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Research Article

Structuring domestic space in the Lower Magdalenian: an analysis of the fauna from Level 115 of El Mirón Cave, Cantabria

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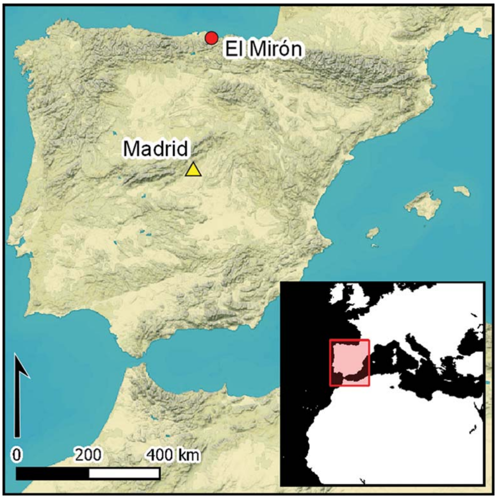

Documenting the intentional structuring of space by hunter-gatherers can be challenging, especially in complex cave contexts. One approach is the spatial analysis of discard patterns. Here, the authors consider the spatial distribution of faunal remains from the Lower Magdalenian Level 115 in El Mirón Cave, Cantabria, to assess a possible structuring function for an unusual alignment of rocks. Although it is impossible to determine whether the alignment was intentionally constructed, differences in the distributions of taxa and in specimen sizes on different sides of this feature suggest that it played a role in structuring the living space of the cave's inhabitants.

Keywords: Iberia, Upper Palaeolithic, zooarchaeology, spatial organisation, archaeozoology, faunal analysis

Introduction

Humans structure the spaces in which they live. Whether through formal architecture or the patterned use of space, at landscape or domestic scales, such structuring is ubiquitous among people past and present, from hunter-gatherers to members of complex societies (e.g. Otte 2012; Codding *et al.* 2016; Maher & Conkey 2019). Identifying spatial structuring in archaeological contexts, however, can be difficult, particularly when studying hunter-gatherer sites. Distinguishing anthropogenic structuring of space from patterning caused by other agents or

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archaeological processes is always challenging, but it is even more so in contexts where clear-cut evidence for intentional construction of architecture is lacking (Wandsnider 1996).

Despite these difficulties, there is evidence for human modification of space in the European Palaeolithic, extending as far back as 176.5 ka BP (Jaubert *et al.* 2016; see also Clark 2016, 2017; Gabucio *et al.* 2014). Much of the evidence comes from open-air sites, for example, a large structure at the Middle Magdalenian site of Peyre Blanque (dated to approximately 19 ky cal BP; Maher & Conkey 2019) and pavements at Magdalenian open-air localities in the Dordogne (Gaussen 1980) and Les Landes (Arambourou 1978; Straus 1995). Despite the many confounding factors associated with cave archaeology, there is also some evidence for the structuring of space at European Palaeolithic cave sites (e.g. Reeves *et al.* 2019). Hearths, for example, are well-documented in cave contexts (e.g. Barandiarán *et al.* 1985; Straus & Clark 1986; Freeman 1988; Freeman *et al.* 1988; Utrilla *et al.* 2003; Nakazawa *et al.* 2009; White *et al.* 2017). Evidence for other types of structures is less widespread, but examples include possible ritual spaces at the Cantabrian sites of El Juyo and La Garma (e.g. Straus 1992; Freeman & González Echegaray 2001; Cacho Quesada *et al.* 2007; Straus & González Morales 2007; Arias 2009). Such domestic structures provide insight into the Palaeolithic concept of 'home', as well as into adaptation, behaviour and decision-making. Distinguishing intentional anthropogenic activity from non-anthropogenic phenomena and other post-depositional processes (e.g. rock falls), however, remains a challenge when attempting to validate any potential Palaeolithic structure.

Here, we evaluate a proposed domestic structure from the Cantabrian cave site El Mirón: an alignment of rocks from the Lower Magdalenian Level 115 that is suggested to have functioned as a wall (Straus & González Morales 2018). We use the spatial distribution of archaeological fauna around this feature to assess whether it represents a deliberate attempt to organise space during the Magdalenian occupation of El Mirón.

