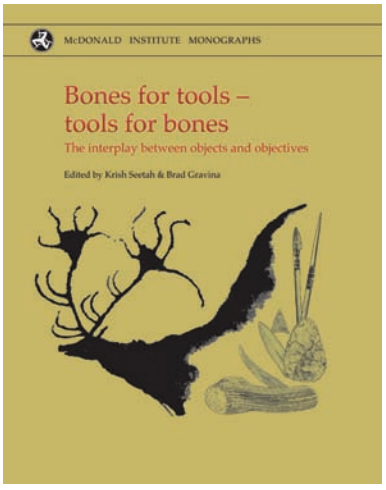
Bones for tools – tools for bones
The interplay between objects and objectives



Edited by Krish Seetah & Brad Gravina

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Chapter 2
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Ignacio de la Torre, Jorge Martínez-Moreno and Rafael Mora

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Chapter 2

When Bones are Not Enough: Lithic Refits and Occupation Dynamics in the Middle Palaeolithic Level 10 of Roca dels Bous (Catalonia, Spain)

Ignacio de la Torre, Jorge Martínez-Moreno and Rafael Mora

This study describes the archaeological assemblage from Level 10 in the Middle Palaeolithic site of Roca dels Bous (Catalonia, Spain), with special emphasis on its lithic refits. An area of 55 m^2 of Level 10 has been excavated, producing a stone and bone assemblage associated with various hearths. Whereas poor bone preservation makes it difficult to assess satisfactorily fossil and stone tool interactions, lithic refits contribute to the act of reconstructing technical processes and use of space by Neanderthals. Such refits also constitute a methodological tool that helps us understand the site-formation processes and behavioural constituents preserved in this part of the site's sequence.

Roca dels Bous is a Middle Palaeolithic rockshelter in the district of La Noguera (Catalonia, Spain), located in a narrow passage connecting the plain of the Ebro Basin and the foothills of the Pre-Pyrenees. This is a strategic point in the landscape which was repeatedly occupied by Neanderthals during the Upper Pleistocene (Fig. 2.1). Although excavations have not yet reached the base of the sequence, more than 14 archaeological levels have been identified so far, all of them ascribed to the Middle Palaeolithic.

Level 10, which is the subject of this paper, is immediately below Level R3, dated by ^{14}C AMS to 38.8±1.2 kyr bp (AA-6481), and above S1, which yielded a date of >46.9 kyr bp (AA-6480) (Terradas *et al*. 1993). An area of about 55 m^2 of Level 10 has been excavated in which lithic artefacts and bone fragments are associated with 16 hearths (Fig. 2.2). Preliminary papers have been published on the hearth features (Martínez-Moreno *et al*. 2004) and lithic patterns (Mora *et al*. 2004). These studies revealed that the apparent homogeneity of the Level 10 assemblage is in practice the result of complex formation processes, in which different occupational events have become mixed up and deflated into a single 15 cm-thick layer (Martínez-Moreno *et al*. 2004). A detailed microstratigraphic study indicates that Level 10 is the result of a series of events over an indeterminate (albeit probably brief) period of time, but which ultimately gives an impression of an apparently synchronic occupation (Fig. 2.2).

This paper presents several contextual elements to discuss interactions between bone and lithic remains in assemblages where poor preservation of fossils biases interpretations. Given the active role of biostratinomic and fossil-diagenetic processes in the selective destruction of bone remains (e.g. Gifford 1981), establishing a systematic methodology for the study of site-formation dynamics is essential to overcome limitations driven by the absence or poor preservation of fossil data. Under these conditions, refit analysis contributes to reconstructing technical strategies, to studying the on-site spatial patterning of lithics and bones (Cziesla *et al*. 1990; Hofman & Enloe 1992) and determining site-formation processes (Bordes 2003; Hofman 1981; Villa 1982), all key components to understanding Neanderthal behaviour.

The faunal assemblage from Level 10 at Roca dels Bous

The faunal assemblage from Level 10 is heavily altered by several taphonomic processes, making it difficult to conduct an accurate zooarchaeological analysis. Mechanical processes such as rockfalls and heavy trampling produced intensive destruction of exposed

