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LITHIC PRODUCTION AND RAW MATERIAL EXPLOITATION AT THE MIDDLE PLEISTOCENE SITE OF EL SARTALEJO, SPAIN

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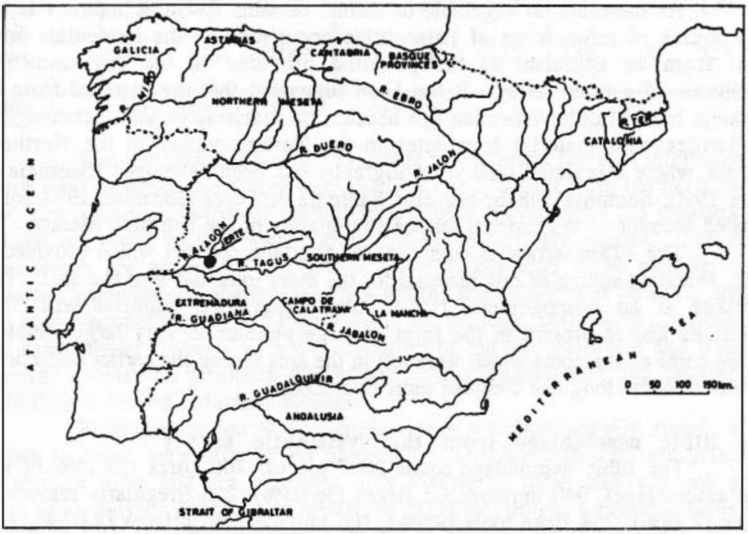
The Middle Pleistocene site of El Sartalejo is located in the Alagon valley of the western Southern Meseta of central Spain close to the confluence of the Alagon and Jerte rivers (fig 1). Lower Palaeolithic artefacts have been reported in this area between the Alagon and Jerte valleys for some time (Santonja 1976, 1981, 1985; Santonja & Villa, 1990). Most of the sites are located in the middle terraces of the Alagon and Jerte rivers, in the widest areas of the valleys. Indeed the Alagon valley provides a natural path through this area of the Central Cordillera between the region of Extremadura to the east and the northern Meseta (Santonja 1981, 1985)(fig 1).



• The site of El Sartalejo

Fig. 1 Position of El Sartalejo in the Iberian Peninsula (adapted from Santonja & Villa 1990)

There are very few absolute dates for the Spanish Lower Palaeolithic. At times a relative chronology has been adopted, based on terrace sequences some of which may be correlated between valleys through additional information on palaeosols and fauna (Santonja & Peréz-González 1984; Santonja & Villa, 1990). Often technological and typological criteria have been used to supplement the terrace chronology. Nine terraces are associated with the Alagon river ranging from +120m to +3m. The +28m middle terrace, from which the artefacts from the site of El Sartalejo are derived, is a 2 metre deposit of mainly quartzite gravels (Santonja & Villa, 1990; Santonja 1985).

In the early 1970s, prior to tree planting, artificial levels of different heights were created on the +28m terrace of Sartalejo de Arriba which revealed a substantial Lower Palaeolithic quartzite industry. Between 1973 and 1980 a number of small surveys were undertaken in the area resulting in a collection of 600 pieces, known as the 'Serie Inicial' (Santonja 1985). In 1983 when the site was in danger of being lost due to a plan to uproot the trees, a fifteen-day, systematic, surface collection was undertaken.

The systematic surface collection covered approximately 9.2 square hectares and resulted in the recovery of over 2500 pieces. Nearly all the artefacts show signs of rolling, but movement from the original position of deposition may have been slight due to the weight, size and variety of artefact types recovered. While it is possible that some of the smaller debitage may have been lost, thereby causing a certain bias in the collection, it seems unlikely that this loss was substantial. In addition, the artefacts tend to be large, simple and the result of a very limited operational chain sequence which would generate little debitage. Although this is not a primary site, therefore, it is probably near the original area of occupation.