Structuring domestic space in Magdalenian Cantabria

Hunter-gatherers through space and time have shaped their domestic spaces, as well as the wider landscapes in which they live; the ways in which they do so, however, are typically quite different from the strategies used among sedentary agricultural societies (Maher & Conkey 2019). In Palaeolithic Europe, evidence for the structuring of space by hunter-gatherers extends back into the Middle Palaeolithic (Clark 2016, 2017; Jaubert *et al.* 2016) and becomes prominent during the Magdalenian (17–12 ky BP; Simek 1984; Utrilla *et al.* 2003; Fuentes *et al.* 2019; Mas *et al.* 2021). While evidence for structuring of space across wider landscapes (that is, economic and social territories) is especially well documented (e.g. Straus 2009; Fontes *et al.* 2016, 2018; Álvarez Alonso 2018), there are examples from across Europe of Magdalenian sites with internal, or domestic, spatial structuring (Koetje 1994; Jochim 2019). Many of these examples include what Koetje (1994) calls 'architectural structures'—hearths, pavements, alignments of rock, or other features that seem to have structured Palaeolithic people's use of space. Although establishing the anthropogenic origin of these structures can be challenging, demonstrating their function can be particularly difficult, especially in cave sites, where the palimpsests formed by repeated occupations, along with post-depositional processes, can cause problems for interpretation (Straus 1979, 1990; Clark

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2017; Jochim 2019). Consequently, archaeologists often fall back on demonstrating that features were present when the site was occupied, rather than attempting to demonstrate how they were used (e.g. Karkanas *et al.* 2002).

In cases where clear-cut evidence for architectural features is lacking, recognition of spatial structuring often rests on analyses of the distribution of refuse, whether lithic debitage, faunal remains, or both (Rosell *et al.* 2012; Speth *et al.* 2012; Vaquero *et al.* 2012; Yeshurun *et al.* 2014; Clark 2016; Anderson *et al.* 2018). Ethnoarchaeological studies provide models for discard patterns, and, in at least some instances, these do appear to align with the distributions of archaeologically documented material, permitting some interpretation of the function and use of specific spaces (see discussion in Clark 2017). While the challenges posed by cave environments are at least as difficult to parse in the analyses of discard as they are in establishing the presence of specific structures, the ethnoarchaeological record of hunter-gatherer discard behaviour provides a useful interpretative framework.

Combining the documentation of features with an analysis of discard patterns may therefore facilitate the recognition of further examples of 'architectural structures' within caves, while also providing insights into their functions. Although the analyses of discard behaviour alone cannot determine whether humans intentionally constructed any individual feature or, conversely, whether they made use of structural materials that were already in place (e.g. a rock fall), such an approach can determine whether these features played a role in the structuring of activities, and, in some instances, how those features served to organise hunter-gatherer space.

The El Mirón Level 115 rock alignment

The Lower Magdalenian (*c.* 20.5–18.5 ky cal BP) of Cantabria, along the northern Atlantic coast of Spain, features numerous documented examples of spatial structuring within cave sites (e.g. Freeman & González Echegaray 2001; Arias 2009; Arias *et al.* 2011; González Echegaray & Freeman 2016). The cave of El Mirón (Figure 1), excavated between 1996 and 2013 under the direction of Straus and González Morales (2012), provides several examples of features that indicate such structuring behaviour, particularly in the levels associated with the Magdalenian. These include the 'Red Lady' burial (Straus *et al.* 2015), as well as a series of hearths, pits and stone-paved areas (Straus & González Morales 2007; Nakazawa *et al.* 2009). One intriguing feature from El Mirón is an alignment of large limestone rocks and sandstone cobbles, infilled with smaller rocks, identified in Level 115 (Straus & González Morales 2018). The age of Level 115 is modelled at *c.* 20 500–20 015 cal BP (Hopkins *et al.* 2020) and is one of several levels in the so-called 'Corral' area (see below; Figure 1) that date to the Lower Magdalenian. Archaeologically rich, this layer is distinct in its sedimentological composition and appearance from both underlying Level 116 and overlying Level 114 (Straus & González Morales 2012).

