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Sickles and "something more" at the Chalcolithic site of Camino de las Yeseras (Madrid, Spain). How use-wear analysis discovers such new production activities as threshing

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ABSTRACT

Until recently, few studies have been made of lithic tools from Chalcolithic sites although they comprise a very abundant record in many productive and funerary contexts. However, it is now possible to go deeper into more aspects than merely typological ones. Use-wear analysis provides the possibility of inferring the functionality of certain lithic pieces that, until now, have been interpreted as sickles by applying only typological analysis.

This research presents an initial study of 17 blade and leaf-shaped tools documented at the central Iberian site of Camino de las Yeseras (San Fernando de Henares, Madrid, Spain). The sample was recovered in different types of domestic structures –huts, segments of ditched enclosures and different pit features–. Although they are typical of Chalcolithic assemblages, these types of tools have not been systematically studied from a traceological or even technological point of view. The results of this study reveal cereal processing in the site, which is well supported by the presence of millstones, remains of cereal grains, pollen and other phytolithic evidence of vegetal elements like spikes and straw.

We have performed a techno-traceological study of a set of blade and leaf-shaped pieces in order to identify their use and try to distinguish tasks connected with farming activities. This research has obtained important results inferring that the leaf-shaped bifacial pieces were not only sickles, but also threshing-board elements. The traces on the tools confirm the implementation of a new farming technology at the site, which would favour a more efficient exploitation of vegetal resources. Indeed, large-scale cereal production would require tools as complex and effective as threshing-boards.

In conclusion, it is necessary to emphasize the important role that use-wear analysis can play in research into Chalcolithic lithic technology. In this case, the use-wear results indicate that most of the pieces described typologically as sickles must have been hafted or inserted in some kind of threshing tool. Up to now, only a few Iberian sites are known with threshing tools, and the Camino de las Yeseras results indicate new agricultural technologies in cereal grain exploitation at Chalcolithic Iberian sites.

1. Introduction

Camino de las Yeseras is one of the largest Chalcolithic sites with ditched enclosures known in Central Iberia. It is located to the northeast of Madrid, strategically placed on a terrace at the confluence of the Henares and Jarama rivers. Belonging to the middle-upper Tagus basin, it is situated in a well-communicated landscape with several natural pathways (Ríos, 2011) (Fig. 1). Nearby, important resource catchment areas -flint, salt, clay- pasture and farming land explain a long-term occupation from the last centuries of the fourth until the second millennium cal BC.

In an extension of ca. 22 ha, more than 8500 documented structures have been documented by surface scraping, and more than 2000 were excavated: mainly pits, ditched enclosures, huts, and tombs (Blasco et al., 2005, 2007, 2011; Liesau, 2017; Liesau et al., 2008; 2013; Ríos, 2011; Ríos et al., 2016).

To date, five fieldwork seasons have allowed some of the site features to be known, especially in the southern area, where several

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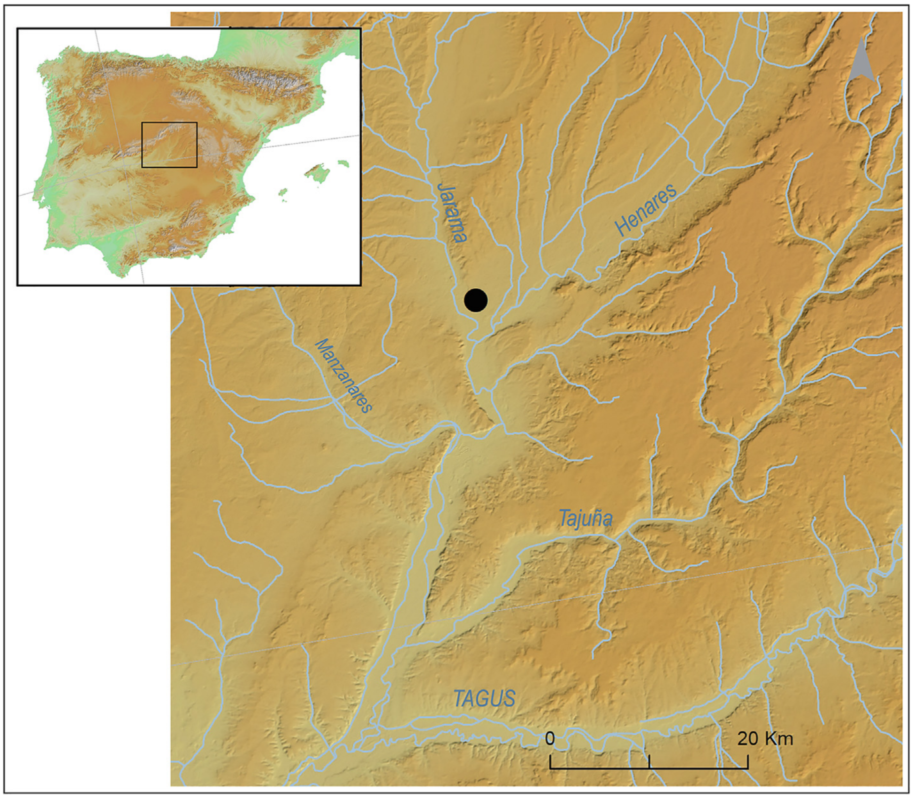

Fig. 1. Location of Camino de las Yeseras in central Iberia (Madrid, Spain).

habitational and funerary structures have been studied, as well as hundreds of pits with great variability in size and function.

Thousands of lithic remains have been recovered, comprising one of the most frequent items, together with pottery and faunal remains. The lithic assemblage is currently under study. Preliminary assessments and analysis of the lithic tools have been carried out in general studies on the site (Blasco et al., 2007; Ríos, 2011: 298-302, 391-410) and in more specific studies on the macrolithic tools (Blasco et al., 2008; Escobar and Ortiz, 2011; Ortiz et al., in press).

The selection criteria for this sample are based on the fact that, with the exception of piece No. 16, all of them were recovered in the second emergency field season carried out in 2003–2004. The materials exhumed in this archaeological field work were submitted to our research group for study. Among these, there was a set of selected lithic tools that included these retouched pieces (morpho-typological criteria), traditionally related to agricultural activities. In this sense, the sample has not been taken from the entire excavated area, but the size of the area where these pieces come from (4600 m^2 and 278 structures) is an acceptable representation of the southern area of the Chalcolithic settlement. Likewise, the extension is comparable and even greater than the areas studied in other contemporary sites.

Until recently, scarce interest was taken in the application of functional analysis to post-Neolithic materials in the Iberian Peninsula. This was probably a consequence of several factors. Firstly, most of the use-wear specialists had been trained in research groups dedicated to older periods. Secondly, archaeologists working on more recent periods did not see in this research line a way of approaching the activities carried out by those later communities, and lastly, there was simply a lack of knowledge of the interpretive possibilities.

