ten combustion structures excavated in 497D are given in Table 1. *X*/*Y* coordinates on the horizontal plane indicate surfaces of varying dimensions (50–90 cm) along the maximum axis. The internal shape of the structures is defined by the vertical dispersion of thermoaltered sediments (*X*/Z and *Y*/Z), which indicates two flat fires and eight pit hearths (Leroi-Gourhan (ed) 1973; Olive and Taborin (ed) 1989). The flat hearths are oval with a reddish basal area and display clear-cut limits between the combustion zone and unaltered sediments. Concave pit fires are filled with thermoaltered sediments and have a reddish layer on the base and walls; some had been deliberately excavated, but its installation on natural depressions is also evident (Fig. 1). It has been suggested that pit hearths allow greater control of temperature and duration of combustion, which would be advantageous for cooking and meat storage techniques (Wandsnider 1997; Black and Thoms 2015); however, we consider more data is needed to validate such interpretations (March et al. 2014; Aldeias 2017). Three thin (<1 cm) circular zones have combustion residues that are not in situ thermoaltered surfaces but redeposited

Table 1 Descriptive and contextual attributes of 497D hearths

		Morphology		Dimensions					
#	*X*/*Y*	Type	Shape	L	W	T	Perimeter	Basal reddish	Artefacts within hearths
H10	189–500	Pit hearth	Oval	74	54	9	2.14 m	Yes	NO
H2	189–497	Pit hearth	Oval	50	42	6	1.49 m	Yes	No
H7	191–500	Pit hearth	Oval	92	74	10.5	2.78 m	Yes	Yes
H4	189–499	Pit hearth	Oval	74	69	8	2.32 m	Yes	Yes
H3	193–501	Pit hearth	Oval	68	38	5.5	1.84 m	Yes	Yes
H13	191–500	Pit hearth	Oval	49	46	4.5	1.58 m	Yes	Yes
H14	191–501	Pit hearth	Oval	87	69	6	2.5 m	Yes	No
H17	190–500	Pit hearth	Oval	75	53	7	1.96 m	Yes	Few
H8	194–502	Flat hearth	Oval	76	42	2.5	1.94 m	No	No
H9	192–501	Flat hearth	Oval	73	45	5	1.93 m	Yes	Few
AS16	190–501	Spot ash	Oval	47	35	<1	1.31 m	No	No
AS11	191–500	Spot ash	Oval	72	62	<1	2.23 m	No	Few
AS5?	194–500	Spot ash	Oval	67	56	<1	1.98 m	No	No

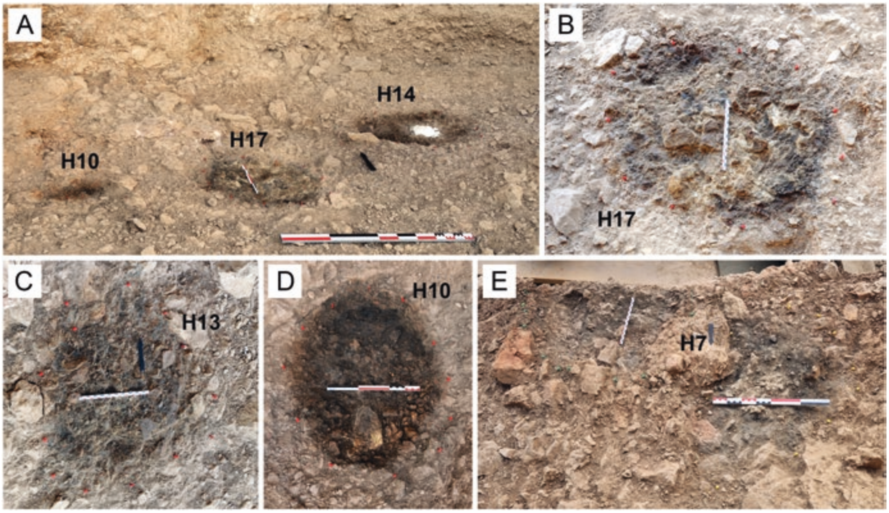


Fig. 1 Indications of fire management in some 497D hearths: (**a**) alignment of H10, H17 and H14 with a soil micromorphology sample); (**b**) excavation of H17 in which the maximum extension of thermoaltered sediments recorded by XYZ data is indicated by pins; (**c**) H13 small pit hearth; (**d**) H10 small pit hearth with important vertical development of thermoaltered sediments; (**e**) block fallen after H7 had been used

sediments that could indicate dumping and sweeping tasks. Although spot-ashes are identifiable only through microscopic analysis (Canti and Linford 2000; Miller et al. 2010; Mallol et al. 2013a, b), the shape and contextual position of these clusters suggest hearth waste management.

It is not easy to determine intentional use of blocks in caves and rockshelters and associate them with structural elements (Rigaud and Geneste 1988; Kolen 1999 and references therein). However, the area and thickness of these irregular volumes explain stratigraphic vacuums that affect interpretation of artefacts and hearths. Phases of abandonment within the level and cycles of use/abandonment/reuse may be inferred by distinguishing blocks that are part of the occupation landscape from those deposited during and after occupation and determining relationships between artefacts and blocks.

3.1 497D Vertical Resolution: The Basis of Contextual Integrity

Usually, thick, continuous layers of artefacts are considered as long-term accumulations (McPherron et al. 2005); likewise, chronometric asynchrony of ^{14}C series within the same level has been interpreted as active sedimentary reworking (Conard and Bolus 2003; Hunt et al. 2015). Such scenarios are not recognized in sector R at Cova Gran. The 2.5-m-thick sequence is formed of seven archaeological levels separated by sterile layers and fallen blocks (Mora et al. 2001) (Fig. 2). Stratigraphically, level 497D is between levels S1B, attributed to the Late Middle Palaeolithic, and 497C, assigned to the Upper Palaeolithic, a cycle relating to the Middle-to-Upper Palaeolithic 'transition'. Level 497D, superposed above several Mousterian levels, is the first manifestation of the Upper Palaeolithic in the sequence which, on a chronometric level, dates between 39 and 38 ka calBP (Mora et al. 2016).