The cave vestibule area was sufficiently spacious to allow inhabitants to segregate activity areas. The rock alignment was identified in an 8.5m^2 excavation area, known as the Corral, at the rear of the cave vestibule (Figure 1). The rock feature comprised 11 unmodified limestone blocks and two large cobbles, plus many smaller stones, laid along the eastern boundary of squares T9, T8 and half-square T7, and the western edge of U9, U8 and half-square U7 in Level 115 (Figure 2). The feature may have continued into the unexcavated portion of

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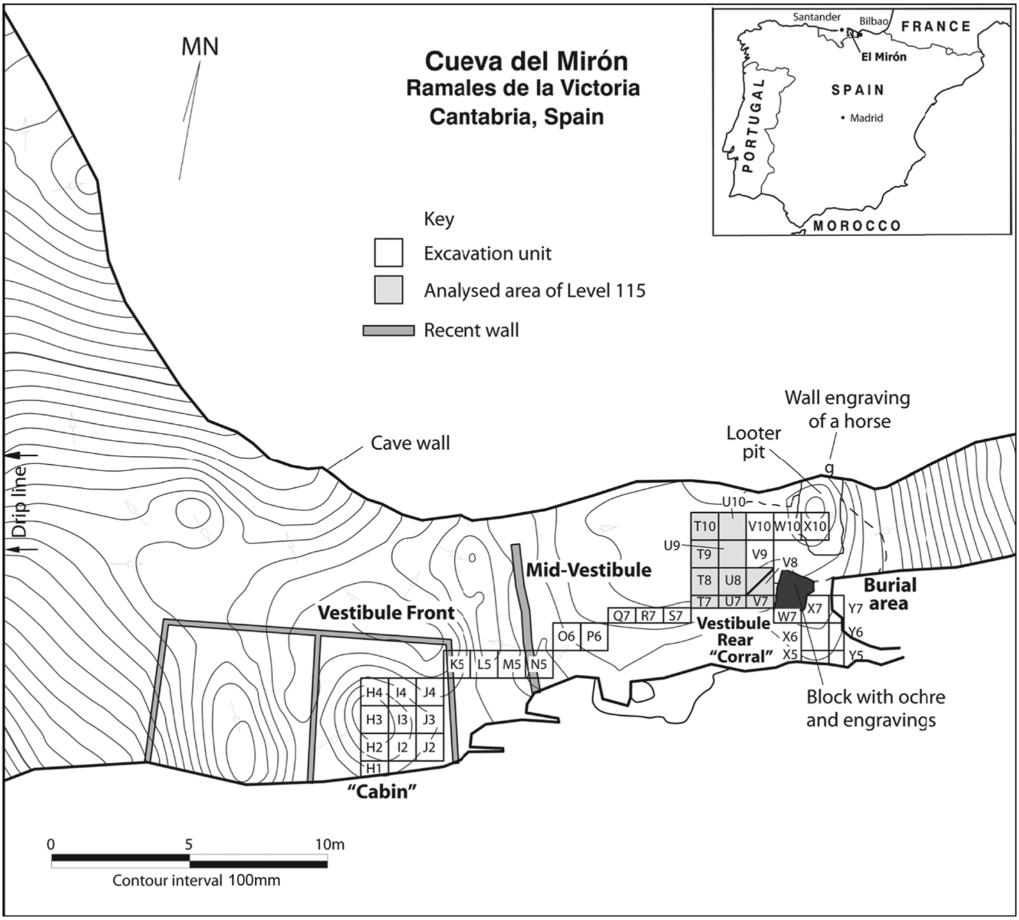

Figure 1. Plan of El Mirón Cave, showing location of Level 115 (by L.G. Straus and R.L. Stauber, based on cave topography by E. Torres).

square U7. The limestone blocks and cobbles sat atop Level 116, indicating that the feature was present during the deposition of Level 115. No traces of postholes were observed in association with this feature, although pits have been documented elsewhere in the Lower and Initial Magdalenian levels at El Mirón (Straus & González Morales 2012).