Fortunately, this outlook has been changing gradually, as evidenced by several contributions published in the last two decades (Gibaja, 1999, 2002; Gibaja et al., 2004, 2012; Palomo et al., 2012; Clemente et al., 2014; Díaz del Río et al., 2014; Esteve et al., 2015; Mangado et al., 2016; Marín, 2018; Marín et al., 2017; Cardoso and Gibaja, 2019).

The aims of this paper are: 1) to test the possibilities of use-wear analysis on a set of pieces studied for the first time in the central Iberian site of Camino de las Yeseras; 2) to present a technological and functional analysis of a selected sample recovered in features from the south area of the ditched enclosure site with several domestic, habitational and funerary features; 3) to study exhaustively the lithic implements related to the processing of cereals, especially the pieces used for threshing, an activity that is still not well-known at European Recent Prehistoric sites (Skakun, 1992; Gurova, 2001; Gurova and Chabot, 2007).

2. Materials and methods

From the huge amount of lithic items recovered at the site, a selection of 17 pieces was made in order to assess the detection and diagnosis possibilities of use-wear. They come mostly from the second emergency excavation season, carried out between November 2003 and April 2004, on the occasion of the duplication of the M − 206 road. This fieldwork was carried out by “Gestión del Patrimonio Cultural S.L.” company, under the direction of Miguel Rodríguez Cifuentes. One piece comes from the 2010 season directed by C. Blasco, C. Liesau and P. Ríos of the Autonomous University of Madrid with the collaboration of the Archaeology and Heritage master students (Fig. 2, Table 1).

Most of these artefacts are prominent carefully-shaped pieces that stand out from the lithic substrate at the site. Their morphology and the presence of macroscopic gloss on some of them, pointed to the possibility that they were all employed in the cereal processing. Although the analysis of the lithic assemblage is currently in progress, we can confirm that this type of artefact is scarcely represented at the site, at least in the south area included in the second field season. In the future, the technological and functional analysis will be improved with a larger sample for a more comprehensive interpretation of the lithic production system and its use.

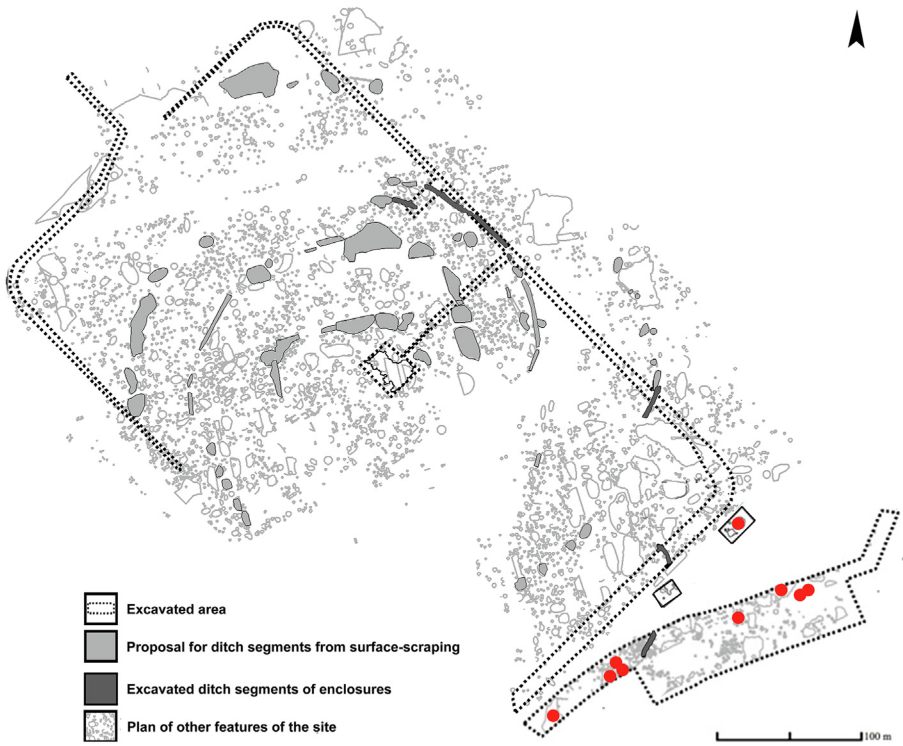

Fig. 2. Distribution of the provenience of the analyzed pieces in the general plan of Camino de las Yeseras site (Plan from Argea Consultores, S.L, Gestión de Patrimonio Cultural & Camino de las Yeseras Group-UAM).

The selected pieces come from ten different archaeological contexts that reveal great spatial and typological variability. Two pieces come from small pits, another two from large circular structures and four huts with sunken floors, another one from a large space altered by a modern gravel quarry (F-337), and the last one from surface cleaning of the excavated area (Fig. 3).

Structures F-276 and F-248 are pits and they stand out because they provided more than one item of the pieces under study, 3 and 4 respectively. Both structures had been sealed, in one case covered by stone pebbles and the other one by a burnt mudplaster. The other two structures of this type, F-245 and F-493, to the west, are larger in size. Regarding the rest of the site, huts are frequent features documented in the southern area. Four of these pieces appeared in four huts distributed across the excavated area (F-251, F-322, F-411 and CE / EA), one piece in each hut.

Except for the so-called Structure F-322, of smaller size, the rest are large and complex structures with several chronological phases and reshaping episodes whose materials are under study. The characteristics observed in a preliminary analysis undoubtedly allow them to be associated with the Chalcolithic occupation, where the available dates indicate a long-term use of this area, from 2850 to 2200 cal. B.C. (Ríos, 2011). In the case of Structure 411, two radiocarbon dates from different stratigraphic levels provided dates from the first half of the third millennium cal. B.C: 3950 ± 40 BP (Beta 20445) and 4090 ± 40 (Beta 20446). Hut F-322 has been interpreted as a space surely of ritual use in relation with ancestors; it contained a series of structured deposits with large quantities of Bell Beakers and non-Bell Beaker decorated pottery and singular deposits of fauna (Liesau et al., 2013). Summing up, the selected pieces do not belong to a specific moment of occupation, but they are present from the earliest dates in the beginning of the third millennium BC to the end of Bell Beaker presence. In any case, they are definitely not associated with the core of Bronze Age structures in the Proto-Cogotas phase, documented at the site.

The functional surface analysis of the assemblage of lithic tools from Camino de las Yeseras was performed with the combined use of a Leica MZ16A binocular microscope with 10x to 90x magnification, and an Olympus BH2 metallographic microscope with 50x to 400x magnification, with a Canon 450D camera. In addition, photographic software (Helicon Focus v. 4.62) has been used in order to obtain fully focused images.