As there are no vegetable or animal remains the lithic industry is the only source of information of Palaeolithic occupation in the immediate area, apart from an appraisal of the potential provided in the environmental conditions of a river valley. It has been suggested that the material from El Sartalejo is of Middle Acheulian age because of stratigraphic and technological similarities with material from sites in the Tormes valley in the Northern Meseta, where a regional relative stratigraphy has been developed (Santonja & Villa 1990; Santonja 1981b; see also Santonja & Pérez-Gonzaléz 1974 for a detailed account of the regional terrace stratigraphy of the Northern Meseta).

The +28m terrace is composed of quartzite cobbles which provided a local, abundant source of raw material for the early inhabitants of the area. The quartzite is an homogenous, fine-to-medium-grained material with few inclusions and is present in the form of large pebbles to very large cobbles. Indeed some of the cores which were left in the area during the earlier collections were over 40cm long and weighed more than 25kg.

The lithic assemblage from the systematic survey

The lithic assemblage totals 2607 pieces: 760 cores (29.15% of the total assemblage), 940 unretouched flakes (36.05%), 203 irregularly retouched flakes (7.79%), 258 flake tools (9.9%), 106 unifaces and bifaces (4.07%), 205 flake cleavers (7.86%), 13 trihedrals (0.5%), 80 pebble tools (3.07%) and 42 fragments (1.61%). The shaped tools form 33% of the total assemblage.

The size and shape of the local quartzite pebbles/cobbles have greatly influenced the artefacts manufactured from them which are, in general, large and heavy although not exclusively so (table 1). However, while smaller pieces are present in all artefact categories they usually only represent a small percentage of the total. As mentioned above, this may be due to loss through post-depositional transportation or a reflection of the size of the raw material and the simplicity of the operational chain followed.

It can be seen from table 1 that some grouping in size is visible among the flake elements and again among the unifaces/biface and cleaver components. It would appear that these two groups each lie within limited, but distinct, size ranges suggesting an element of standardisation within the groups.

	WEIGHT (g)			LENGTH (mm)			WIDTH (mm)		
	mean	min	max	mean	min	max	mean	min	max
unret. flakes	569	16	>2500	102	28	236	100	22	237
retouched flakes	599	95	>2500	108	33	235	104	41	199
flake tools	492	39	1659	100	39	213	100	19	186
unifaces/ bifaces	662	194	1696	146	88	230	85	59	131
cleavers	665	181	1910	138	93	216	91	40	132
trihedrals	752	318	1190	156	101	181	81	61	100
pebble tools	852	210	1946	128	82	218	100	46	170
cores	2807	143	18000	186	60	425	132	28	323

table 1. El Sartalejo: artefact dimension

The size and shape of the available raw material has also influenced the blank type on which the pieces were manufactured; flakes form the basis for the majority of pieces. Most of the unifaces/bifaces, virtually all the cleavers and almost one third of the pebble tools are made on flake blanks. The cores themselves are generally on cobbles. The flakes tend to be oval in shape although irregular end-shapes (length > width) and side-shapes (width > length) are also frequently present. Pieces made on primary, cortical flakes dominate the assemblage; indeed, with the exception of the uniface/biface and trihedral groups, substantial amounts of surface cortex characterise the assemblage indicating a limited reduction sequence.

Flake production at El Sartalejo was a technologically simple affair which required very little or no preparation; striking platforms are primarily cortical or plain and are generally only visible on those flakes which show little or no further flaking. As would be expected, on the unifaces/bifaces and trihedrals they have usually been removed in the process of modification. The technological simplicity of the assemblage is also evident in the retouch techniques used; retouch is primarily simple and non-invasive although on some pieces retouch scars can be quite large and unlike those found on flint artefacts in general. Retouch on the ventral surface of the piece is common.