No similarly dense and apparently linear concentrations of large rocks and cobbles have been found elsewhere in the Magdalenian levels during any excavations of the site. It may, therefore, have been a deliberately constructed alignment, or perhaps the occupants of El Mirón rearranged some blocks that had fallen from the cave roof, enhancing them with the addition of rocks and cobbles from the alluvial fill of the inner cave. Either way, the fact that the feature was present during the deposition of Level 115 qualifies it as a potential 'architectural structure'. The uneven artefact distribution around the rock alignment supports this hypothesis (Table 1; see also Straus & González Morales 2018). End scrapers were more frequent to the east and north of the feature, while bladelets were concentrated to the west. Straus and González Morales (2018) suggest that this patterning may reflect

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Figure 2. The rock alignment in Level 115: top) during excavation (photograph by L.G. Straus. From left to right are squares U9, U8 and the north half of U7—that is, the eastern portion of the feature); bottom) in plan view (see Straus & González Morales 2018: fig. 2). 'Éboulis' indicates angular limestone spall (plan by L.G. Straus and R.L. Stauber).

an arming/re-arming area to the west and a sewing/hideworking area to the north (three bone needles and an awl were also recovered to the north of the feature). Sample sizes, however, are small, and the spatial patterns identified are subtle, making it difficult to draw conclusions about the function of the rock alignment. While the associated tool discard patterns suggest a feature on which people sat, its location, far from the cave mouth, as well as the presence of some round cobbles on top of the limestone blocks, might suggest otherwise. The alignment may instead have functioned as a wall—perhaps, a partition that served to demarcate an area

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Table 1. Residuals of chi-square analysis of artefact distributions around the rock alignment feature (data from Straus & Gonzalez Moráles, 2018: tab. 6). Values significant at the α = 0.05 level are in bold.

Main Tool Groups/Areas	West of feature (T7–9)	East of feature (U7–9, V7–8)	North of feature (T–U10)
Endscrapers	**−4.41**	**2.62**	**3.04**
Nucleiform 'scrapers' & planes	−0.21	0.40	−0.28
Burins	−0.50	−0.44	1.48
Perforators	0.00	−0.09	0.13
Retouched and backed bladelets	**5.77**	**−3.88**	**−3.27**
Denticulates, notches & sidescrapers	**3.07**	**3.29**	−0.15
Splintered pieces (bipolar cores)	−0.21	1.01	−1.23
Continuously retouched pieces	−1.78	−0.43	**3.52**

for rubbish disposal. Combining the findings of Straus and González Morales (2018) with an analysis of the distribution of the faunal remains recovered in this area may provide additional insight into the function of the rock alignment.

Materials and methods

Previous analyses indicate that humans were the primary accumulators of many faunal assemblages at El Mirón (Marín Arroyo 2009, 2010; Straus *et al.* 2013; Geiling & Marín-Arroyo 2015; Marín-Arroyo & Geiling 2015; Geiling *et al.* 2016; Geiling 2020; Carvalho *et al.* 2021), including the macro-mammalian assemblage from Level 115 (Carvalho *et al.* 2021). Faunal remains at El Mirón were recovered using two methods: larger pieces (generally ≥10mm, or readily identifiable, such as teeth) collected during excavation were piece-plotted, while smaller bones and fragments were recovered by screening ('general bags'). Bulk materials were recorded to 0.25 × 0.25m squares, allowing for the spatial analysis of the distribution of finds. While there is some variation in density, the faunal remains appear to have been evenly distributed around the rock alignment (Figure 3).