For the functional interpretation, several macro- and microwear traces were considered: scars, rounding, striae and micropolish. Such traces are diagnostic for determining both the motion of tool utilization (kinematics) and the worked material, as well as for detecting surface alterations (Keeley, 1980; Plisson, 1985; Vaughan, 1985; Van Gijn, 1989; González and Ibáñez, 1994; Gassin 1996). The functional diagnosis has been established by comparing the archaeological samples with the experimental reference collection at the IMF-CSIC in Barcelona, Spain. This collection is the result of many years of research and experimental analyses conducted by the members of the *Grupo de Arqueología de las Dinámicas Sociales* (see for example Ibáñez, 1993; Clemente, 1997; Gibaja, 2003; Mazzucco, 2018).

3. Technological analysis

The lithic assemblage from Camino de las Yeseras is currently under study. Although the total number of items has not been established, the lithic assemblage is known to contain the remains of at least five *chaînes opératoires*. These are: blades, long blades, leaf-shaped tools, arrowheads and small flake-based tools. At first sight, it constitutes a typical Chalcolithic industry in inner Iberia. The most abundant remains belong to small-flake tool production. This is a domestic production usually made from local raw materials. In this site, blades are scarce and it seems that they were not produced on site, at least in the excavated area. This is also the case of long-blades, whose production waste has so far not been recorded in Camino de las Yeseras. In this geographic area, long blades appear systematically fragmented and used unlike other areas of the Iberian Peninsula (Castañeda 2018: 149-150).

A production area for arrowheads, and probably leaf-shaped

Table 1
Morpho-technological and functional information about the lithic tools at Camino de las Yeseras.

N°	Archaeological context	Structure	Morfo-tecno	Size (mm)	Distance between teeth (mm)	Depth between teeth (mm)	Number edges used	Use-wear	Other associated information
1	F-245	Pit	Leaf-shaped flake with serrated edge	74 × 31 × 9.5	2	1	1	Threshing element	generic Chalcolithic
2	F-248	Pit	Leaf-shaped flake with serrated edge	66 × 37 × 6	3.5	2	1	Threshing element	generic Chalcolithic
3			Flake with serrated edge	46 × 32 × 7	3.5–5	2	1	Sickle	
4			Leaf-shaped flake with serrated edge	57 × 30 × 10	3–6	2	1	Cut Plant indeterminate	
5			Leaf-shaped flake with serrated edge	8 × 39 × 10	2.5	1.5	1	Threshing element	
6	F-276	Pit	Leaf-shaped flake with serrated edge	59 × 25 × 8	2	1	1	Sickle or/to separate spike and roots on the ground	generic Chalcolithic
7			Leaf-shaped flake with serrated edge	50 × 34 × 10	1.5	1		Not Used?	
8			Long blade fragment with two serrated edges	78 × 29 × 11	3	1	2	Cut Indeteterminate Soft Material	
9	F-493	Pit	Leaf-shaped flake	68 × 33 × 9	Continuous edge		1	Sickle	Associated to Hut F-411
10	F-251	Hut	Long blade fragment with serrated edge	45 × 25 × 6	2.5–3.5	1.5	1	Sickle	generic Chalcolithic
11	F-322	Hut	Leaf-shaped flake	95 × 58 × 8	Continuous edge		1	Threshing element	Bell beaker pottery2500–2000 cal BC in the site
12	F-337	Big structure Ditch?	Leaf-shaped flake with serrated edge	83 × 25 × 10	3–4	1.5	1	Threshing element	Bell beaker pottery2500–2000 cal BC in the site
13			Long blade fragment with serrated edge	33 × 20 × 8	2–2.5	0.2	2	Sickle or/to separate spike and roots on the ground	
14			Long blade fragment	34 × 21 × 8	Continuous edge		2	Side Left (Threshing element); Side Right (Sickle or/to separate spike and roots on the ground)	
15	F-411	hut	Retouched flake	63 × 39 × 16	Continuous edge			Not used	C14 dating –charcoal: 3950 ± 40 (Beta-20445): 2572–2307 cal BC
16	SECTION E/EST. A/ 1/1	hut	Long blade fragment	66 × 25 × 6	Non retouched natural edge		1	Sickle or to cut the plants on the ground	C14 dating –bone- UE 03: 3751 ± 42 BP (Ua-41497): 2287–2036 cal BC
17	SURFACE	–	Long blade fragment with serrated edge	47 × 21 × 9	1.5	0.2	2	Side Left (Sickle); Side Right (Sickle or/to separate spike and roots on the ground)	generic Chalcolithic

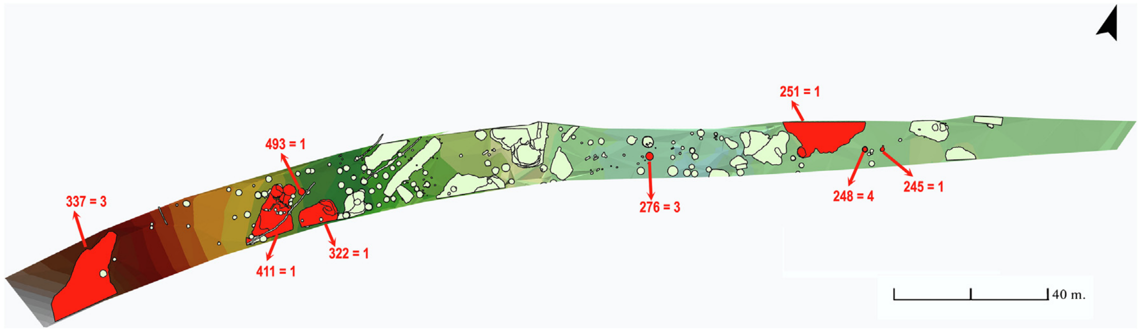

Fig. 3. Detailed plan of the southern area of Camino de las Yeseras showing the distribution and number of the analyzed pieces in each of their archaeological contexts (Plan from Gestión de Patrimonio Cultural).

elements too, has been recorded at the site with the presence of two antler pressure tools, pressure debris and roughouts (Ríos 2011). These two artefact types were made from flake blanks by pressure retouch. At a regional scale, leaf-shaped elements occur exclusively in domestic Chalcolithic contexts (Castañeda 2018: 150-151).

In this paper, we have focused on the analysis of all the leaf-shaped elements, blades and long-blades that *a priori* could have been used for cereal processing, including two retouched flakes with clear lustre gloss. In the case of leaf-shaped elements, the sample includes all the pieces of this type found in the second field season and almost all the blades.

From a technological point of view, the analysed tools have been divided into three groups according to the blank selected to make them: leaf-shaped pieces made from flakes (9) (Fig. 4) and armature elements made from long blades (6) (Fig. 5) and from flakes (2) (Fig. 4.C). The assemblage can also be divided into two groups by the shape of the edge: if it is simple (continuous) (5) or serrated (12) (Table 2).