There are numerous scrapers, notches and denticulates on flakes and formal tools on blade/bladelet blanks in the lithic assemblage. It is difficult to place such an odd techno-typological combination within the initial phases of the Upper Palaeolithic of Western Europe (Bon 2006; Anderson et al. 2015). Various factors could provide an explanation; the association might be due to stratigraphic disturbance resulting from aggressive syn-/post-depositional processes affecting the archaeological layer; equally, poor retrieval methods and errors in contextual attribution in numerous sites included in the Middle-Upper Palaeolithic discussion could cause mixing of assemblages (Zilhão and d'Errico 1999, 2003 and references therein). Nevertheless, such circumstances do not explain the ordered succession of thin archaeological assemblage layers integrated in discrete sedimentary segments, as identified during excavation and confirmed by soil micromorphology (Martínez-Moreno et al. 2010; Polo-Díaz et al. 2016). In this respect, the archaeostratigraphic configuration of sector R is key in assessing the contextual resolution of 497D (Mora et al. 2016) (Fig. 2a).

By excluding the impact of the above factors, it is possible to address identification of cycles of occupation/abandonment/reoccupation in 479D, assuming that it is not easy to establish synchronic/diachronic relationships even with extremely precise data. Accurate graphic models can be used to define relationships (i.e. before/during/after) between artefacts, hearths and blocks, but they are subject to interpretation

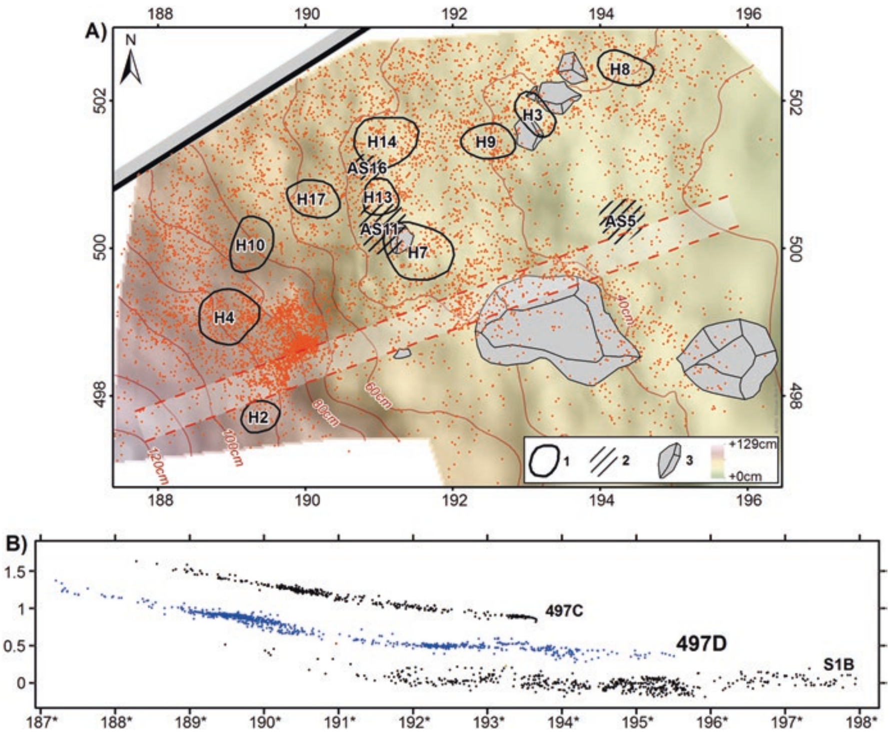


Fig. 2 (**a**) General plan of 497D archaeological unit: (1) hearth, (2) spot ashes, (3) blocks forming part of the 497D landscape. Equidistant contour lines: 10 cm. Contour values represent Z values with respect to the 3 m baseline (**b**) 40-cm-thick vertical oblique plot following the maximum slope of 497D (artefacts contained in the clear area within the dashed lines Fig. 2a). Coordinated artefacts of levels 497C and S1B have been positioned

and should be analysed with prudence. Likewise, geo-statistical tests establish clusters on the horizontal scale, but they do not necessarily imply a temporal order. Despite these limitations, interesting indications can be noted.

Evidence from 55 m^2 of 497D has been recorded although the level continues to the N and W of the excavation area. The horizontal dispersal of artefacts shows that towards the east (*X* axis = 195), the level has been damaged by an erosive surface conforming to the natural slope of the deposit, which diminishes towards the south where it meets the drip line of the rock shelter (*Y* axis = 497) (Benito-Calvo et al. 2011; Mora et al. 2016) (Fig. 2a). The maximum vertical dispersion is 5 cm, although in some areas maximum thickness reaches 10 cm. The accumulation forms a thin, continuous succession of archaeological material extending for 10 m N-S and 12 m E-W as indicated by vertical plots and forms a gentle subhorizontal slope (5°–10°) from the W towards the NE that stabilizes mid-way, while from the S towards the N-S, slope tilts slightly towards the rockshelter wall, forming a horizontal platform. The surface is not horizontal and slopes form an irregular substrate on which the accumulation lies (Fig. 2b).

A preliminary visual analysis shows artefacts scattered over the surface without any apparent spatial organization, except for an important concentration of artefacts between hearths H2 and H4. An alignment of hearths is also evident, such as H4-H10-H17, separated from each other by less than 1 m, or H7-H13-H14 associated with spot-ashes SA11 y SA16, possibly resulting from cleaning tasks (Fig. 2a). Furthermore, there was no clear indication of patches of artefacts around hearths suggesting centralization of activities, a pattern usually mentioned in studies on spatial analysis (Stevenson 1991; Vaquero and Pastó 2001). The evidence could be interpreted in various ways: all hearths are part of a single occupation, or each of the ten hearths corresponds to different times, not forgetting possible reuse suggested by spot-ashes that would increase the number of events. Such observations are not relevant when establishing phases of installation/abandonment/reuse based exclusively on hearths. This fuzzy scenario prompted us to examine whether vertical dispersion might be an avenue towards identification of stratification processes, an important attribute in assessing assemblage formation.

3.2 Deciphering Vertical Internal Order

Archaeostratigraphic analysis of 497D followed oblique and vertical cross-sections. A tomographic analysis of slices of the excavated surface was taken each 20 cm and included coordinates of artefacts, hearths and blocks (Roy 2015) (Fig. 3). We have selected representative plots following these parameters: the horizontal and vertical developments of hearths have been considered as spatial indicators whose surface is defined from the rock shelter roof which represents the maximum area of thermoaltered sediments and serves in assessing earlier/later relationships between them. These graphic representations should include a significant number of artefact coordinates, prioritizing projections that include three hearths. Due to their spatial arrangement, not many orthogonal cross-sections allow such projections, a constraint that, nevertheless, are overcome by oblique plots. It is necessary to consider that the slope dip of the archaeological assemblage coincides with the alignment of hearths (Fig. 2). Likewise, irregularities of the substrate and fallen blocks distort graphic representations. The 'slope effect' impacts bi-dimensional projections obtained from three-dimensional coordinates, as they can indicate apparent superpositions or stratigraphic phases. The interpretation of these graphs is indicated from the cardinal points established on the floor of the level; in this way, S-N indicates the direction in which the axis is projected.