Cores

Most of the 760 cores have more than one removal scar. Those with only one scar, or which were exceptionally heavy, were usually left at the site area (Santonja pers.comm.). In about one-third of the pieces the material has some type of inclusion. Pebble tools are the only other class of worked artefact in which this proportion of flawed material occurs. The cores form an important percentage not only of the shaped pieces (46.76%) but also of the total assemblage (29.15%). Most are on cobbles and are impressive because of their size (table 1); over 50% weigh more than 2 kilos with 11% weighing more than 10 kilos. The very size of the vast majority of cores excludes the possibility of their being tools in themselves; there is no doubt that they are parent blocks used solely for the production of flakes. Although large, they tend to have been only partially exploited, in a systematic manner, to provide large flakes. There are few irregularly shaped cores and almost a quarter show a centripetal patterning of removals. Many could have provided more flakes, but smaller than those which had been previously removed; that this has not occurred may be due to the quantity of available raw material or a preference for larger flakes for the production of heavy duty tools, namely unifaces, bifaces and cleavers. As a result, there are substantial areas of cortex on the core surface.

Unretouched and retouched flakes, and flake tools

The unretouched flakes, retouched flakes and flake tools form almost half of the assemblage. There are no great differences between the three groups of flakes; flake tools are slightly smaller on average, with some showing slightly more working than the other two groups, as seen in those pieces with less cortex. A preference for oval shapes for further modification by retouch is suggested. The mean length:width ratio is uniform between the three flake groups at 1:1.

Blade types are rare and unretouched; it would seem from the general shape and simple preparation that these blades are fortuitous results of percussion rather than desired pieces. Almost 10% of the unretouched flakes have been affected by flexion or Siret fractures during the knapping process.

Retouched flakes are those on which retouch is limited, often irregular or difficult to distinguish, making classification among flake tools impossible. While most are primary flakes, 5% are the result of more extensive working. A few (4.46%) are on flakes with Siret or flexion fractures.

The flake tools are large in all dimensions (including striking platforms) with some weighing over 1000g, but the reduction process tends to be minimal. As with the other tool types, the flake tools are generally made on a good quality, fine-grained quartzite. Blades and points are virtually non-existent but 12% of the tools are made on blanks which cannot be classified as flakes. Complete flakes were almost always chosen as blanks to be retouched. Retouched edges are more often convex, as would be expected from the predominance of oval flakes, although concave, denticulate and notched edges are well represented. Retouch on these pieces does not often resemble the small, regular, confined-to-the-edge, 'scraper' type associated with flint pieces; retouching flakes tend to be larger and more irregular.

The scraper groups dominate the typological list, with denticulates, notches and piercers well represented. A wide variety of scraper types are present but those with retouch on the ventral face of the flake, single convex side scrapers and transverse convex scrapers are most common.

Unifaces/bifaces

Bifaces (i.e. pieces with both faces fully, or almost fully, worked) and partially worked bifaces are almost equally represented (35 and 37 respectively) while there are 27 unifaces (one face worked or partially worked). Together these form 12% of the shaped tool assemblage. Most are made from good quality, fine-grained quartzite; inclusions are present in just 12% of the artefacts, in contrast to the cores and worked pebbles in which a higher proportion of flawed material occurs. Although the local quartzite is generally good, a process of selection is indicated in the choice of material for the manufacture of unifaces and bifaces.

These pieces, usually made on large, cortical flake blanks, tend to be thick, heavy, asymmetrical and have sinuous edges. While large pieces are to be expected, considering the huge cobbles which provide the raw material, there is a range in size which indicates either a non-exclusive use of large cobbles or a considerable reduction process in some cases. A variety of types are present with partially flaked surfaces which often display step fractures but rarely invasive flake scars. The low total and invasive scar count together with the high presence of step fractures explain the general thick nature of the pieces as seen in the width:thickness ratios which have a mean of 1.86 (Bordes 1961). Although these pieces do not indicate much expenditure of time or effort (one might expect to see more retouch used to straighten edges) the limited working has not adversely affected the potential working edge which is consistently extensive (mean 85% of the perimeter).

Cleavers

The flake cleavers form a prominent part of the assemblage (24% of the shaped pieces) and are characterised by simple, asymmetric types, morphometrically similar to the uniface/biface group although slightly shorter and thinner. They are manufactured on cortical flakes, but although a few show signs of special preparation the blanks, on the whole, have not been greatly modified (fig 1). Many pieces have been partially retouched; the cleaver edge appears to have been retouched at times, and signs of use or post-depositional effects (it is difficult to distinguish between the two) are often apparent. Although the cleaver edge itself is short, the potential functional edge is as long as that of the uniface/biface group (85% of the perimeter).