To test the hypothesis that the feature may have had an effect on taxonomic distribution, we use Jones's identification of the macro-mammalian remains (both piece-plotted and bulk-collected) from Level 115; identifications were conducted, with support from Marín-Arroyo, at the Laboratorio de Bioarqueología (Instituto Internacional de Investigaciones Prehistóricas de Cantabria), using its comparative osteological collection (for additional details on identification methods, see Carvalho *et al.* 2021). Following Straus and González Morales (2018), we divide these data into three spatial units: west (excavation squares T7, T8 and T9); east (excavation squares U7, U8, U9, V7 and V8); and north of the rock alignment feature (excavation squares T10 and U10). Given our inclusion of both piece-plotted and bulk collected material in this analysis, as well as the context of Level 115, the chances of aggregation errors are high. We therefore make use of the Number of Identified Specimens, or NISP (see discussions in Grayson 1984; Lyman 2008). We use Spearman's rank-order correlation to identify any large-scale taxonomic differences in the assemblages from the west, east and north

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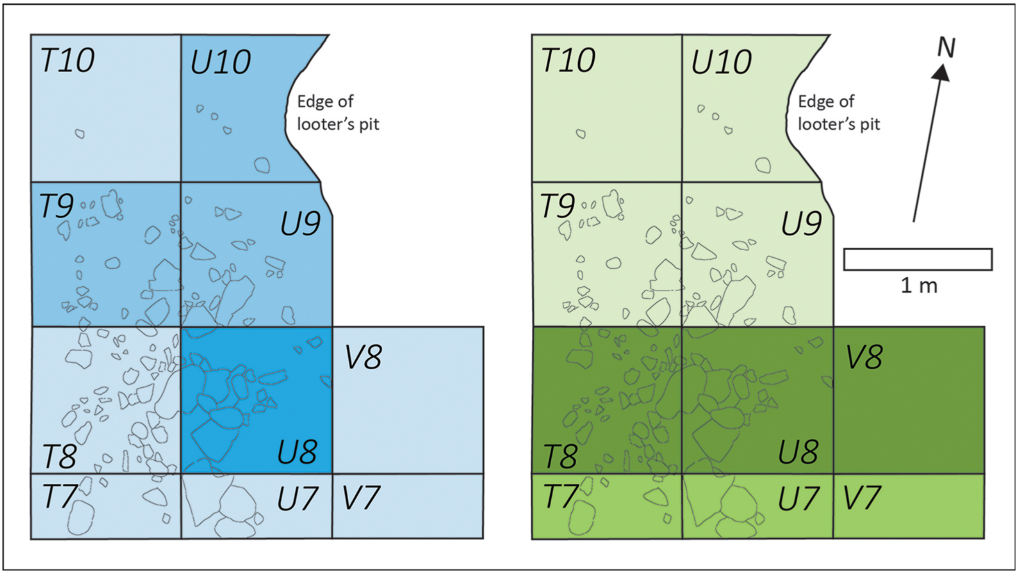

Figure 3. Left) number of bone specimens recovered from Level 115 by excavation square (light blue: 5–10 per cent of total; medium blue: 10–15 per cent of total; dark blue: 15–20 per cent of total); right) average weight of Level 115 bone specimens by excavation square (light green: ≤2.70g; medium green: 2.71–3.49g; dark green: ≥3.50g) (figure by E.L. Jones).

sides of the feature. We then apply a chi-squared test for association to test for differences in taxonomic frequency.

To investigate the possibility of variation in the types of bone-working activities on different sides of the rock alignment feature, we take two approaches. First, we assess differences in fragmentation to either side (east and west), and to the north, of the feature. We use two metrics as proxies for specimen size: weight, which was recorded for all specimens; and maximum length, which was recorded for long bone fragments only. For both metrics, we assess normality using the Shapiro-Wilk test. For normally distributed data, we test for differences using Analysis of Variance; for non-normally distributed data, we use the Kruskal-Wallis rank-order test.