The orthogonal plot S-N $X = 191.000–191.200$ includes the alignment of H7-H13-H14, each separated by 1.5 m (Fig. 3a). The plot shows that H14 underlies H13 which itself is below H7, indicating the superposition of three events, an inference that should be checked with other cross-sections.

The orthogonal plot S-N $X = 189.000–189.200$ is on a parallel axis to the previous plot (S-N $X = 191.000–191.200$) and, separated from it by 2 m, includes

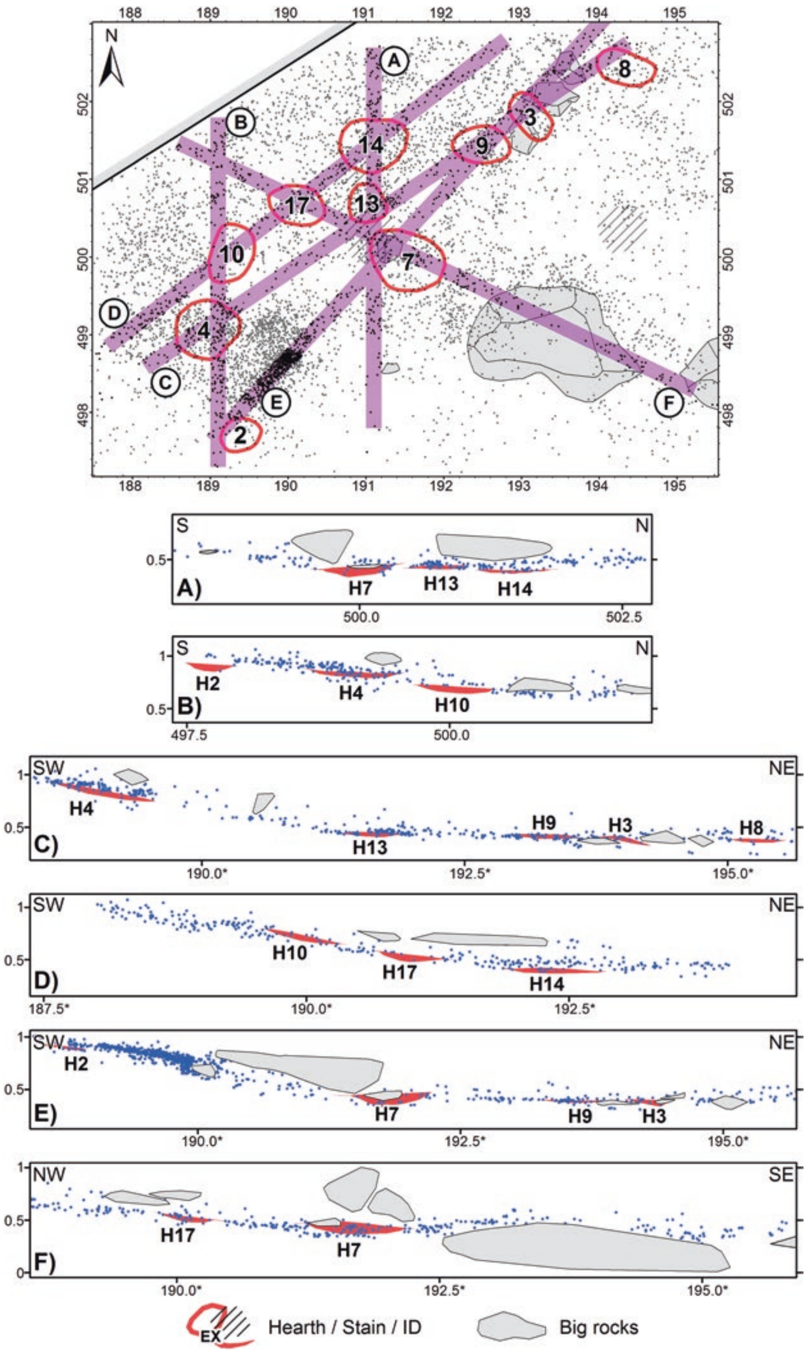


Fig. 3 Contextual relationships between coordinates, hearths and blocks from 20-cm-thick vertical plots shown in m. (**a**) Orthogonal plot N-S $X = 191–191.2$; (**b**) orthogonal plot N-S $X = 189–189.2$; (**c**) oblique plot 34° on the X axis; (**d**) oblique plot 38° on the X axis; (**e**) oblique plot 47° on the X axis; (**f**) oblique plot 154° on the X axis

H2-H4-H10 (Fig. 3b). The vertical plot places H10 below H4, as its altimetric position with respect to the level does not correspond with the N-S slope between H2 and H4. The plot shows that the level tilts towards the interior of the rock shelter, stabilizing around H4, so that H2 would be earlier. This pattern indicates at least two stratigraphic phases, suggesting that at a contextual level H2 and H10 could be attributed to the same event.

Oblique plot 34° SW-NE (Fig. 3c) includes the 7 m sequence H4-H13-H9-H3-H8. H9 is earlier than H13 and could be contemporaneous with H3, an interpretation that should be compared with other plots. H4 is above the E-W slope, difficulting to evaluate possible relationships. Although the coordinates do not establish temporal relationships, visually they fit with the natural EW slope (Fig. 2).

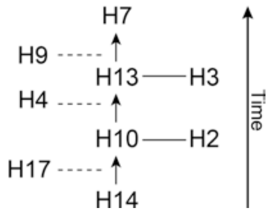
Oblique plot 38° SW-NE connects H10-H17-H14 (Fig. 3d) and, as with oblique plot 34° SW-NE, shows that the slope descends towards the E and then stabilizes. Two blocks, fallen after the level had been abandoned, partially seal the artefacts associated with H17 and H14 but do not affect their arrangement. These positions suggest that H14 is earlier than H17, while H10 would be later than H17. The vertical dispersion identifies artefacts earlier than H10, but does not rule out that some materials accumulated on the slope seem to correspond to a later phase. The combination between the position of hearths and vertical dispersion of coordinates suggests three possible phases.