Typologically (Tixier 1956) the cleavers from El Sartalejo are not diverse and reflect the simple modification process described above; 70% may be classed as type 0, with some type 1 (9%) and type 2 (14%). There is one example each of type 3 and type 6.

Trihedrals

The few trihedrals in the assemblage differ from the unifacial/bifacial groups in all dimensions (table 1). However they lie between the unifaces, bifaces and cleavers in the minimum number of removals required for, and by implication the level of working invested in, their manufacture.

Pebble tools

Pebble tools always appear to be the result of summary working and little investment of time and effort. Those from El Sartalejo are no exception. Although the quartzite chosen is fine grained, as with the other heavy duty tools, more of the pebble tools are made on quartzite which has inclusions indicating a less rigourous material requirement. Although most are on pebbles, many are on flake blanks (Bordes' 'chopper inverse' Bordes 1961), some on cobble fragments and some on split cobbles.

Artefacts in the 'Serie Inicial' (figs. 2 and 3)

Prior to the systematic surface collection described above, a number of artefacts had been gathered over the years and studied by Santonja (1986); this collection was named the 'Serie Inicial' (SI) (table 2).

	SI		systematic collection	SI	systematic collection
	no.	% total	%total	% tools	% tools
unretouched flakes	184	30.36	36.05		
cores	88	14.52	21.15		
flake tools	118	19.47	17.69	35.32	54
unifaces/ bifaces	54	8.91	4.07	16.16	12
cleavers	138	22.77	7.86	41.31	24
trihedrals	13	2.15	0.5	3.89	2
pebble tools	11	1.82	3.07	3.29	9
large tool component		64	47		

Table 2. Assemblage composition of the Serie Inicial (SI)
NB Retouched flakes were incorporated into the flake tools in the Serie Inicial and the same has been done to the present systematic collection for comparative purposes in the above table.

Percentages of tool types vary between the two collections, as would be expected considering the different gathering techniques. The main difference between the two groups is in the percentage of large (i.e. heavy duty) tools. The systematic survey collection indicates that the heavy duty component does not outnumber the flake tools as suggested in the SI. In fact they are almost equally important in the later, and more comprehensive, assemblage. However, both assemblages underline the importance of the heavy duty tools, in particular cleavers, in the assemblage.

Technologically the two assemblages are very similar (see Santonja, 1985). There are some differences in the types present between the two groups of flake tools. In the SI, scrapers and denticulates dominate, the miscellaneous category is important (21% of flake tools) and there are very few notches and no piercers. In the artefacts from the systematic collection, notches and piercers are important while the miscellaneous category is much less so (4% of flake tools). There are, in addition, types which appear in one list and not in the other but these are represented by one or two pieces. While differences in types may be the result of the assemblage size, they also underline the problem of applying a rigid typological classification to quartzite assemblages in which elements are not always clearly visible and give rise to varying interpretations. Many of the differences seen between the SI and the systematic collection are the result of the classification of the two assemblages by different people.

Despite these slight typological differences, the SI and the systematic collection appear to be technologically and typologically homogeneous and may be considered as manifestations of the same general parent assemblage.