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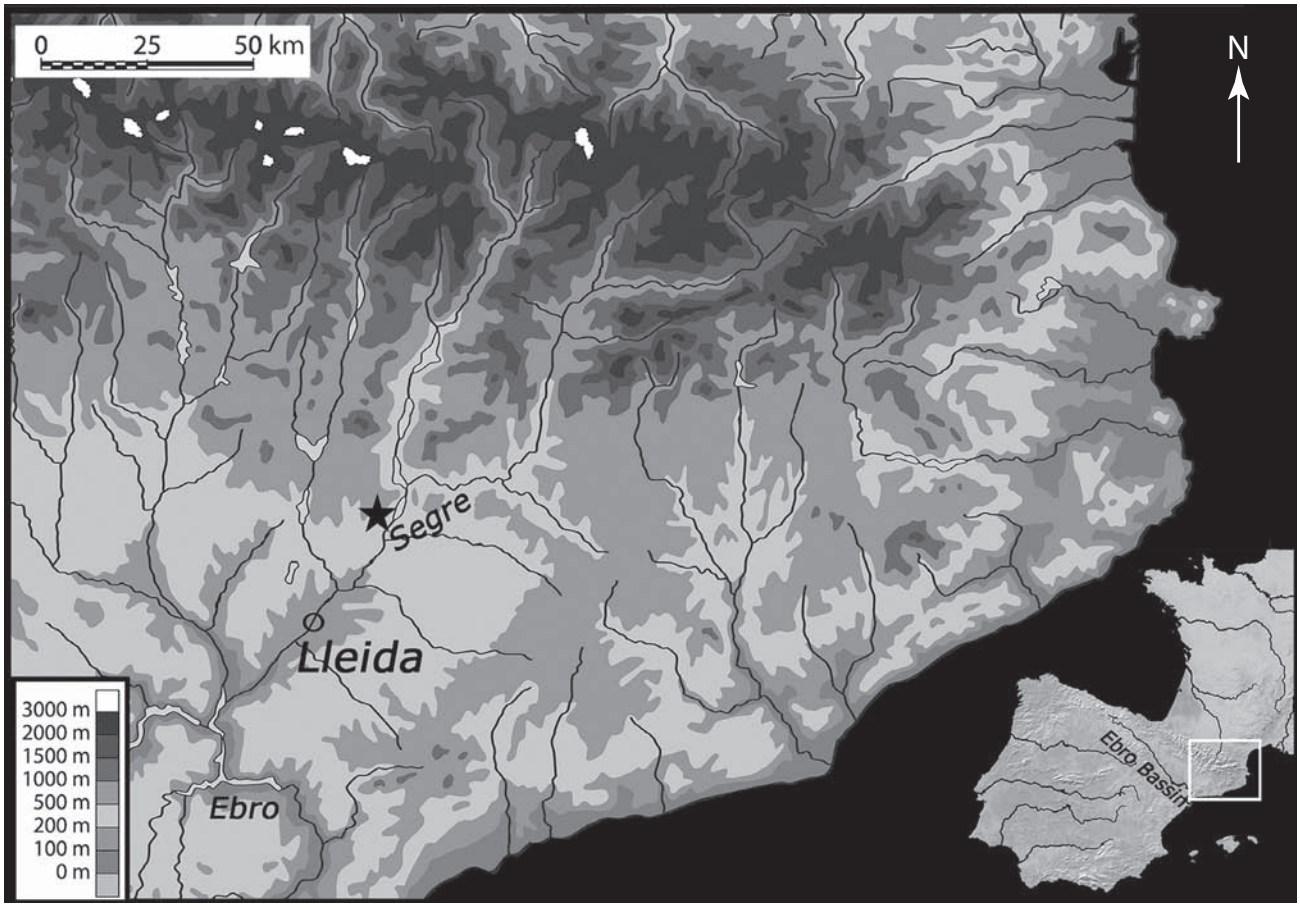


Figure 2.1. *Location of Roca dels Bous in northeastern Spain.*

and buried bones, fragmenting them into small pieces for which taxonomical and anatomical identification is difficult; 90 per cent of the bone assemblage is composed of fragments under 3 cm in size, displaying transversal and longitudinal fracture angles produced by intense post-depositional fragmentation. This pattern also applies to the teeth, whose count is made up of predominantly small unidentifiable pieces. Despite these constraints, two species of equids (one identified as *Equus hydruntinus*), a medium-sized cervid (*Cervus elaphus*) and the Spanish ibex (*Capra pyrenaica*) have been identified in Level 10. This species association indicates a mosaic landscape, with animals typical of dry grasslands and (to a lesser degree) rocky landscapes, as expected from the topographic position of the site.

In the few bones where analysis of surface modification was possible, wide and short superficial marks, indicative of trampling (Olsen & Shipman 1988), were usually observed. Other alterations are likely due to accidental fractures caused by falling rocks, as inferred from the *in situ* refit of broken pieces (usually diaphyses from limb bones) which, although fragmented, lie together. Amongst the well-preserved bones, two breaking patterns are observed, with some bones displaying helicoidal fractures and others green-bone breakages (Bonnichsen & Sorg 1989).

In some cases, impact notches on the medullar surface associated with percussion pits and percussion striae were found, which indicate the use of hammerstones for bone-marrow processing (White 1992). The few well-preserved diaphyses show slicing and scraping marks, suggesting regular filleting activities. Thus, in spite of the poor preservation of most of the bone assemblage, activities relating to animal transport and consumption such as skinning, dismembering and disarticulation (*sensu* Binford 1981; Lyman 1987; White 1992) can be inferred. These marks on the bones clearly indicate the involvement of lithic tools, either non-retouched sharp flakes producing slicing-marks, or scraping marks caused by retouched artefacts (Shipman & Rose 1983). Likewise, percussion marks and impact scars on bones link the fossil assemblage with artefacts such as cobbles or hammerstones, all present in the Level 10 lithic assemblage. The few identifiable bones show an association of slicing and