Oblique plot 47° SW-NE shows fallen blocks on hearths H7-H9-H3 and coordinates (Fig. 3e). The plot indicates H7 to be later than H9, which is earlier than H3. A 'wall effect' was detected in the SW area in the form of the imprint of a small rock, signifying that artefacts surrounding the stone did not accumulate in a single event. The vertical dispersion of coordinates below a large block supporting H7 is anomalous and could have resulted from the pressure exerted by its collapse that distorted the delineation of the level. Although the lateral position of H2 makes it difficult to relate it with other hearths, it is associated with the accumulation of coordinates that develop towards the block. The superposition of coordinates between H9 and H3 signals two events, which puts their contextual relationship into question.

Oblique plot 154° NW-SE, relating to H17-H7, is perpendicular to the direction of the level dip, so the slope in the graph is obvious (Fig. 3f). The hearths indicate that H17 is earlier than H7, while artefacts around and within H7 suggest it was above indicating a previous occupation, possibly corresponding with the materials associated with H17. The section shows that artefacts conform to the shape of a large block from an earlier collapse and was part of the 497D landscape. The H17-H7 sequences indicate at least two distinct temporal periods.

Although these positions are restricted to the limited number of axes represented, they indicate a fuzzy scenario of spatial/temporal associations between artefacts, hearths and blocks. While the low vertical dispersion (average 5 cm) is not helpful in detecting stratification, all plots indicated diachronic positions suggesting several cycles of accumulation/abandonment/reoccupation. The contextual positions, established by hearths, reveal a minimum of four superpositions defined by the stratigraphic axis of the H14-H10-H13-H7 sequence from oldest to most recent (Table 2). They are not assimilated in 'central hearths' (sensu Leroi-Gourhan and

Table 2 Stratigraphic sequence and relationship between hearths in 497D. Conitnuous lines show possible contextual links between hearths. Alternatively, dashed lines indicate imprecise realtionship between hearths



Brezillon 1966), but are altimetric positions that vertically order events occurring in an indeterminate time interval. H13-H3 and H2-H10 form related contextual, but not synchronic *sensu stricto*, groups. Several hearths are integrated in intervals between phases; thus H17 is between H14 and H10, H4 between H10 and H13, and H9 between H13 and H7. These spatial associations are indicators of internal temporality and entail the need to assess whether the positions indicate synchronic relationships with respect to the stratigraphic axis or conform to different diachronic events. In the same way, the lateral position of H8 poses difficulties in its correlation with other hearths, which does not occur with H7 whose stratigraphic position indicates a final event.

Because of the limited thickness of ash spots in AS11 and AS16, it is difficult to analyse any potential reuse of H14-H13-H7 in later occupations. These residue accumulations indicating cleaning activities are by hearths less than 1 m apart that are allocated to three separate events; but these concentration of fire management-related activities over time and in a small space suggests it was a preferred area in site organization (Fig. 3).

At the same time, changes in the organization of occupations can be sensed. Groups H3-H13 or H2-H10 are 2–3 m apart. Although H4, H9 and H17 could be assigned to one of the groups and form part of this web of interactions, H7 seems to be excluded. These forms of spatial/temporal organization are compatible with events of accumulation/abandonment/reoccupation of diverse intensity, deriving from group activities occurring over a short time period. Such changes imply variation in occupation that could be explained by environmental and/or organizational factors of aggregation/splitting up affecting group size. Such basic decisions documented repeatedly in modern hunter-gatherer (Kelly 1995; Bettinger et al. 2015).

It is not easy to determine the duration of 497D occupations and/or intervals of abandonment. Nevertheless, the spatial relationships described here indicate that the formation and accumulation of the assemblage are not the result of a single event, but imply an 'internal time' of formation. The vertical dispersion of 497D also does not allow association of the stratigraphic axis, indicated by hearths, with specific artefacts or discrete times such as that which a hearth can represent. These precautions suggest it is not appropriate to interpret the assemblage in the sense of 'human time'.

Questions also arise in defining 497D site function. It does not appear to be associated with prey acquisition, although, despite the poorly conserved bones, transportation of carcasses for consumption has been identified (Carro Samper 2015). Nor does it seem to be a quarry site, although raw material is abundant in the landscape, as explained below. However, a suite of suggested activities such as tool manufacture, processing of prey and transport of combustible material for hearths might support a definition of 497D as a home base. A study of raw material management can provide relevant indicators to aid assessment of the function of 497D.

3.3 Raw Material Inputs

The techno-economic focus of the 1980s indicated that the correlation between raw material resource areas and transport distances were closely related with mobility patterns and site function (Geneste 1985, 1991, 1992; Feblot-Augustins 1993; Machado et al. 2013; Romagnoli et al. 2016; Roy 2016). An accurate cartographic map of the Cova Gran area shows outcrops of siliceous rocks based on macroscopic attributes (texture, impurities, cortex, colour, presence of bioclasts) and on a petrographic level through thin sections and XRD (cited or illustrated on the cartographic map). Siliceous rocks are abundant in the area; 99.95% of the 4995 lithic artefacts in 497D are of two main types: chalcedony and fine-grained chert. Chalcedony is from outcrops at the base of the Palaeocene in the mountains north of the site (Tremp Fm), less than 5 km away. It is a tough rock with many impurities and fissures making it difficult to knap, but it represents 80% of the raw material of the 497D assemblage. The fine-grained chert, which is a good material to knap, outcrops in an Oligocene formation (Castelltallat Fm.) in the Serra Llarga, that extends E-W for 20 km south of the site (Roy et al. 2013; Roy 2016) (Fig. 4).

Management of raw material sources at 497D centres on these two geographic trajectories: collection of the locally abundant but poor-quality chalcedony north of the site and transport of good chert from the Serra Llarga south of the site near the Ebro Basin. This arrangement suggests that provision of raw materials does not have to follow the same organizational principles. Serra Llarga chert implies arrival of groups from outside the Pre-Pyrenees (Ebro Basin), while transport of chalcedony could be integrated within foraging activities around the site. Although the Serra Llarga chert outcrops are not far away, and of easy access, the number and weight of chert artefacts show they are not common, but had been selected for the manufacture of formal tools on flakes, blades and bladelets (Mora et al. 2016) (Table 3). While we have no influence over techno-economic implications, we can examine the relationship between raw material management and settlement dynamics.

One approach is to look at the group of 'incongruent' (Mora et al. 2008) artefacts that indicate movement of selected and/or isolated pieces from the landscape to the site and show a high level of spatial/temporal fragmentation of the *chaîne operatoire* (Turq et al. 2013). Another avenue is to establish raw material units (RMU) of nodules, cobbles, cores or blanks (among others, Larson and Kornfeld 1997; Roebroeks 1988; Vaquero and Pastó 2001).