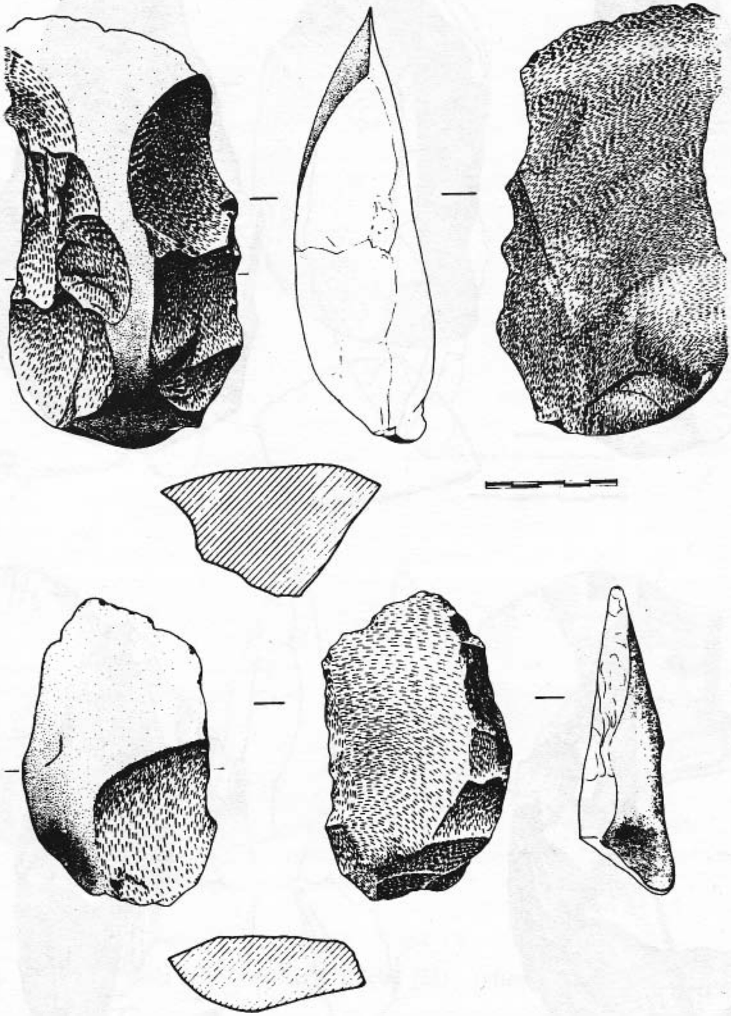


Fig. 2. Cleavers from the 1983 systematic collection

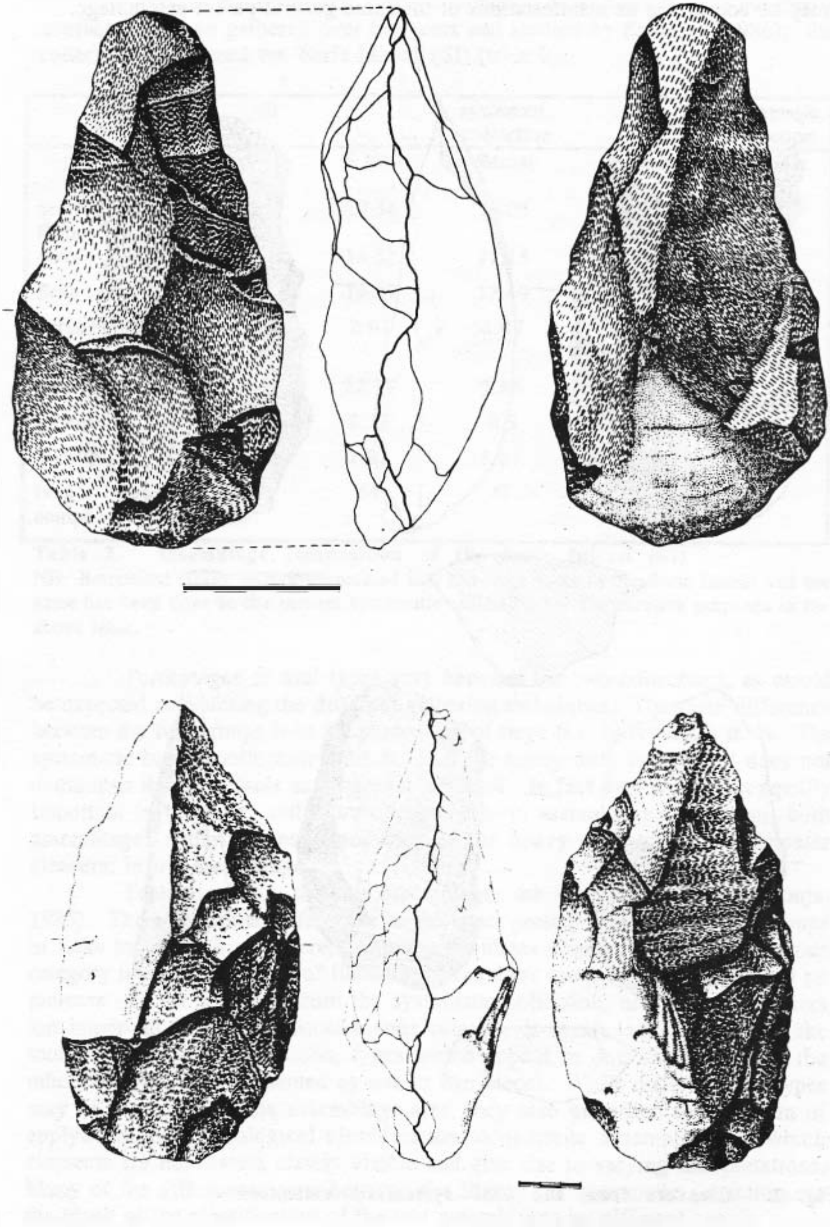


Fig. 3. Bifaces from the Serie Inicial (SI) (after Santonja 1985)

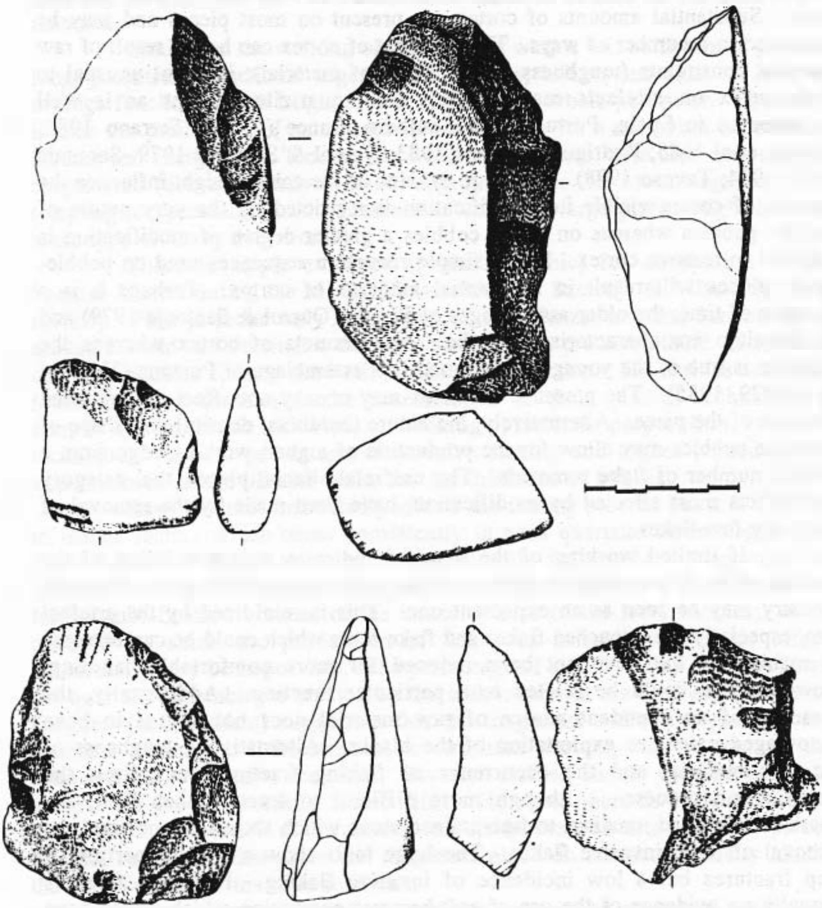


Fig. 4. Flake tools from the Serie Inicial (SI) (after Santonja 1985)

Discussion

Perhaps the most outstanding feature of the lithic assemblage from El Sartalejo is the size of the pieces. While the cores have a mean weight of almost 3 kilos, the mean for flake tools, the lightest of the artefact categories, is around half a kilo. There are strong similarities between the cleaver and uniface/biface groups, and to a lesser extent between the flake groups. It would appear then, that although the artefacts are all large, a slightly varying preference for size is indicated within artefact groups.