The mean size of the six blade tools in the sample is 50.5x23.5x8 mm (Fig. 5). All of their blanks are long-blade fragments obtained by means of reinforced pressure. Shaping in these pieces is very light, with direct or inverse marginal retouch (never bifacial) and rectilinear delineation of edges. None of them displays rejuvenation by means of retouching. This does not imply the absence of rejuvenation, because they might be used first with the natural edge, as in the case of piece number 16 (Table 1) (Fig. 5.D). This reinforces the hypothesis of retouching as a means of rejuvenating edges.

The two retouched flake fragments (numbers 3 and 15) were made in opaline heterogeneous flint. The blanks were not selected obviously for the raw material quality, but for its size and shape, similar to a blade fragment. Although both have scarce marginal retouch on one edge, one of them is more carefully shaped than the other (3) (Fig. 4.B).

The leaf-shaped tools have a mean size of 70.89x34.67x8.9 mm (Fig. 4). They were made on fine flake blanks by scarce bifacial shaping. In several cases (1, 4, 11 and 12) it is possible to observe parts of the original surface of the flake. The final configuration of the edges was carefully made by pressure retouch that is often short (1, 2, 4, 5 and 6) or shows long parallel scars (1, 6, 7, 9, 11 and 12) and they generally display rejuvenation (1, 4, 5, 7, 9 and 12). On occasions, rejuvenation was so intense –perhaps in the case of fractures- that the general shape of the tool was affected (7, 9 and 11). All the pieces have at least one convex edge, most of them both edges, excepting three tools with one rectilinear edge (6, 7 and 9). The distal end of the tool is frequently pointed, excepting two convex cases (4 and 12). The proximal end is variable: three cases are rectilinear (7, 9 and 12), two convex (1 and 5), one concave (4), one oblique with two notches (11) and two of them were fractured by the effect of fire and the proximal end is indeterminable (2 and 6). In any case, both proximal and distal ends were very carefully shaped.

The size of leaf-shaped and blade tools in the sample differs noticeably (Fig. 6), with the former longer and wider than the latter. The only two flakes are similar in width to leaf-shaped tools but comparable to blades in length. The sample is too small to allocate them the role of blade-like tools. However, morphologically they look like blade-tools and the sizes of the active edges are within the blade tools range.

As the size of the sample precludes statistical analysis, it is important to notice that the serrated edge is the most frequent characteristic, in both leaf-shaped and blade elements (Table 2).

The choice of a simple or serrated edge depends on the future use of a tool. The simple edge is most suitable if the type of cut requires a transversal movement with reference to the edge (push cutting). However, when it is necessary to cut hard materials, a serrated edge is more efficient. This is because the smaller surface of the ridges applies greater pressure to break the surface. Although shaping the teeth makes a serrated edge thicker, each tooth edge is thinner than a continuous simple one. A serrated edge is more hardwearing and it requires slicing cutting with back-and-forward motion in a longitudinal direction with regards to the edge.

Although the serrated edges of the analysed sample show wear in every piece, they were made very carefully, with a very regular distance between the teeth in each tool, between 1.5 and 6 mm and a depth of 0.2–2 mm. Blade serrated edges show a mean distance between the teeth of 2.5 mm and 0.7 mm in depth. Among leaf-shaped serrated edges, the mean values are 3.05 mm and 1.43 mm for the distance between teeth and depth respectively.

The serrated edge is located on only one side of the tool (excepting piece number 8) (Fig. 5.A) and usually shows evidence of rejuvenation in the leaf-shaped tools. The straight delineation of the serrated edges of blades creates a homogeneous shape that protects teeth from wear and fractures by a balanced distribution of pressure on all of them. The presence of rejuvenation traces suggests the reshaping of an edge that probably was simple at the beginning and was afterwards reinforced with the teeth.

In addition to the obvious technological differences between leaf-shaped and blade-based armature elements, there are very noticeable differences in this assemblage regarding the raw material. A macroscopic classification suggests that all the leaf-shaped elements were made from different varieties of opaline and recrystallized flint from the Casa Montero formation (Bustillo et al., 2009). Its genesis in Magnesian smectite clay deposits (Bustillo et al., 2009: 177-180) made it particularly suitable for pressure retouch, in addition to its aesthetical qualities. On the contrary, blade elements were made in another type of flint probably from the Henares basin. This flint has a high quantity of quartz and is homogeneous and hardwearing. The two armature elements made on a flake blank as an imitation of blade elements were made from the local Casa Montero formation flint. The presence of these elements reinforces the hypothesis of the absence of long blade knapper specialists at Camino de las Yeseras.

Taking into account that blade and leaf-shaped implements evidently differ in blank, shaping, morphology, size and raw material, a difference in use is expected.