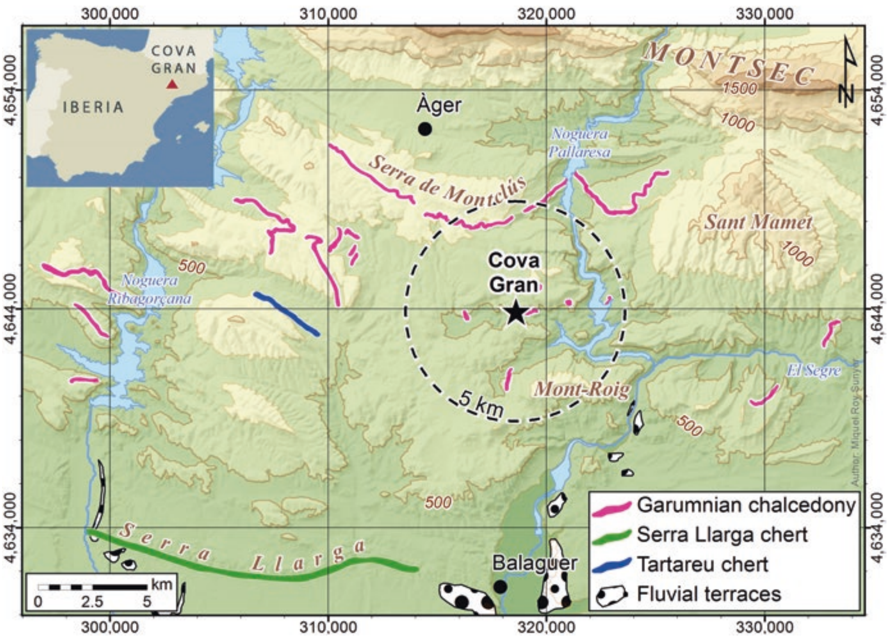


Fig. 4 Location of Cova Gran and geographic position of chalcedony (red) and Serra Llarga (green) outcrops

Table 3 Characterization of the different RMUs in 497D

Type	RMU	General description	Other features	Color/Munsell code	*n*
Garumnian chalcedony Tremp group lower Palaeocene	A	Semi-translucent. Medium-to-coarse-grained Spherulites Megaquartz crystals Eventual microgeodes (Ø 1–10 mm) Rugged cortex Botroydal structures		Colorless/white	1822
	M		Oxide spots	Reddish-pinkish (10R 7/4)	1324
	G			Yellowish (10YR 6/6)	192
	B		Blotched aspect	Beige (10YR 6/2)	286
Serra Llarga chert Castelltallat Fm. Oligocene	SLL1	Fine- and very fine-grained. Lacustrine bioclasts (charophytes and gasteropods). Smooth cortex Eventual Liesegang rings	Not translucent	Black (N2)	86
	SLL2		Semi-translucent	Brownish (5YR 4/1–5YR 2/1)	331
	SLL3				82
Total RMU					4123
Undetermined					872
Total					4995

Comparison of several RMUs in 497D shows that macroscopic attributes such as colour, texture or impurities in the chalcedonies vary within the same outcrop, or even the same nodule, creating problems in RMU identification. While it is better to consider several nodules when defining RMUs (Roy 2016), this implies loss of

Table 4 Number of remains (A) and weight (B) of RMUs

	A	B	G	M	SLL1	SLL2	SLL3	Other	Total
No. of remains									
Cores	15	4	6	16	0	1	1	4	47
Flakes	189	35	22	220	4	43	0	48	561
Broken flakes	1345	189	132	827	53	225	62	297	3130
Chunks	73	39	3	101	12	8	0	58	294
Retouched tools	93	6	24	93	11	30	14	18	289
Debitage	107	13	5	67	6	24	5	407	634
Total RMU	1822	286	192	1324	86	331	82	832	4955
Weight (kg)									
Cores	2.40	0.30	0.86	2.56	0	0.03	0.04	0.44	6.62
Flakes	0.97	0.22	0.13	1.40	0.01	0.07	0	0.19	2.99
Broken flakes	2.01	0.42	0.44	3.02	0.06	0.28	0.06	0.44	6.73
Chunks	0.26	0.39	0.01	1.41	0.01	0.28	0	0.19	2.30
Retouched tools	0.58	0.02	0.30	1.06	0.04	0.06	0.05	0.03	2.14
Debitage	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.08	0.13
Total RMU	6.25	1.36	1.73	9.45	0.12	0.49	0.15	1.37	20.91

contextual resolution, although the establishment of a great variety of rock types does not insure patterns of organization. Furthermore, geo-statistical methods cannot be applied to multiple groups of few artefacts (see Machado et al. 2013; Machado and Pérez 2016). However, our interest lies in involving RMUs in the spatial study to assess differences in the techno-economic management of raw materials. Using general criteria as colour and texture, four types of chalcedonies, A, M, G and B, and three types of Serra Llarga chert, SLL1, SLL2 y SLL3, were established (Table 4, Fig. 5). Eighty percent of the 497D lithic material falls within these seven groups; the remaining pieces showed surface alterations (patina, thermoalteration, etc.) and were excluded.

3.4 *Hot Spot RMUs: Searching Time on the Horizontal Scale*

Previous statistical tests on the pattern of RMUs around different nodules can be used to determine spatial organization. Average Nearest Neighbor Analysis and General G tests (ESRI 2017; Sánchez-Romero et al. 2016) were used to determine whether the distribution of 497D was dispersed, random or clustered; results indicate a clustered distribution. The Gi∗ test (Getis and Ord 1992; Ord and Getis 1995), also known as the hot spot method (ESRI 2017; Sánchez-Romero et al. 2016), detects clusters based on a quantitative variable and the spatial relationship (continuity and discontinuity) between objects. Unlike other forms of spatial distribution analysis, such as kernel density estimation (KDE) (Baxter et al. 1997;

Fig. 5 Macroscopic attributes of chalcedony varieties: (**a**) RMU A, (**b**) RMU M, (**c**) RMU G, (**d**) RMU B. Macroscopic attributes of varieties of Serra Llarga: (**e**) RMU SLL1, (**f**) RMU SLL2, (**g**) RMU SLL3

Wheatley and Gillings 2002), the Gi∗ method provides statistical significance (90–99%) for each group detected (Getis and Ord 1992; Ord and Getis 1995; ESRI 2017) and is a relevant attribute in the interpretation of RMU dispersion patterns.