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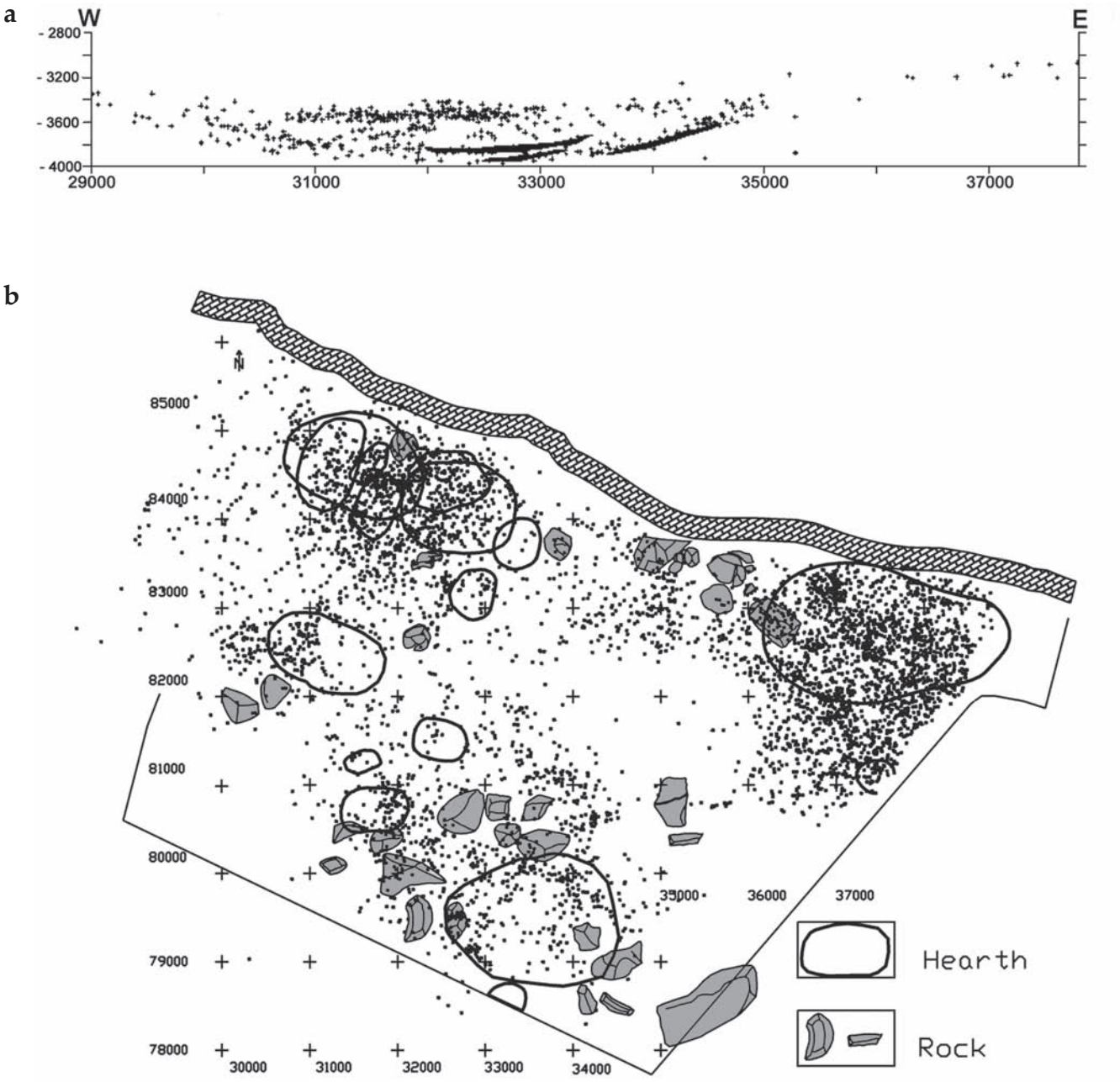


Figure 2.2. *a) East–west vertical plot of artefacts and hearths in Level 10 of Roca dels Bous. b) Area of Level 10 of Roca dels Bous, showing the location of the artefacts and hearths.*

bone-marrow extraction activities. Tentatively, this pattern could be linked to the final stages of processing and consumption of carcasses. The bone assemblage suggests systematic butchering and prime access to fresh carcasses. Also, in Level 10 the use of some bone fragments as *retouchoirs* (Martínez-Moreno 2005) has been attested, which constitutes another element linking the fossil and lithic assemblage (Fig. 2.3).

Fire traces are the most typical human-induced bone modifications in Level 10, with several degrees of thermo-alteration, from brown colour to charred bones (Shipman *et al*. 1984). However, in Level 10 we cannot automatically link burned bones with domestic activities such as the cooking and dismembering of anatomical parts (Gifford-González 1991). The analysis of the horizontal and vertical dispersion of burned bones (Fig. 2.4) demonstrates that some were deposited before and after the use of hearths, therefore suggesting that some thermo-altered bones were charred post-depositionally (i.e. after the discarding

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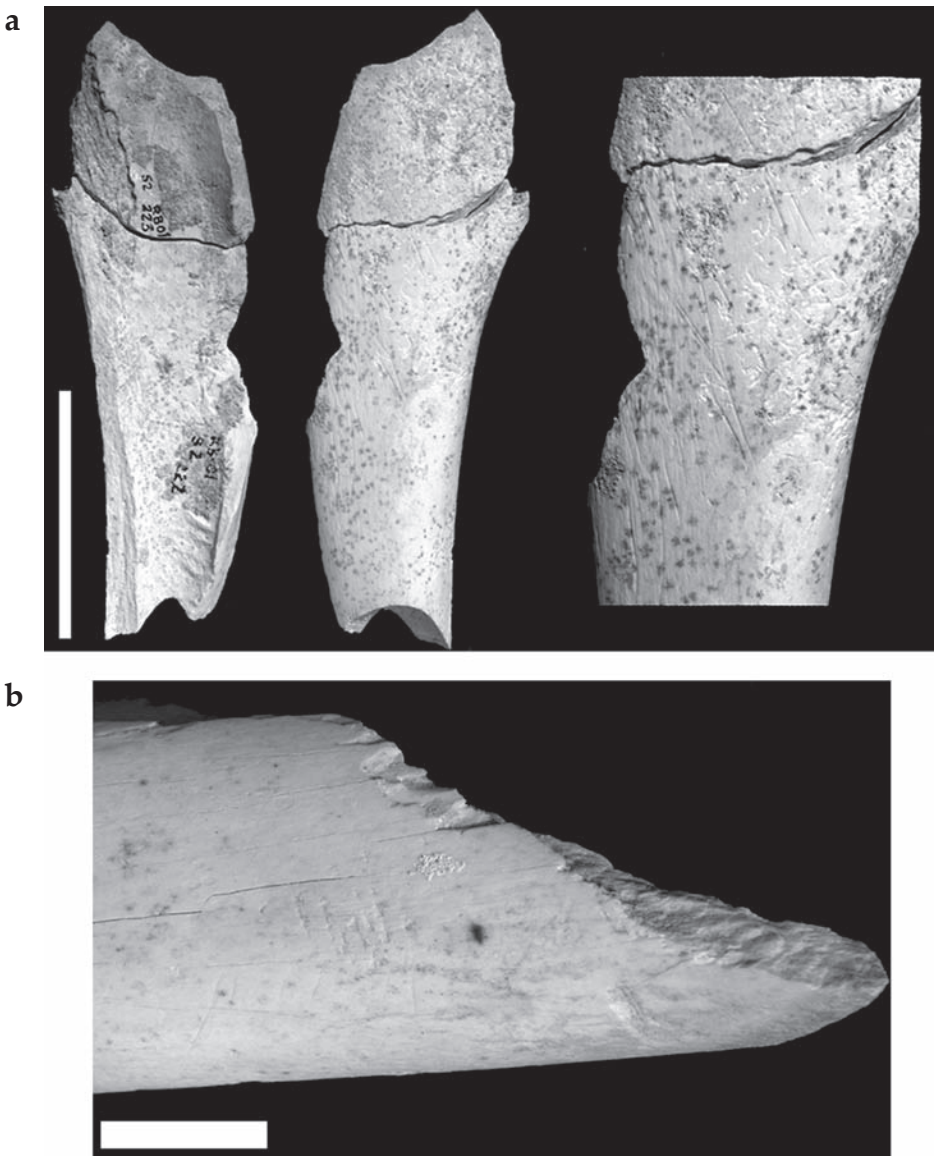