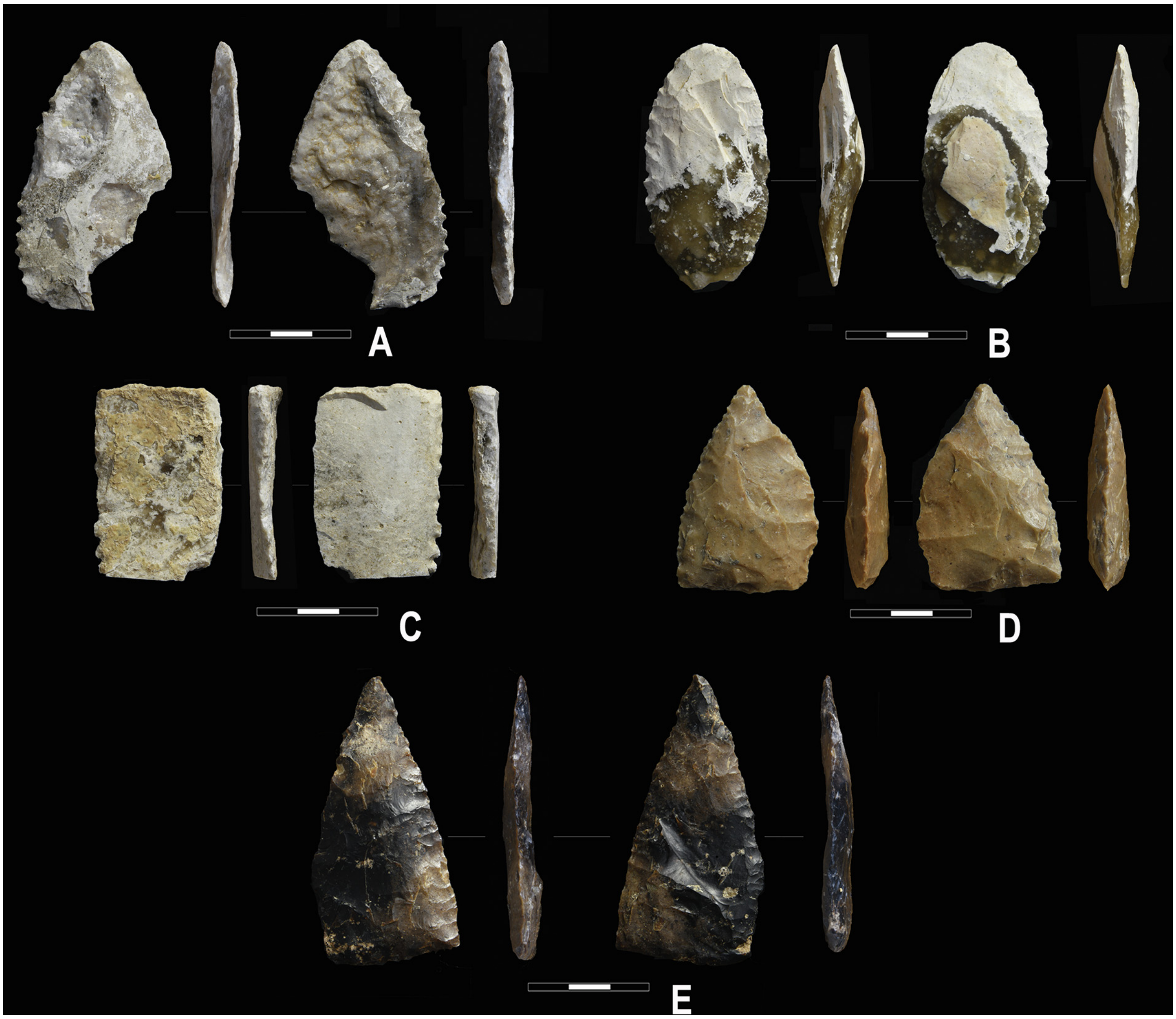

Fig. 4. Analysed pieces numbers 2 (A), 4 (B), 3 (C), 7 (D), and 9 (E).

4. Use-wear analysis

This first test confirmed that, even though the material showed different natural and anthropic alterations (floor and thermal lustre and patinas), the use-wear development level allows, in most cases, a precise diagnosis of the worked matter and the movement made.

In this way, 15 of the 17 selected pieces showed modifications by use while two of them were not used (numbers 7 and 15) (Table 1). Among the used tools, 11 have a single active area and four have two used edges (8, 13, 14 and 17). Most of these pieces, up to 14 of them, were used to cut non-woody plants, especially in different activities linked to cereal processing, and one retouched blade was used to cut a soft indeterminate matter (number 8).

This study focuses precisely on the pieces devoted to cutting non-woody plants. It is important to highlight that not all of them showed the same type of modifications because of the activity they were used for, and varied considerably in the intensity of use.

4.1. Sickles

Three blades with retouched edges (two of them serrated: numbers 3 and 10) and a large leaf-shaped flake (9) show typical traces of cereal reaping (Fig. 7.A). Two of these blades and the bifacial flake reveal only one active edge. The opposite side, and also the distal parts in two cases, were retouched. These modifications should probably be linked with hafting. The retouched areas would have made fastening them easier and avoided the integrity and preservation of the haft being affected by use.

With regard to retouch in the active areas, its goal was to extend the working life of the tool. Cereal cutting usually results in severe wear with rounded and blunt edges that cause a consequent loss of effectivity. The only way to continue using these edges was rejuvenation by retouching.

In these pieces, the cereal polish shows great variability in the quantity of the striations. These differences can relate to the part where the plant was cut (more striations if it was a low cut or fewer striations if the cut took place in the middle or high part of the stem) (Anderson-Gerfaud, 1988, 1992; Korobkova, 1992; Juel Jensen, 1994; Ibáñez et al., 2008).

Finally, the distribution of the gloss on the edge indicated that the tools were fitted parallel to the haft. The edge length (between 45 and 68 mm) and shape demonstrate that they must have been highly effective tools. Wear intensity and edge rejuvenation, due to the length of time of use, suggest that sickles were tools made with care to be used for a long time.

4.2. Threshing elements

Six pieces show clear threshing traces (Fig. 8) (Table 1). All of them are bifacial leaf-shaped flakes, excepting a blade fragment with both

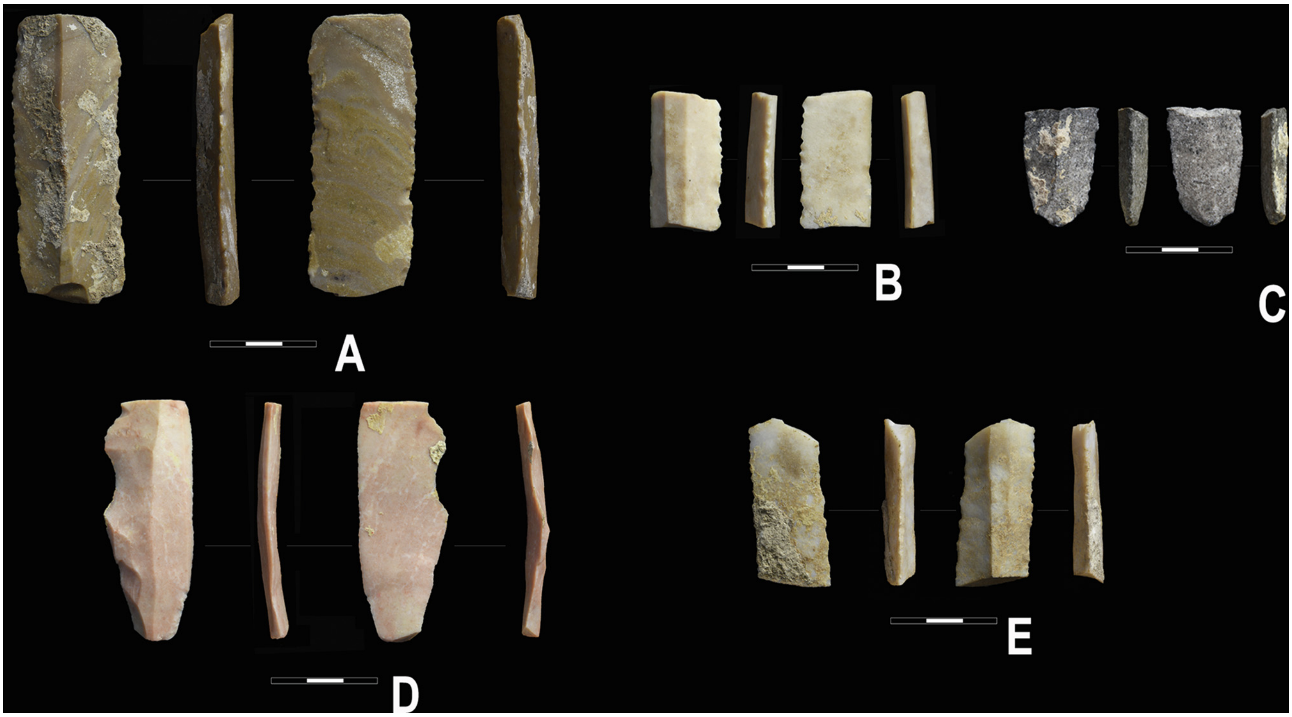

Fig. 5. Analysed pieces numbers 8 (A), 13 (B), 14 (C), 16 (D), and 17 (E).