Second, we consider the frequency of different types of anthropogenic bone surface modification (i.e. cut marks and impact marks) on specimens from different sides of the feature. Cut marks (typically defined as incisions that are V-shaped in cross-section) may represent butchering and other carcass processing activities, while impact marks (including features such as conchoidal fractures, notch marks or chop marks) may indicate post-butchering bone processing. Our identification protocol for fracture types and bone surface modification follows the work of Carvalho and colleagues (2021; see also Fernández-Jalvo & Andrews 2016; Vettese *et al.* 2020). Statistical analyses are conducted in PAST (Hammer *et al.* 2001); the raw data for all the analyses are available in the online supplementary material (OSM).

Results

Taxonomic distribution appears to differ around the rock alignment feature (Table 2). While the Spearman's rank order correlation analysis indicates that taxonomic rank order is similar

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Table 2. NISP of macro-mammalian faunal specimens from Level 115.

Taxon	West of feature (T7–9)	East of feature (U7–9, V7–8)	North of feature (T–U10)
Bos/*Bison* sp.	2	10	2
Equus ferus	2	8	2
Cervus elaphus	153	280	68
Capreolus capreolus	2	13	2
Capra pyrenaica	180	351	130
Rupicapra rupicapra	9	28	12
Lepus sp.	1	0	2
Lynx lynx	1	0	0
Vulpes vulpes	2	1	3
Indeterminate artodactyl	129	283	156
Indeterminate carnivore	2	3	2
Indeterminate	527	1261	370

on all sides (Table 3)—a finding that likely reflects the relatively small number of taxa identified, as well as the dominance of red deer (*Cervus elaphus*) and ibex (*Capra pyrenaica*)—the chi-squared analysis identifies a significant association between location relative to the feature and taxonomic distribution ($\chi^2 = 30.68$; $p = 0.02$). The adjusted residuals associated with this analysis (Table 4) suggest that this result is driven by differences in the area to the north, where there are significantly fewer red deer remains than expected, but more ibex and smaller fauna, notably hare (*Lepus* sp.) and red fox (*Vulpes vulpes*; see Figure 4).

Specimen size also varies spatially. As both weight and maximum length are not normally distributed, we use the rank-order Kruskal-Wallis test for both analyses. Our analysis of weight indicates that fragments recovered from east of the feature are significantly heavier than those from areas to the west and north ($H = 21.79$; $p = 0.00$; Figure 3). This is corroborated by our analysis of maximum length; again, the Kruskal-Wallis test indicates that long bone fragments recovered from east of the feature are significantly longer than those from the west or north ($H = 6.63$; $p = 0.03$). Finally, bone surface modification frequencies are low overall, particularly cut marks; impact marks are slightly more frequent (Table 5). There appears to be no significant spatial difference in the frequency of bone surface modifications—an observation supported by the results of a chi-squared test ($\chi^2 = 0.24$; $p = 0.89$).

Table 3. Spearman's rank-order correlation analysis.

Locations compared	r_s	p-value
West of feature/east of feature	0.96	0.00
West of feature/north of feature	0.91	0.00
East of feature/north of feature	0.81	0.02

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Table 4. Adjusted residuals from the chi-square analysis of taxonomic frequencies surrounding the rock alignment feature. Values statistically significant at the α = 0.05 level are in bold.

Taxon	West of feature (T7–9)	East of feature (U7–9, V7–8)	North of feature (T–U10)
Bos/*Bison* sp.	−1.14	1.27	−0.32
Equus ferus	−0.87	0.84	−0.08
Cervus elaphus	1.73	0.71	**−2.97**
Capreolus capreolus	−1.49	1.82	−0.63
Capra pyrenaica	−0.519	−1.17	**2.14**
Rupicapra rupicapra	−1.51	0.36	1.32
Lepus sp.	0.21	−1.90	**2.25**
Lynx lynx	1.61	−1.10	−0.46
Vulpes vulpes	0.30	−1.87	**2.10**