Figure 2.3. *a) Red deer humerus diaphysis, showing impact scars on the internal bone surface produced by hammerstones, and slicing marks from defleshing with lithic tools (scale: 5 cm). b) Diaphysis of limb bone of a medium-sized mammal, showing short, superficial marks in the centre of the shaft typical from its use as a* retouchoir *together with chopping and slicing marks (scale: 1 cm).*

of bones and as a consequence of the setting up of a new superimposed hearth).

These observations do not refute fire use for cooking, but point to the necessity of designing methodological strategies for testing such assumptions. The Level 10 bone remains demonstrate that equifinality (Gifford 1981; Gifford-González 1991) is relevant to the interpretation of the assemblage. The presence of a high number of heat-altered bones can be due to the accidental exposure to fire of pieces belonging to previous spells of site occupation. In fact, this issue recalls the problems related with the notion of 'temporal synchrony' raised in several other contexts (e.g. Bordes 1980; Villa & Courtin 1983).

General characteristics of the lithic assemblage

The lithic assemblage of Level 10 of Roca dels Bous consists of 3046 items. These are dominated by chert from a variety of different sources (67 per cent), together with various metamorphic rocks (mainly quartzites) obtained only a few metres from the site in the terraces of the river Segre. *Microdebitage* is by far the most abundant technological category (Table 2.1),

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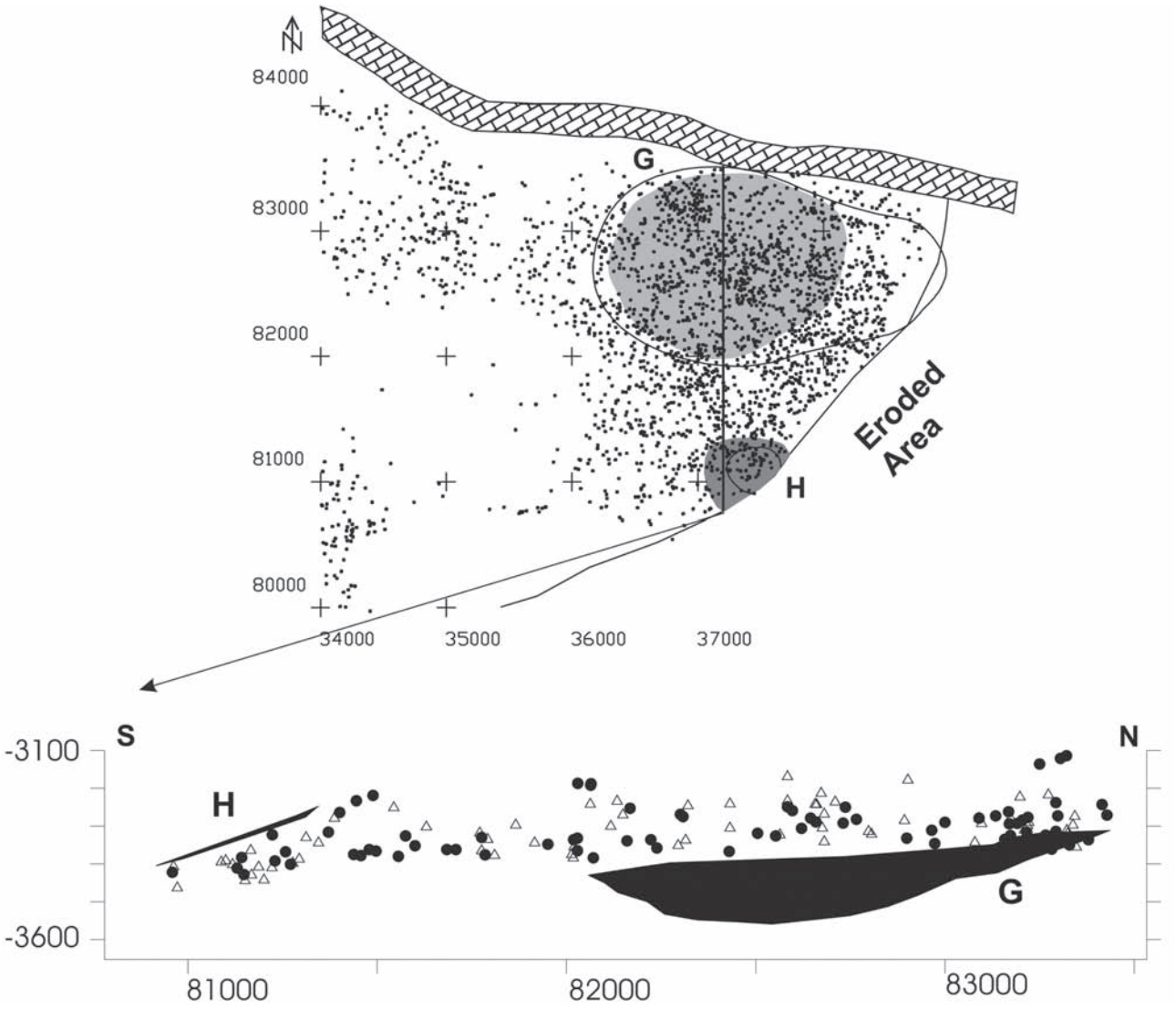