Table 2
Classification of the pieces by blank and edge type.

Type of element	Simple continuous edge	Serrated edge	Total
Leaf-shaped element	2	7	9
Blade element	2*	4	6
Flake element	1	1	2
Total	5	12	17

*One of them is non-retouched.

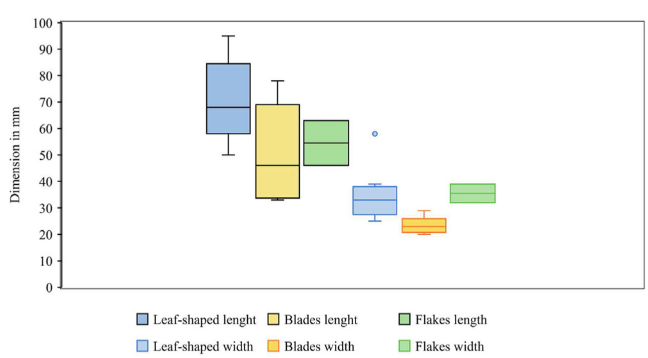

Fig. 6. Box plot of length and width of blade and leaf-shaped tools.

sides used: one of them shows the typical traces of threshing and the other one a mixture of harvesting and cutting on the ground. Various factors indicate that these materials are threshing elements, not blades used to cut the stems at ground-height by hand. There is a marked rounding of the edges associated with a highly developed, intense use-wear, characterized by their extension to the medial part of the elements, with strong abrasions -marked by very numerous striations. We have no doubts about this diagnosis since this type of use-wear is similar to those we see in the modern lithic threshing elements.

As a result of the constant contact of the tool edge against the ground, severe roundness is formed in little time. Due to this effect, rejuvenation was a recurrent method to recover the effectivity of the tool. Profuse notches and intense roundness produced by threshing can only be overcome by repeated edge rejuvenation. Indeed, the different degree of development of the traces observed in the inner part of notches demonstrates that these pieces were rejuvenated several times. The last rejuvenation moment shows the least developed traces.

For the shaping of threshing elements, bifacial retouched flakes were especially selected, and they were used only on one side. Although the morphology is similar, they show differences in size (between 38 and 95 mm) that should not avoid the parallel insertion in the haft.

In the same manner as P. Anderson-Gerfaud and collaborators (2004, 2006) noted regarding Canaanite blades from Bronze age sites (fourth millennium BC) in Iraq, Syria and Turkey that are interpreted as threshing elements, we have also observed variability in traces regarding their intensity, abrasion grade, compactness polished areas, etc. Following their hypothesis, this diversity can be linked to such factors as the humidity level of the threshed plants or the threshing floor features.

When discussing a threshing tool, we should not envisage a threshing-board until recent times when small flakes were inserted in a board. It rather would be a kind of raft in which a sticky substance or mastic was applied to fit the pieces in line. This model could support the width of the elements like those found in Camino de las Yeseras.

4.3. Sickles or tools to separate spike and roots on the ground?

On the other hand, the opposite edge of one of the aforementioned retouched blades for harvesting (number 17) and four blades (numbers 6, 16, 13 and 14) (one of them −6- with retouched edge and another one −14- was previously used for threshing on the opposite edge) showing harvesting traces with intense abrasion (abundant striations, punctured surfaces and roundness of the edges and ridges). This series of modifications may have been produced by the simultaneous contact of the tool with cereal stems together with the ground (Fig. 7.B). From our own experience, this circumstance can only be produced in two ways: a) the pieces were reused: first in harvesting and subsequently to cut stems near the ground and b) they were part of an implement to cut the plants on the ground to separate the spikes and roots from the

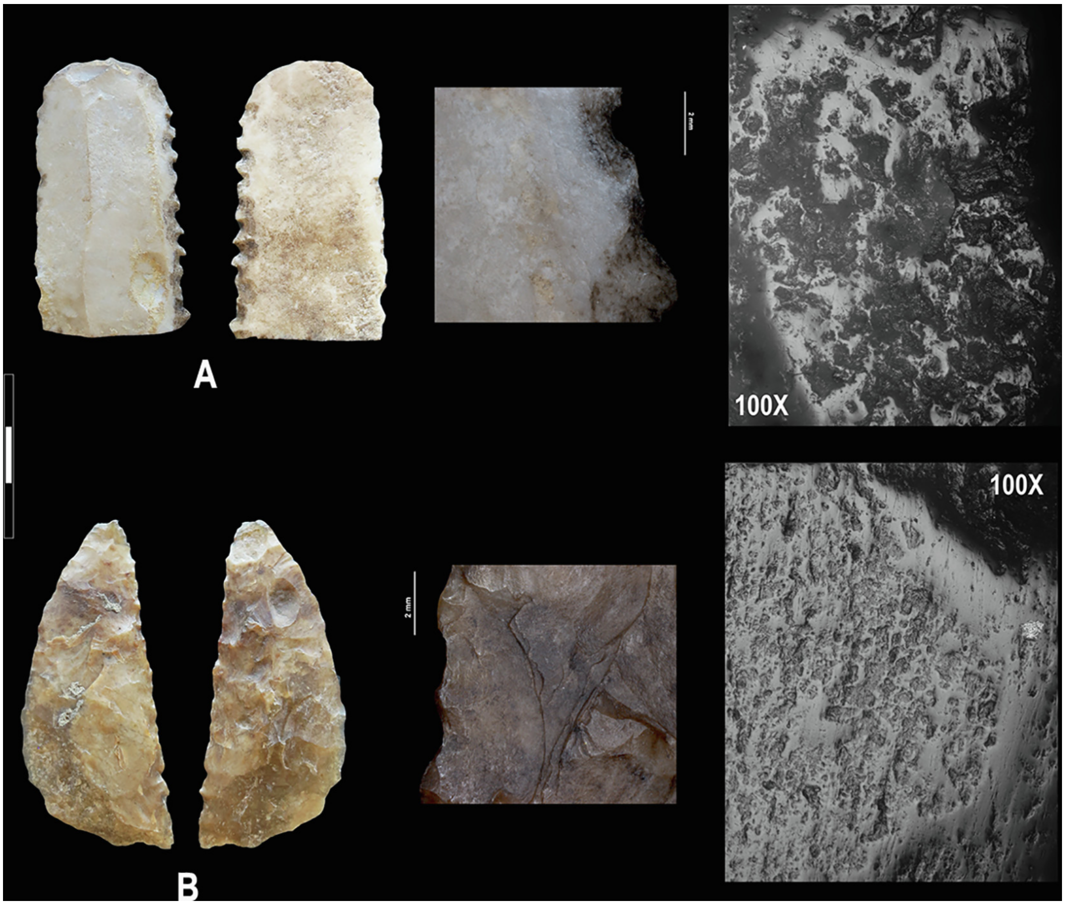

Fig. 7. A. Piece No. 10. Blade used to harvest cereal. It was fitted parallel to the haft. B. Piece No. 6. Flake probably used first to harvest cereal and later to separate spikes and roots on the ground. It displayed harvesting traces with intense abrasion.

stems. The use of non-retouched blades demonstrates that edge modification was not compulsory for harvesting or cutting plants on the ground. Finally, a bifacially retouched flake with strong patina (number 4) was used to cut an indeterminate vegetal material (Fig. 4.B). Unfortunately, its surface alteration hinders the determination of the type of plant that was cut and the work process in which it was used.