Discussion

The distribution of the faunal remains around the rock alignment in Level 115 suggests that the hunter-gatherers who lived at El Mirón used this feature to structure their domestic space. This finding supports the results of the spatial analysis of artefactual material undertaken by Straus and González Morales (2018) (Figure 4). But what can this distribution of faunal remains tell us about the function of this feature? The small size of the faunal fragments, the relatively low frequency of cut marks, and the higher frequency of impact marks combine to suggest that the area around the feature was neither a primary butchery area nor a food-consumption area. The small fragment size could reflect marrow extraction, but particularly to the north and west of the rock alignment, the presence of red fox—a taxon often hunted for raw material (such as pelts, teeth for ornaments and bone for toolmaking) rather than for its contribution to human diet (see discussion in Baumann *et al.* 2020)—suggests another option. At least one of the red fox specimens recovered from Level 115—a mandible with multiple parallel grooves along the ramus and with the inferior surface removed—is heavily modified in a way that suggests use of the bone for making tools or ornaments (Figure 5). Hares, a few fragmentary bones of which were also recovered in this area, may also have been hunted for non-dietary reasons, such as for pelts (Rosado-Méndez *et al.* 2019).

The patterns do not seem to indicate a wall or partition used to contain rubbish; in such a case, one would expect most of the refuse to have been contained on one side of the feature, rather than distributed around it. The rock alignment may have demarcated a bone-working area; this would be consistent with the findings of Straus and González Morales (2018). If

Table 5. Bone surface modification NISP in Level 115.

	West of feature (T7–9)	East of feature (U7–9, V7–8)	North of feature (T–U10)
Anthropogenic cut marks	38 (5.66%)	124 (9.12%)	33 (7.07%)
Anthropogenic impact marks	76 (11.31%)	264 (19.43%)	76 (16.27%)

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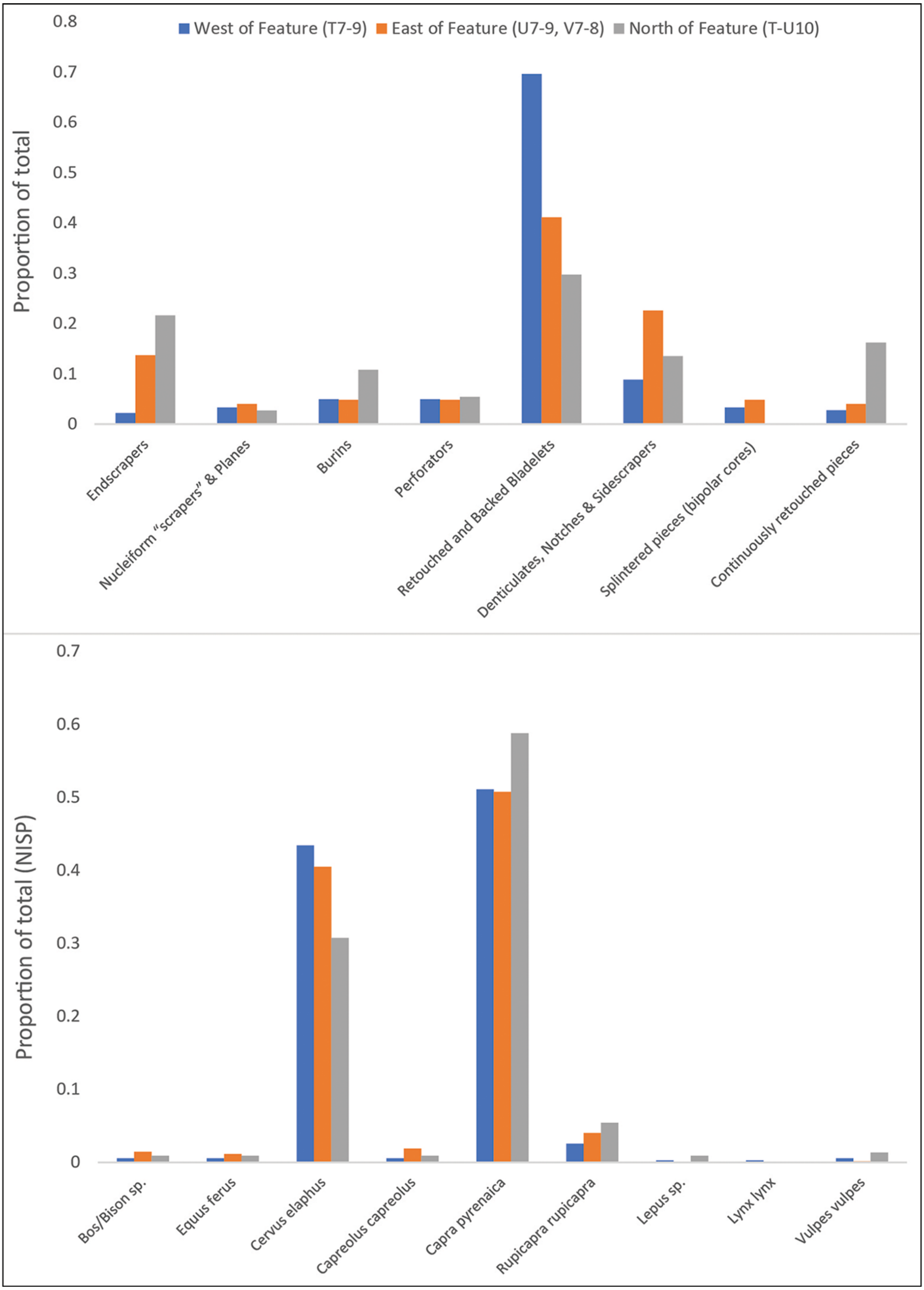