Figure 2.4. *Plan and section of the artefact distribution around hearths G and H in Level 10. Although horizontally fossils and hearths appear to be related, the vertical plotting of burnt bones (●) and unburnt bones (Δ) shows that such association is unclear.*

indicating the importance of *in situ* knapping and the absence of high-energy post-depositional processes. By comparison, few cores (0.8 per cent) or retouched pieces were recovered.

Given that 43.1 per cent of the lithic assemblage from Level 10 consists of debris smaller than 1 cm, refitting was restricted to a sample of 1750 larger artefacts, of which 145 artefacts (8 per cent) conjoin, making up a total of 63 refit sets (43 sets of flint, 16 of quartzite and 4 of quartz). This pattern is similar to frequencies obtained in Abric Romaní; in Level Ja, 282 refits (6.5 per cent) have been made out of 4556 artefacts larger than 1 cm (Martínez & Rando 2001). This percentage increases to 9.9 per cent in Level I of Abric Romaní, where 55 conjoined pieces were identified (Vaquero 1999). Neither Level 10 of Roca dels Bous nor Abric Romaní appear to have high percentages of refits, particularly when compared with the indices described by Cziesla (1990, 24–5).

Table 2.1. *Lithic categories in Level 10, Roca dels Bous.*

Category	N	%
Cores	26	0.8
Flakes	512	16.8
Flake fragments	889	29.1
Angular fragments	149	4.8
Microdebitage	1313	43.1
Retouched pieces	133	4.3
Hammerstones	19	0.6
Total	**3046**	**100**

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These small percentages of refits may have a behavioural meaning, since at both Abric Romaní (Martínez & Rando 2001; Vaquero 1999; Vaquero *et al*. 2004) and Roca dels Bous (Martínez-Moreno *et al*. 2004; Mora *et al*. 2004; de la Torre *et al*. 2005) the evidence suggests occasional, episodic occupations with fragmented *chaîne opératoires*. In itself, the fact that most of the lithic material cannot be refitted indicates a time–space separation between elements of the same reduction sequence, either by already-finished objects being introduced to the site or by others being taken away.

Certainly, the low percentage of refitted artefacts indicates the severity of fragmentation of the reduction sequence in Level 10 of Roca dels Bous. Only in nine cases (out of a total of 63 sets) has it been possible to refit three or more pieces, with the largest set being seven refitted pieces and most of the series (54 sets) consisting of only two lithics. Had all the reduction sequence been carried out at the site, one would expect there to be several dozen pieces per refit series (see Cziesla *et al*. 1990). Furthermore, the 63 refit series come from 18 different nodules of flint, five different metamorphic rocks and two varieties of quartz. Such variety in raw materials across what is a comparatively small number of artefacts may be taken as further indication of considerable fragmentation of the *chaîne opératoire*.

Types of lithic refits

Following the general categories proposed by Cziesla (1990), in Level 10 we have differentiated between refits from reduction sequences, refits of fractured artefacts and refits from secondary modification of artefacts. Within Cziesla's general category of conjoinable pieces from reduction sequences, we have distinguished between cores/products and dorsal/ventral refits. These two groups only comprise 36.4 per cent of the conjoined sets, which once again emphasizes the incompleteness of the *chaîne opératoire* here; very few of the cores refit with flakes at Level 10, and none of them comprise sequences with several artefacts, despite the scars on the cores indicating a high degree of exploitation. This indicates that artefacts were imported to Level 10 and taken away in different phases of reduction, suggesting a dynamic process of curating and discarding cores and products.

Another main group of conjoined pieces is that of fragmented artefacts. These types of refit sets are common elsewhere, and Level 10 of Roca dels Bous is no exception (Table 2.2). Amongst the conjoined pieces fractured during knapping, we have followed Cziesla (1990) and distinguished between transversal (17.4 per cent) and sagittal ('Siret') (12.6 per cent) fractures; they both indicate the occurrence of knapping accidents on site.

Other refit sets of fractured pieces can be attributed to post-depositional causes (7.9 per cent). It has been suggested that trampling of lithic artefacts (Gifford-González *et al*. 1985; McBrearty *et al*. 1998; Shea & Klenck 1993; Villa & Courtin 1983) may be one of the main causes of post-depositional fragmentation, although rockfalls (Nash 1993) and sedimentary compression also must be taken into account. Even though these kinds of refits do not normally show specific techno-typological attributes, post-depositionally fragmented pieces are usually found in adjacent position (e.g. Hovers 2003, 150–51), so that the post-depositional nature of fractures can confidently be identified during fieldwork.

Conjoined pieces resulting from the secondary modification of artefacts are also observed in Level 10, making up to 14.2 per cent of the refit sets (9 series). This group does not refer to the initial retouching of blanks, but to pieces that were re-sharpened after being fractured during their use. According to Eickhoff (1990), it is only possible to identify these reuse processes through refits, as only by connecting two objects with different retouches can we reconstruct the time sequence by which the artefact was broken and reused. In Level 10 we have an example of this type of refit; one retouched object was fractured in use and, instead of being discarded, one of the fragments was re-sharpened to extend its use-life.