5. Discussion

The use-wear study has demonstrated that blades and flakes recorded at Camino de las Yeseras settlement were used alike for harvesting and threshing. There appears to be a tendency in which non-retouched or scarcely serrated blades were devoted to harvesting, while leaf-shaped tools were selected for threshing activities. This tendency, however, will be confirmed in the future by the analysis of a larger sample.

The careful shaping of most of the tools, the quantity of pieces destined to these activities, the intense development of the use-wear traces, the presence of threshing elements and recurrent edge rejuvenation to extend their working life help us to appreciate how important agriculture would be for the community that lived there.

The presence of threshing elements can only be explained when the cereal production of a community was important. Blades used to separate spikes or roots on the ground have been documented in Neolithic sites (Gibaja, 2003). They are very simple tools and have also been recorded at Camino de las Yeseras. But the revolutionary change comes from the mainly bifacial leaf-shaped pieces made and prepared to form part of a more complex tool, probably close to the traditional threshing-board types. This kind of tool would be only justified if cereal production was important and produced a surplus.

If we assume the existence of a ratio among the number of analyzed pieces, the size of the site they come from (ca. 1.5 ha), and the high density of structures in the domestic area, we could estimate that the whole assemblage of these tools could be abundant of this type in the 22.5 ha of the entire site. Although this calculation is hypothetical, we know that these pieces appear in all of the excavated areas in a low proportion in relation to other lithic elements as they underwent a different treatment compared with other lithic and non-lithic domestic objects. They belong to pieces with a long-term use, probably repaired several times, and also reshaped into smaller size tools, as in one case documented in the arrowheads workshop (Ríos, 2011: 397-399).

The possibility that more leaf-shaped pieces could appear concentrated in a yet unknown area of the site (perhaps a workshop) is not ruled out. However, the current dispersion of these elements fits with a use that could be made in any of the excavated areas, since the settlement attests domestic activity in all its extension. It should be highlighted that none of these pieces appeared in burials. However, they are also documented in the central area of the settlement, currently being excavated, which presents exceptional characteristics of intense economic and ritual activity, as already observed in previous fieldwork (Ríos, 2011: 434-437),

The results in relation to the contexts confirm the use of threshing tools from the beginning of the third millennium cal BC, as verified at other sites in Central Iberia (Gibaja et al., 2012) with continued use at least until the middle of the third millennium (2500 cal BC), which matches the time of the greatest concentration of structures and chronologies in this site. The importance of agricultural activities for the inhabitants of this settlement is not reduced only to certain spaces, and could explain their presence in wide-ranging contexts. In addition, they appear also in other contexts, such as the so-called "structured

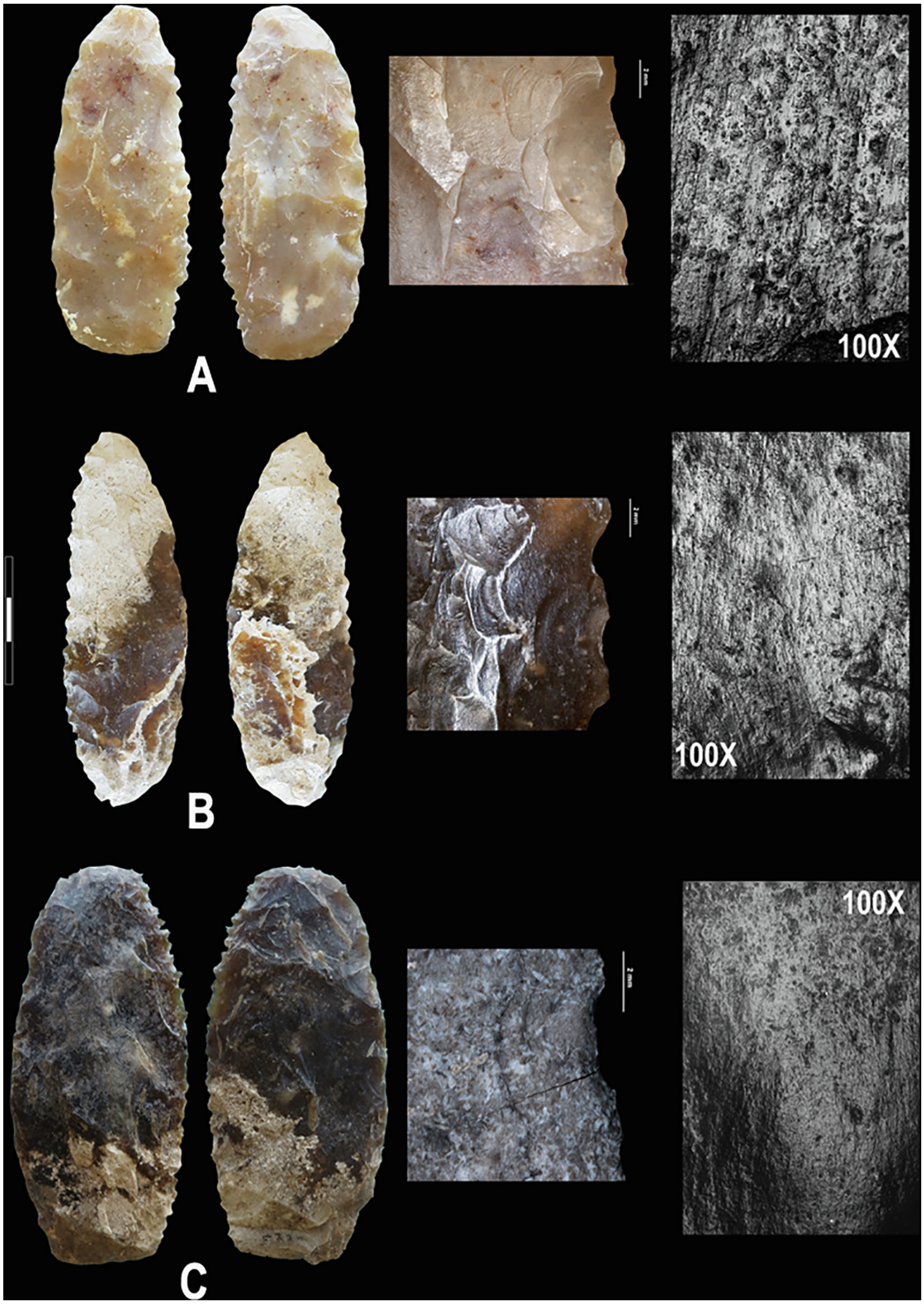

Fig. 8. Leaf-shaped implements used as threshing elements. They displayed intense abrasions. A. Piece No. 1; B. Piece No. 5; C. Piece No. 12.

deposits" of symbolic or ritual nature, as we know from huts named F-322 and Hut A (CE/A), as well as pits No. F-248 and F-276. The same occurs in some structured deposits in other central Iberian ditched enclosures, as observed in the below-mentioned site of Casetón de la Era.