We chose frequency of the material (estimated with the quadrat method) as the analytical variable and used an orthogonal mesh with an interspacing of 14 × 14 cm that recounts and stores in each polygon the number of lithic artefacts of each RMU. The number of RMUs in 497D fulfilled the criteria required (i.e. more than 30 elements) to use hot spot analysis (ESRI 2017). The spatial relationship between objects in the study was the inverse distance between quadrats.

Hot spot analysis confirmed a dense 3 m^2 cluster in the SW quadrant of 497D, between hearths H4 and H2 ($X = 190/Y = 499$), with a statistical significance of 99%. The cluster included cores, broken blanks and chunks of chalcedony weighing 9.8 kg, 45% of the 21 kg of this assemblage (Fig. 6a).

A detailed analysis of chalcedony types clarifies the hot spot observation. The largest group, RMU A, is spread over the entire surface, except for the main cluster and two patches at the W end of the excavation area (one on top of H4) (Fig. 6b). Distribution of RMU M is similar; it is in the accumulation between H4 and H2 and represented in several clusters in H13 and H14 (Fig. 6c). RMU G is primarily in the accumulation around H4 and H2 but also appears in the area of the large block associated with H7 and marginally in H14, H13 and H9 (Fig. 6d). The graphic illustrations show that groups A, M and G overlap the H4 surface, a superposition showing that H4 is an event that occurred later than the chalcedony cluster associated with H2-H10, a conclusion supporting the hearth stratigraphy (Table 2). RMU B is a precise marker among the chalcedonies; all chalcedony artefacts are from a single nodule forming the cluster around the large block in the SE quadrant of the occupation area (Fig. 6e). We have indicated that RMUs A, M and G are associated with H4 and H2. However, the spatial position of RMU B around H7 is not associated with this pattern; although RMU G is scarce, the larger groups, such as A and M, are not significant in this space.

A different horizontal dispersion to that of the chalcedony groups is seen in the lower number of RMUs SLL1, SLL2 y SLL3 that may reflect decisions involved with their transport of 20 km. Hot spot analysis of the limited number of elements and the distance between them revealed small, isolated clusters with a high level of statistical significance in comparison with the chalcedony groups. SLL1 establishes small clusters around H14 and a residual presence in the main cluster, supporting an introduction of blanks or shaped tools (Fig. 6f). The pattern can be seen in SLL2, which has the largest component of Serra Llarga raw material, widely dispersed in the central and E in clusters scattered around H14, H9 H3, H13, H8, and the block in the SE and H7 quadrant (Fig. 6g). SLL3, towards the SE of the block, forms small clusters, interspersed by different hearths in the central part of the level (H17, H14, H13, H9, H3 y H3 (Fig. 6h)). The spatial dissociation in the main cluster between the Serra Llarga groups and the A, M and G groups is interesting and suggests these spatial positions could correspond to different temporal events.

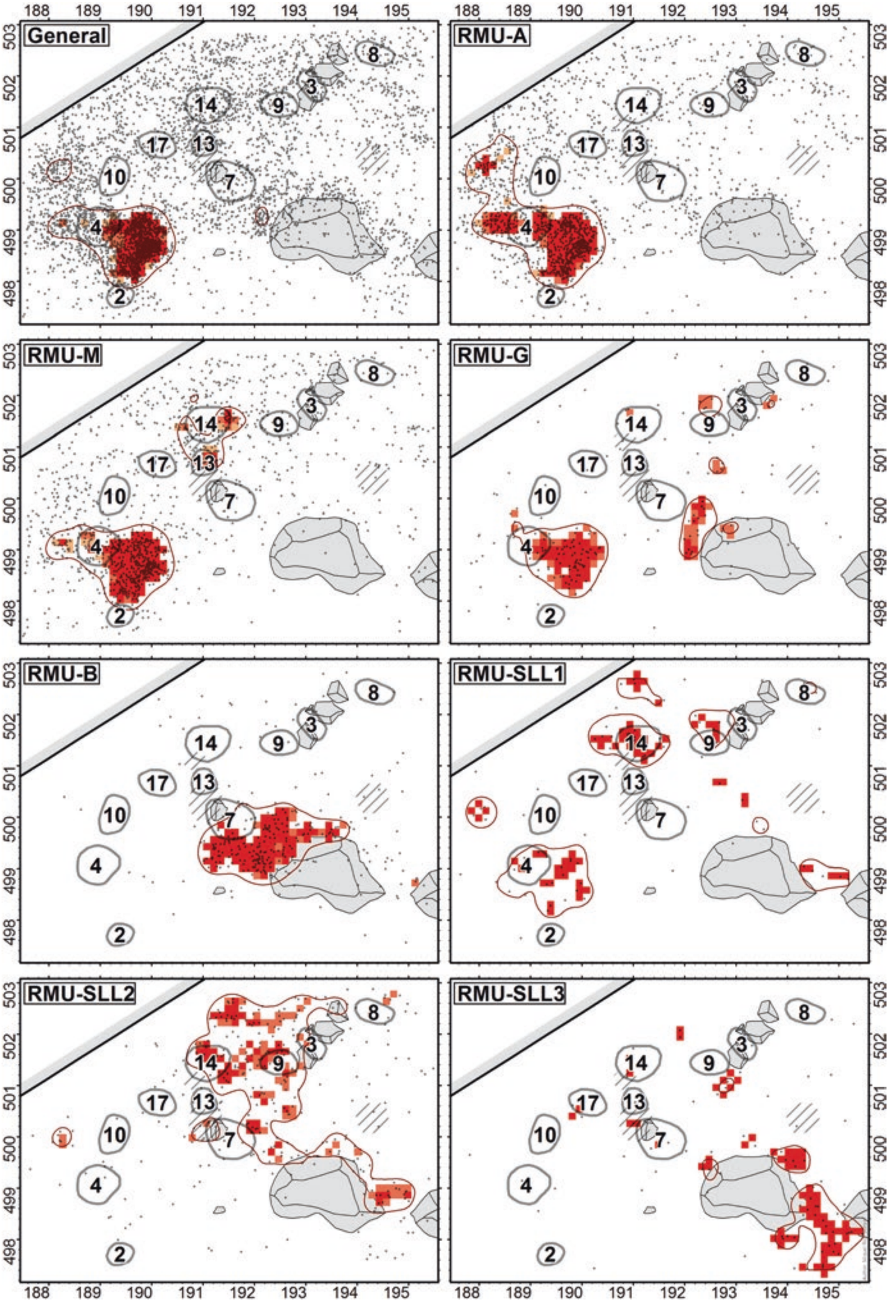


Fig. 6 Spatial hot spot clustering of the 7 RMU. (**a**) All the surface, (**b**) RMU A, (**c**) RMU M, (**d**) RMU G, (**e**) RMU B, (**f**) RMU SLL1, (**g**) RMU SLL2, (**h**) RMU SLL3. Statistically significant hot spots using Getis-Ord Gi* statistics showing confidence areas of 90% (yellow squares), 95% (orange squares) and 99% (red squares) and kernel density isopleth set at 2 std. dev. from the mean density value (brown curves). See Fig. 2a for key to contextual features (hearths, rocks)