In Roca dels Bous we have added one extra refit type to Cziesla's (1990) groups, i.e. thermic refits (those produced by fire cracking); although they are relatively infrequent (see Table 2.2) and provide little technical information, these are interesting in spatial and taphonomic terms. Provisionally these thermic sets are considered to be post-depositional and unrelated to the intentional heat treatment of lithic material, but they provide relevant contextual data concerning their proximity or distance to hearths.

Spatial dynamics of the refits at Level 10

The vertical dimension of refits is frequently used to address stratigraphic ascriptions and the contextual resolution of archaeological levels (Bordes 2003; Cahen & Moeyersons 1977; Gifford-González *et al*. 1985; Hofman 1986; Villa 1982). As yet no refits between different levels have been identified in Roca dels Bous. Although this possibility cannot be excluded, the archaeological levels excavated so far appear to show good internal coherence and are usually separated by sterile gaps of more than 20 cm, frequently made of hard carbonate crusts that pre-

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vent movement of artefacts. Still, the vertical distribution of artefacts and the presence of superimposed hearths, have made it possible to discern different phases within Level 10 (Martínez-Moreno *et al*. 2004), although refits alone do not allow the identification of each occupation.

Figure 2.5 is illustrative in this respect; despite there being gaps of 3–4 cm between lines of artefacts, which could be interpreted as defining different phases of occupation within Level 10, some refits suggest that artefacts above and below are indeed connected with each other. It is difficult to determine whether or not this was the result of the vertical movement of some artefacts due to post-depositional processes (trampling, gravity, rockfalls, etc.) disturbing different phases of occupation. The irregular rhythms of sedimentation suggest the existence of different occupation within a single archaeological unit, and reinforce the notion of Level 10 as a palimpsest.

The spatial dynamics of Level 10 refits also have behavioural implications. Our working hypothesis is that there were independent occupations of different sectors of the site, which produced the patches identified in Level 10. These clusters are usually associated with specific hearths. However, there are also elements that indicate some connections between patches. This is evidenced by refits linking different clusters within the 55 m^2 area excavated in Level 10, which imply that at least some of the assemblages in different clusters are contemporary (Fig. 2.6). Connections between the different patches are also suggested by stone tools that, although they do not conjoin, belong to the same raw material nodules and are spread across more than one of the clusters. At any rate, and in spite of these elements indicating some relation between the patches in Level 10, the general pattern of the refit spatial dynamics supports the occupation of single areas of the site. Although some connections are more than four metres apart (see Table 2.3), the distances connecting conjoinable pieces are generally shorter than the diameters of the patches (115 cm on average), and seem to represent separated episodes of stone knapping and use.

Table 2.2. *Groups of refit sets in Level 10, Roca dels Bous.*

Group	Type	Number of pieces		Number of refits	
		N	%	N	%
Knapping sequences	Core-products	23	15.8	6	9.5
	Dorsal-ventral	42	28.9	17	26.9
Fractures	Sagittal	16	11.0	8	12.6
	Transversal	22	15.1	11	17.4
Reworking		18	12.4	9	14.2
Post-depositional		10	6.8	5	7.9
Thermic		14	9.6	7	11.1
Total		**145**	**100**	**63**	**100**

Tables 2.3 and 2.4 show that technological refits and artefact re-working refits present the longest distances, apart from the seven-metre connection of a thermic refit. Although a number of knapping sequence refits exceed two metres, most are considerably shorter and fall within the dispersion ranges of material produced during single knapping episodes (Cattin 2002; Newcomer & de Sieveking 1980), a fact also supported by fracture refit sets (see Table 2.4). Post-depositional refits follow the same pattern, with connection lines under 1 m and usually under 30 cm (Table 2.4).

Refits of artefact re-working are particularly interesting; most of the re-worked refitted pieces are found in close proximity to each other, therefore suggesting the immediate re-sharpening of tools when they fractured: while using the artefact, instead of discarding it, the knapper immediately rejuvenated the tool. Additionally, the refit of two pieces separated by more than four metres indicates the movement of a re-worked tool from one cluster to another. Reconstructing the direction of the refits also evinces the sporadic relationship between different patches. Dorsal/ventral refits indicate the order of flaking sequences, and Figure 2.7 shows that in several instances the knapper moved around more than one patch of the site. Although it is not possible to identify preferential direction from one concentration to another, both the refits of re-worked pieces and the examples shown in Figure 2.7 depict occasional episodes of interaction between different clusters of the site.

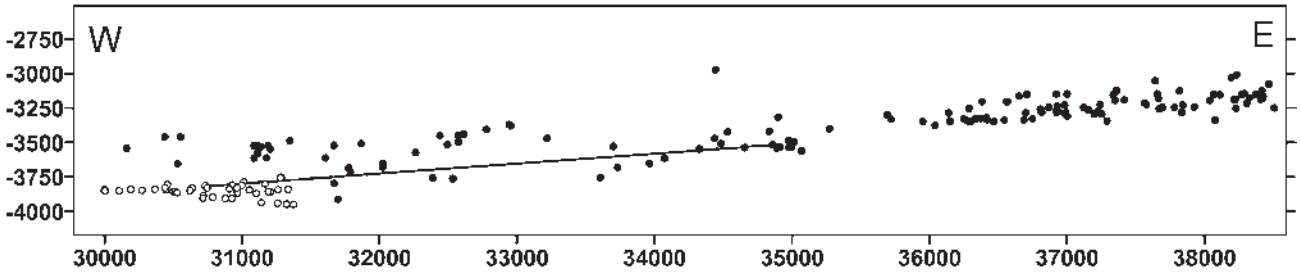


Figure 2.5. *Cross-section of part of Level 10, where a refit set links two separated alignments of pieces.*