The amount of work that the leaf-shaped elements represent in their manufacture suggests that they were a single cutting tool, for personal use rather than a traditional threshing-board. This hypothesis is reinforced by the care put into rejuvenation and fixing the hafting (Fig. 9). Rejuvenation together with the choice of a serrated edge can explain the absence of extreme wear similar to flint elements of contemporary threshing-boards. The hypothesis considers the processing of a modest amount of surplus cereal production, within a domestic or community framework. Threshing large-scale cereal production with this kind of tool would have been reflected in the archaeological record by a larger number of leaf-shaped elements.

In other Iberian post-Neolithic sites, those bifacial retouched flakes and/or blades were also mainly used for cereal harvesting or threshing. Very similar cases are found at Casetón de la Era (Gibaja et al., 2012), at Chibanes (Clemente et al., 2014) and Leceia (Cardoso and Gibaja, 2019). The existence of tools used as a part of threshing-boards has occasionally been mentioned in other European contexts (Skakun, 1992; Gurova, 2001; Gurova and Chabot, 2007).

At European sites, similar leaf-shaped elements were also used for harvesting. This is the case of Horgen culture sickles (Switzerland, about 3500 cal BC). These knives were used for harvesting with the

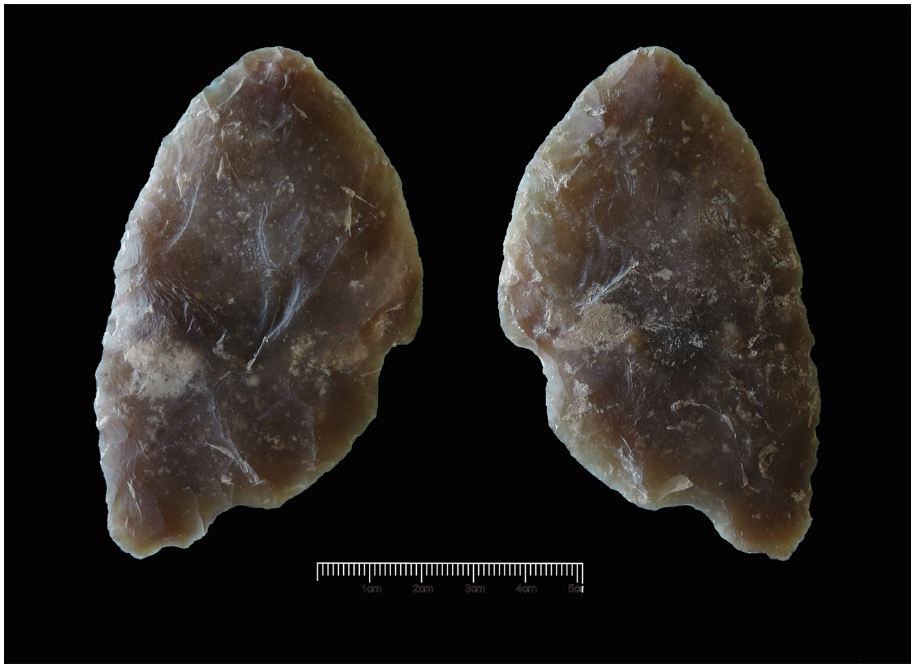

Fig. 9. Piece No. 11. Leaf-shaped tool used as threshing element in which a modification of the edge for hafting is observed.

blade held against the thumb, to strip off hulled grain using a pulling-up motion (Anderson-Gerfaud, 1992; Anderson-Gerfaud et al., 1992).

6. Final considerations

The technological analysis of the sample has brought to light the differential raw material source for leaf-shaped elements and blades. The Madrid basin and neighbouring areas (Toledo and Guadalajara) are well known for the existence of wide and abundant silicification areas with nodules of variable quality and size that have been exploited from the Middle Pleistocene (e.g. Torres and Baena, 2018; Santonja and Pérez-González, 2010). The proximate Casa Montero formation (Bustillo et al., 2009), only 4 km from Camino de las Yeseras, seems to have been the main source of siliceous rocks for the lithic industry at this site.

However, results from structures that are currently under study indicate that flint was gathered from secondary outcrops, not mined. It describes, therefore, a new strategy employed during the Chalcolithic period for the exploitation of local resources.

Otherwise for Camino de las Yeseras, the allochthonous origin of the raw materials for the blade implements must be highlighted. For now, this can be confirmed by the absence of blade production evidence, like cores, rejuvenation tablets or crest blades. Therefore we suggest the existence of regional exchange of blades and long-blades. As well as for other items (pottery, bone artefacts, lithic ornaments etc.), the lithic studies confirm the strategic location of the site at a regional scale in a fertile and well-communicated landscape where complex exchanges took place or where these pieces arrived, taking into account the high mobility of past societies (Fig. 1).

Long blade products (more than 15 cm long and fragments more than 20 mm wide) have been studied in several areas of the Iberian Peninsula, such as Portugal, and southern and north-eastern Spain (e.g., Clop et al., 2001; Morgado and Pelegrin, 2012; Pelegrin, 2006) and confirm that it is a lithic marker of craft specialisation and long-distance exchange (Castañeda, 2018: 149). They were produced by means of a reinforced pressure technique that implies a complex preparation of the core and a high level of skill of the knapper. Similarly, the fabrication of leaf-shaped elements also requires specialized skills.

The existence of tools used as a part of threshing-boards has only been occasionally mentioned in other European and Iberian sites. Undoubtedly, in the future this huge site will provide much more information to appreciate the relevance of these artefacts and their distribution in other areas for a more comprehensive interpretation. However, they are probably another key element to understand why the large aggregation dynamics are so intensive during Chalcolithic times in relation to previous Neolithic settlements.

The wide chronological timespan of the use of the harvesting and threshing implements, during almost six centuries, indicates no important changes in that time, either by a clear technological relation or evolution.

Threshing elements made both on leaf-shaped flake blanks and on blade fragments have been recovered together in the same archaeological structure. Nevertheless, it appears that blades tended to be used in cereal harvesting and leaf-shaped elements for threshing. To confirm this tendency, a larger sample will be analysed in future works. It is also necessary to address the study of new contemporary sites in order to estimate the extent to which these tools were of common use not only where agriculture was an important subsistence activity but also for the production of a surplus.

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