3.5 One or Multiple Events?

Differences in the horizontal scale raise questions concerning formation of the level; is it the result of a massive, single, deposit event or a number of different events? Groups A, M and G form a small surface cluster of 9.8 kg of raw material including numerous chunks and cores indicating knapping activities. However, potentially, it could be a stockpile of raw material for use at other times (Table 4). While it is difficult to assess different patterns of consumption, similar behaviours have been identified in other levels (Roy et al. 2013). Chalcedony forms an important element of the accumulation but, by the same token, is also dispersed over the entire surface, suggesting a type of organization that might indicate transport of artefacts at different times. Although still at an early stage, refitting in groups A, M and G establishes a pattern of selected artefacts radiating from the main cluster towards other zones, while the remaining refit sets were abandoned at the accumulation. These observations indicate a low distribution of tools in the interior of 497D, a pattern that does not match actions carried out in a single event on the same surface (Martínez-Moreno et al. 2019). It would be interesting to check whether the accumulation is the result of a single, massive and unconnected contribution of materials suggesting a transport pattern in contrast to that indicated by the small patches of the Serra Llarga groups.

RMU B is interesting as the materials are from the same nodule and spatial level that defines a discrete cluster between H7 and the block in the SE, an event which, according to the sequence of hearths, corresponds to the final moments of the 497D level (Fig. 6e). Isolated SLL2 artefacts are located around H7, while SLL3 artefacts scattered around the SE quadrant and block suggest knapping activities. The few type G chalcedony artefacts found in this area might indicate a previous, separate event. Alternatively, they could have been collected with type B materials during a clean-up of the area.

Varieties of good-quality Serra Llarga chert form inter/intrasite markers indicating patterns of group mobility and fragmentation of the operational chain. Distribution of SLL1 suggests it was not knapped on-site; these low-density clusters imply abandonment of isolated artefacts taken as individual pieces to specific spaces such as H2, H4, H14, H3 and H9 (Fig. 6f). The same scenario is evident with SLL2 y SLL3. SLL2 types which appear to correspond to a single event are located primarily in the centre and N of the area, suggesting some fragments were knapped between hearths H14, H9 y H3 and some transported towards the SE area (Fig. 6g). SLL3, found exclusively around the large block in zone E, is not associated with other RMUs (Fig. 6h). These interpretations should be assessed with other studies to identify in situ knapping of materials, although we suspect that they were prepared and selected at the outcrops prior to their transport. Indeed, only one formal core of SLL2 and SLL3 types was recovered, an indicator supporting the introduction of isolated, possibly prepared blanks.

The dispersal of RMUs provides indicators with which to infer input rates associated with short-term events. A, M and G varieties form a cluster around H2 and

H10; H4 is a later event (Table 2). The accumulation could have derived from a substantial contribution of materials which, both during and after the event, were recycled and distributed across the surface according to the needs of the group. These indicators imply dynamic processes where RMUs are associated with discrete events as illustrated by Serra Llarga types, SLL2 Y SLL3 or RMU B, that refer to collection and transport cycles associated with discrete periods. Their spatial distribution and limited association with the main varieties of chalcedony in the accumulation illustrate fragmentation of the 497D assemblage in space and time. Such a scenario indicates that the recycling of materials in this potential "cache" is relevant when making the decision to return to the site or not and affects group mobility when people know in advance a stockpile of materials suitable for daily activities.

4 Discussion: Characterizing Archaeological Short-Term Events in 497D

Observations of present-day hunter-gatherers reinforce basic concepts in the spatial and functional interpretation of archaeological sites. But, such a procedure implies an inferential leap as there may have been situations in the past that are unidentifiable in actualistic studies (Kelly 1995). The central aim of this article is to address the analysis of small-scale palimpsests. The imprecise sequence of events (C-Transforms), syn-/post-depositional alterations (N-Transforms) and combination of both make it difficult to capture the 'human' temporal dimension of technical, spatial and social processes, so that the balance between these behaviours and those described in high-resolution sites is not clear. In other words, the limited visibility communicated by N-Transforms complicates identification of site function or mobility patterns, both key in detecting short-term events. In this regard, 497D generates several points for reflection.

Its position in the interior of a multilayered archaeological site establishes a cycle of installation/abandonment with low vertical dispersal that enables precise contextual and stratigraphic control. If an approach aimed at recognizing behaviours that capture the 'human' dimension were applied, a key element would be the analysis of fire management, indicated by the ten regularly maintained hearths and three ash spots that potentially denote reuse of some. Distance between hearths has been identified as an essential factor in the organization of occupations (Movius 1966; Guan et al. 2011; Henry 2012; Vallverdú et al. 2012) or sleeping areas identified by their proximity to the rockshelter wall (Binford 1996; Vallverdú et al. 2010). Level 497D exposes the need to overcome parameters related to horizontal distance, requiring us to question whether synchronic connections arising from surface analysis conceals independent events indicating internal diachrony. In this sense, archaeostratigraphic vertical methods are tools with which to examine stratigraphic positions within an accumulation.

These 4,955 artefacts spread from the 55 m^2 imply the transport of 21 kg of raw material, connotes another way of considering space in terms of 'ethnographic' time. Half of the assemblage is scattered on the surface without any apparent organization. The remainder is in a 3 m^2 cluster in which abundant cores, blanks and knapping debris indicate knapping activities. Some blanks and retouched tools are found near hearths, preferred areas abandoned once different activities had been accomplished. Such a description complies with the classic notion of 'home base'.

Confronted with this perspective, we suggest an analysis using attributes that differ from those usually applied. Artefact coordinates plot the geometry and relationship between components on the vertical and horizontal scales that can be examined using spatial analysis to determine the sequence of events in time. Vertical plots analyse stratigraphic dispersion in order to assess temporal association and determine anomalies on the vertical scale and syn-/post-depositional changes. Hot spot analysis reveals the spatial distribution of clusters and their statistical significance with respect to raw material. It is true that few attributes were considered in the current study: XYZ coordinates of artefacts, hearths and blocks and the XY position of lithic artefacts assigned to raw material groups. Future studies should integrate and combine more attributes to provide a better understanding of 497D and in general others levels of the site. A summary of reflections arising from our analysis is presented below.