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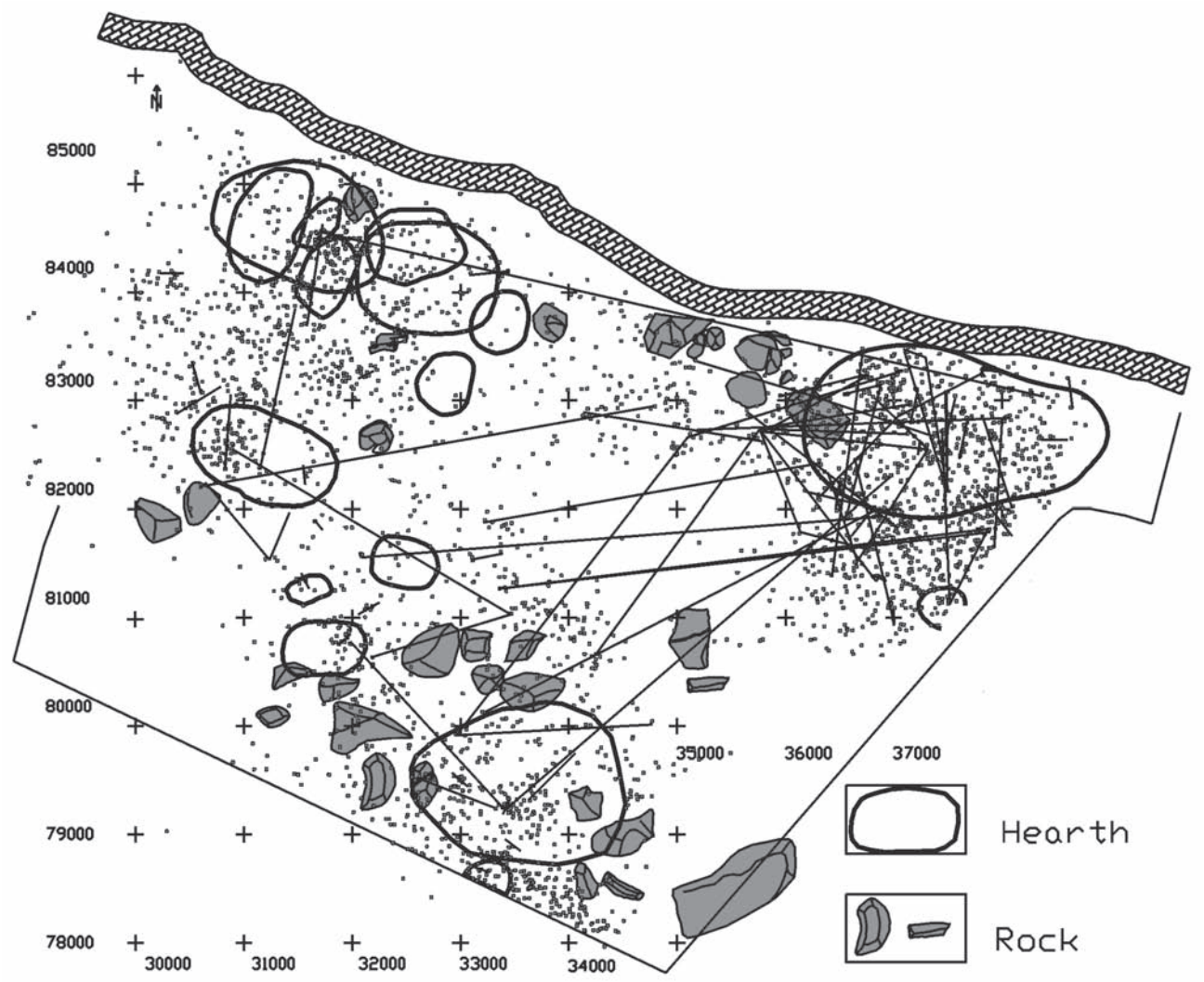


Figure 2.6. *Plan of Level 10 with the connections between refit sets.*

Table 2.3. *Number of refitted pieces in Level 10 by distance of connection.*

Distance (m)	Number of refits	%
<0.5	28	34
0.5–2	39	48
2–4	8	10
>4	7	8
Total	**82**	**100**

Table 2.4. *Average connection distance by refit type.*

Groups	Mean distance (cm)
Knapping sequences	144
Fractures	106
Reworking	147
Post-depositional	23
Thermic	156
Total	**115**

Conclusions

The study of refits is currently a common practice in the understanding of site-formation processes and human behaviour in Palaeolithic sites (Cattin 2002; Cziesla *et al*. 1990). This analytical tool has proved particularly helpful for the interpretation of the Level 10 assemblage at Roca dels Bous. The overall pattern of artefact distribution suggests the chrono-stratigraphic independence of the patches comprising this level at the site, but a few refits linking these clusters indicate that some relation also existed between the patches. That is, we assume that Level 10 consists of an indeterminate number of visits to the site that focused in small areas of the rockshelter, normally around one or two hearths, but that occasionally involved the interaction of more than one cluster.