Figure 4. Top) proportion of stone tool types to the west, east and north of the rock alignment feature (data from Straus & González Morales 2018); bottom) the taxonomic relative abundance of faunal remains (as a proportion of NISP) to the west, east and north of the rock alignment feature (figure by E.L. Jones).

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Figure 5. Red fox (Vulpes vulpes) *mandible from excavation square T9 (grooves, indicated by arrow, are along the body of the mandible, parallel to the alveolus). Scale in cm (photograph by E.L. Jones).*

bone-workers sat on the feature facing west, discarding materials behind them (to the east), this might account for the larger faunal specimen size to the east of the wall. The suggestion that this was an area for bone-working, however, is confounded not only by the limited natural light in this area of the cave (it receives direct light only during the late afternoon), but also by the scarcity of bone tools (aside from many needles) recovered from deposits at El Mirón, despite the abundance of antler projectile points. If the inhabitants of El Mirón were working bone as a raw material, where were the products of this activity eventually deposited? Still, the frequency of internal marks on the faunal specimens does suggest that the activities undertaken at El Mirón were not primarily related to food production, and the discard patterning around the alignment suggests that its function was not simply to contain or demarcate an area for refuse disposal.

The El Mirón rock alignment can thus be added to the list of Magdalenian domestic structures from Cantabria and elsewhere in Upper Palaeolithic Europe. Our analysis has several further implications. In terms of zooarchaeological analysis, the Level 115 faunal assemblage does not appear to reflect dietary subsistence directly, but rather indicates the use of animals for other purposes. This has important implications for interpretation of the relative abundance of different animal taxa in the Level 115 fauna. More broadly, the rock alignment, and its possible function as a type of site furniture, serves as a reminder that even in caves, which afforded pre-existing structural spaces, Palaeolithic hunter-gatherers still actively shaped the spaces in which they lived through everyday practices.

Conclusion

While we cannot demonstrate whether the El Mirón Level 115 rock alignment was intentionally constructed, our analysis shows that it was used as a structure by the Lower Magdalenian inhabitants of El Mirón Cave. The taxonomic distribution of faunal remains, size of faunal specimens recovered, and the distribution of stone tool artefacts around this feature all indicate that it shaped the space in which these people lived, whether as a 'bench' that served as seating, a type of partition, some other function, or a combination of these possibilities. As with features identified at other Magdalenian sites in Cantabria and elsewhere in Western Europe, the El Mirón rock alignment from Level 115 demonstrates one of the myriad ways in which Palaeolithic hunter-gatherers engaged in the spatial structuring of their daily lives and physical environments.

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Supplementary materials

To view supplementary material for this article, please visit https://doi.org/10.15184/aqy.2023.9.

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