Orthogonal and oblique cross-sections indicate different stratigraphic positions that are not explained by slopes or other irregularities in the deposit. Vertical plots establish a sequence of a minimum of four phases represented by H14-H10-H13-H7. Contextually, H10-H2 and H13-H3 could be contemporaneous. The position of H17, H4 and H9, which cannot be associated on the temporal axis, could indicate a greater number of events (Table 2). While AS11 and AS16 groups might inform us of reuse of hearths, they have been excluded from this study because of preservation issues. Finally, the fallen blocks indicate several processes, such as arrangement of artefacts on slopes, relief of deposit and distortion of the level by rockfalls, all of which provide information on syn/post-depositional processes.

Hot spot analysis identifies groups of raw material that define spatial organization based on different decisions relating to transport and accumulation and also detects significant differences. Serra Llarga chert, outcropping at the contact with the Ebro Basin 20 km away, indicates entry of groups coming from the south and carrying selected materials towards the first valleys of the Pre-Pyrenees. Chalcedony, with outcrops in the mountains near the site, is abundant but of mediocre knapping quality. Apart from transport distance, no other factors hinder access to rocks of such different qualities. Nevertheless, there is a clear segmentation between the Serra Llarga chert and the poorly selected chalcedonies.

Patterns of spatial concentration and dispersal can be distinguished by hot spot analysis. Discrete clusters of the Serra Llarga raw material form patterns supporting the idea of its fragmented introduction to the site. The limited interaction between groups suggests individual cycles of transport/consumption/abandonment of artefacts which, spatially, appear to be centred around hearths. The same model of discard is not apparent in the A, M and G varieties of chalcedony that form a continuous, extensive and discrete patch, while the remaining chalcedony artefacts are scattered over the surface, rarely forming clusters. Among group G types, patches were revealed consisting of a few artefacts near several hearths and the large block. In this pattern, all type B artefacts are from the same nodule and dispersed between H7 and the block but marginally represented elsewhere on the surface.

Preliminary refit data confirms a low association between groups A, M, G and other areas, suggesting transport of isolated tools, particularly towards hearths. Such a restricted distribution with scant evidence of interaction might indicate short temporal events. If so, the accumulation, essentially of chalcedony groups, could have a double function: knapping area and cache. There are numerous signs (cores, fragments, chunks) of knapping the poor-quality chalcedony, indicating a space where lithic sources were managed, and forming a debitage area with high spatial significance but little association elsewhere with the surface. The area of chalcedonies could also have functioned as a cache of blocks and nodules for future exploitation. This accumulation was formed in the early stages of the occupation and regularly restocked through the transport of nodules and chunks, abundant in the surrounding area and which appear even within a few metres of the site, transported by the ravine.

Spatial analyses indicate stratigraphic processes, while raw material groups reveal segregated spaces with little interaction between them. At least some different temporal events have been established on the vertical and horizontal scale and provide information on links between them: (a) the association between type B and H7, some SLL2 and SLL3 artefacts and some type G pieces, located in a space between the fallen block and H7, suggests a short-lived event corresponding to the end of 497D; (b) the H2-H10 connection associated with the A, M and G RMU accumulation on which H4 was subsequently installed, implying the superposition of two events at the beginning of 497D. The high fragmentation on the horizontal and vertical scales would fit with an indefinite sequence of short duration cycles of transport/consumption/abandonment.

The low vertical dispersion of 497D makes it difficult to characterize these occupations. Such difficulties are not related to the methods and proxies applied in the study, but rather highlight methodological implications indicated throughout this article. Vertical resolution is a relevant focus in analysis of space/time relationships. An interpretation centred on horizontal dispersion might define 497D as an organized and balanced space forming a "home base". Nevertheless, the assemblage consists of inputs and deposits demonstrating high spatial and temporal fragmentation. Hearths and raw materials are not the result of a single occupation or synchronic accumulation. Changes detected are consistent with an indeterminate series of events, and changes identified are those of groups who repeatedly settled in a landscape they knew well.

In the light of these results, 497D would be a high-resolution palimpsest, a paradoxical concept conveying a model of the archaeological record antithetical to the dichotomy palimpsest/high-resolution level. It is a palimpsest formed by events in which spatial/temporal associations are difficult to establish. Such fuzzy associations result from visits which could have taken place in a period, not necessarily long, a few decades or less than a century. Such an inference is difficult to assess without precise references on 'formation time' and affects identification of site function and mobility patterns.

Despite this limited resolution, decisions related to the transport and distribution of raw material abandoned on the surface are identified which, at the contextual level, hearths indicate as diachronic. These assemblages are not entities referring to general categories of the home base type; they are occupations that vary over time and space. Repeated occupation of a settlement would be regulated by factors such as group size and composition, which essentially refer to the biosocial support of groups rather than activities undertaken. The shelter is in a seemingly unattractive location at the bottom of a marginal valley in the first of the Sierras of the Southeastern Pre-Pyrenees. However, it is a landscape where essential tasks are concentrated and embodied in the remodelling of space, the preparation of an assemblage of artefacts to accomplish a variety of tasks or meet the lighting and calorific needs of the group, implying an important investment of time and energy to ensure that hearths function properly. Fulfilment of these factors explains the reoccupation of 497D for short intervals, implying a pattern of high residential mobility and settlement in specific areas of the site.

There is growing interest in defining the concept of short-term events as it interrelates mobility and site function of prehistoric sites. 497D is an example. Ostensibly it could be considered to be the result of a single occupation; however, horizontal and vertical studies of the level indicate organization arising from short-term events. Although syn-/post-depositional processes hinder identification of such a settlement pattern, we believe it could have been more frequent in the past. Contextual features hamper identification of activities occurring over a limited period that are assimilated into a 'human' temporal scale.

497D indicates problems associated with identification of short-term events. The perspective proposed here will probably be adjusted according to other ongoing studies. Although formation time masks identification of spatial/temporal relationships in archaeological assemblages, the increasing accuracy of recovery and representation of archaeological information facilitates identification of syn-/post-depositional processes and behaviours implied in the transport, consumption, abandonment and reuse of components of the archaeological record. Identification of short-term events in repeatedly visited sites is a challenge that emphasizes the value of a model that is key for the analysis of prehistoric hunter-gatherer lifestyle.

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