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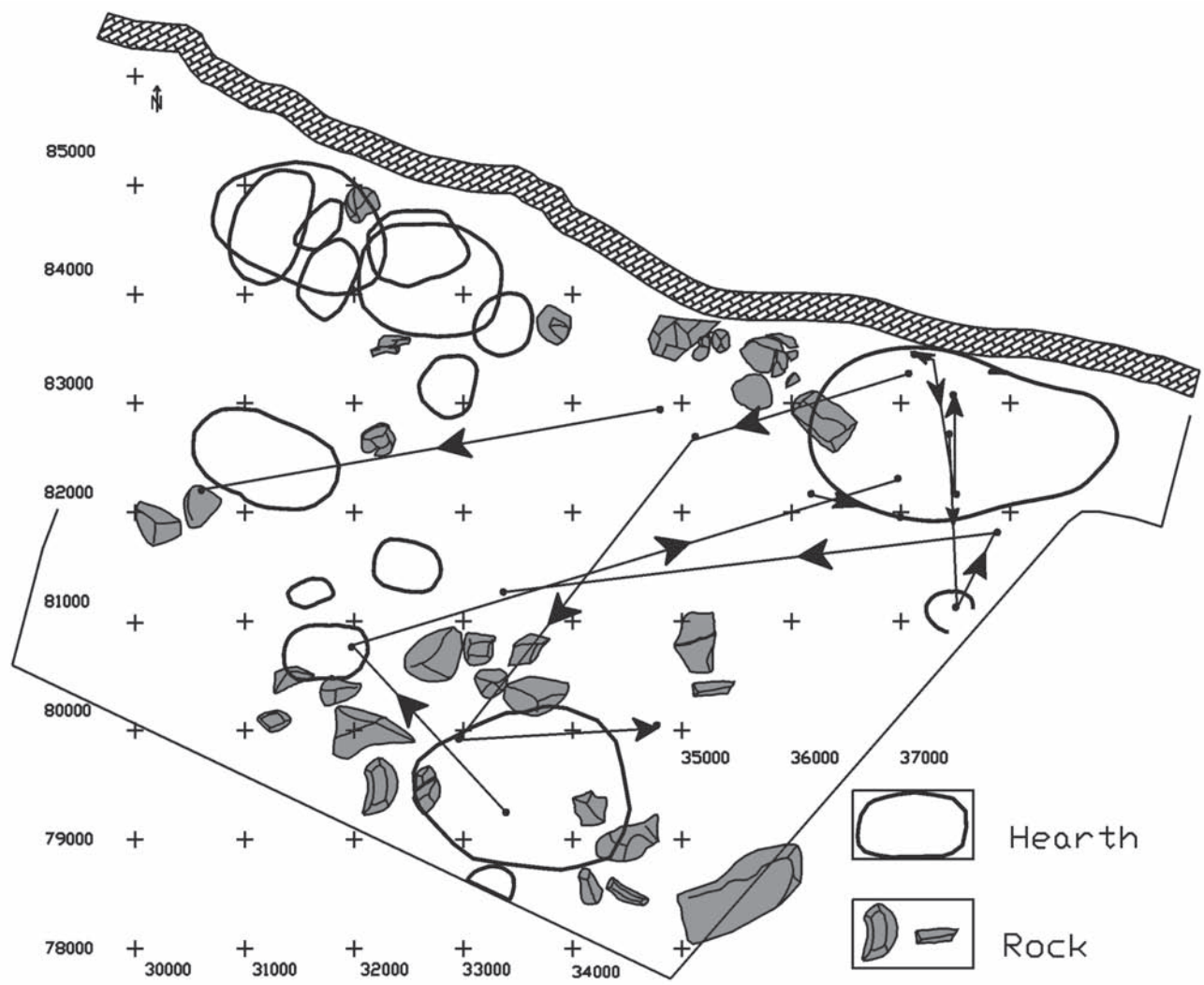


Figure 2.7. *Direction of some series of dorsal-ventral refits, indicating the connection between different patches in Level 10.*

Methodologically, the refit study has contributed to understanding the dynamics of artefact vertical dispersion. This refers particularly to the problems of isolating discrete phases within Level 10, given the fact that some refit sets connect artefacts separated by a vertical gap, and which otherwise would be considered as belonging to separated occupations within the same archaeological unit. At any rate, and even taking into consideration the objections raised by F. Bordes (1980) concerning the difficulty of establishing the contemporaneous character of assemblages, it is also obvious that refit analysis helps to gain a better understanding of the internal chronology of each assemblage (e.g. Cahen 1980), even if one assumes the palimpsest nature of Level 10.

Furthermore, refits provide valuable information on the knapping processes. In Level 10, 80 per cent (49 sets) of technological conjoined pieces are located within less than a 2 m radius and represent only short sequences of reduction, while at the same time include a wide range of raw materials. All of this indicates that there is a space–time separation between the different stages of reduction and use, and that processes of input and output of lithics consistently took place at Roca dels Bous. As a result, the *chaîne opératoire* present at Level 10 is substantially fragmented, preventing us from reconstructing complete knapping sequences through refit analysis.

Although at Level 10 the faunal assemblage is not very informative owing to its fragmentary state, detailed micro-stratigraphic analyses of bone distribution reinforce the notion of a palimpsest for Level 10. The example from Figure 2.4, where the purported association between burned bones and hearths is

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demonstrated to be ambiguous, provides a cautionary note about automatic assumptions linking bones and stone tools. More often than we usually acknowledge, understanding the actual relationships between bone and lithic assemblages is not an easy task and should be approached with caution. This leads to reflection on the notion of synchrony of occupations (Martínez-Moreno *et al*. 2004), and prompts the development of new methods to assess the temporal relationships of artefacts in the same levels.

The patterning from this study indicates small patches of artefacts and little interaction between the three main clusters in Level 10. This can be related to the occupation of localized parts of the rockshelter during brief visits to the site by small groups of Neanderthals. Tentatively, this could be linked to the occasional transport to the site of some animal resources, especially limb bones. However, the poor preservation of the bone assemblage makes it more advisable to consider other archaeological proxies. The taphonomic and behavioural information provided by conjoinable pieces in Level 10 of Roca dels Bous complements the conclusions drawn from the study of hearths (Martínez-Moreno *et al*. 2004) and knapping strategies (Mora *et al*. 2004): that the Neanderthals who occupied Roca dels Bous during the formation of Level 10 paid short-term visits to the rockshelter, bringing with them finished artefacts, making others on site, and then taking some with them when they left. All this produced a palimpsest that can be systematically studied, and to which this study aimed to contribute.

Acknowledgements

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