The general operational chain distinguishable in El Sartalejo is a very simple one: the production of large flakes which are then slightly modified into tools. Substantial amounts of cortex are present on most pieces and may be explained in a number of ways. The presence of cortex can be the result of raw material constraints (toughness and/or shape of material); it is not unusual to find cortex on artefacts manufactured from quartzite pebbles as is well documented in Spain, Portugal and Southern France (Ciudad Serrano 1986; Raposo et al 1985; Rodriguez Asensio 1983; Querol & Santonja 1979; Santonja 1981, 1984; Tavoso 1978). However the size of the cobble might influence the amount of cortex visible i.e. modification is restricted by the very nature of smaller pebbles whereas on larger cobbles a greater degree of modification is required to remove cortex. Short, simple reduction sequences used on pebble-based pieces will result in substantial amounts of cortex. Perhaps it is a question of time; the older assemblages of Pinedo (Querol & Santonja 1979) and El Sartalejo are characterised by the large amounts of cortex whereas the opposite is true of the younger, more modified assemblage of Porzuna (Vallespí et al 1979, 1985). The presence of cortex may or may not affect the proposed function of the piece. Alternatively, the nature (hardness, density) and shape of quartzite pebbles may allow for the production of a good working edge from a limited number of flake removals. The unifacial/bifacial pieces, that category of artefacts most affected by modification, have been made by the removal of relatively few flakes .

If limited working of the material indicates an appreciation of the amount of work necessary to produce an acceptable, functional piece, then the industry may be seen as an expedient one. This is reinforced by the artefact size, especially the retouched flakes and flake tools which could be cumbersome to manipulate but have not been reduced for more comfortable handling. However, size could be related to a particular function. Additionally, the presence of an abundant source of raw material does not appear to have encouraged extensive exploitation of the blanks. Alternatively, toughness of the raw material and the occurrence of flaking fractures may limit the modification process. Although more difficult to fracture than flint, the quartzite is a good, medium-to-fine-grained stone which should not obstruct the removal of long, invasive flakes. The large tools show a high proportion of step fractures but a low incidence of invasive flaking. However, there is virtually no evidence of the use of soft hammer percussion which would have improved the chances of achieving invasive removals.

The important presence of flake cleavers is most probably linked to the nature and form of the raw material: large, quartzite cobbles. The vast majority of these cobbles cannot be used as tool blanks in themselves but rather as a source for blanks. The force required to fracture such cobbles resulted in the production of large, cortical flakes, often oval in shape, with naturally sharp edges. These flakes, in turn, required very little further modification to make them functional pieces as evidenced by the numbers of type 0 cleavers in the assemblage. Villa (1981, 1983;) has for some time maintained that the presence of flake cleavers is linked to the use of cobbles or large blocks of raw material which require very little core preparation, the use of a simple technology and little modification. This appears to account for the large number of flake cleavers at the Campsas site in the Garonne valley (Tavoso 1978). Likewise, Santonja (1985 and pers. comm.) links the frequency of cleavers at El Sartalejo to the nature, shape and size of the available raw material.

Limited as the working of the material was, it was sufficient to produce long, potentially functional edges. The unifaces, bifaces and cleavers have an average functional edge length almost equal to the whole perimeter. The result is then the production of an extensive, usable edge for a minimum expenditure of time and energy. The function for which these pieces were used may only be conjectured (use-wear analysis is not appropriate for this assemblage) but it is tempting to speculate that the presence of so many large pieces might indicate some type of heavy duty work.

There is ample evidence (primarily lithic) for occupation in the Spanish Meseta during the Middle Pleistocene (see Santonja & Villa 1990 for a review). Flint is found only in the area of the Manzanares and Jarama rivers around Madrid and dominates the lithic assemblages produced there. Elsewhere quartzite pebbles formed the basis for lithic production. Similarities are to be found between these quartzite assemblages in their general technological simplicity, presence of cortex, striking platform preparation, retouch techniques, the low percentage of invasive flaking and higher percentage of step fractures on the bifacial tools, and the thickness of bifaces.

Raw material undoubtedly affects the flaking process but it is difficult to isolate factors which occur consistently in each quartzite assemblage. The shape and size of the block or cobble directly influences the approach to modification; at El Sartalejo the production of flakes was a prerequesite to further modification because of the unwieldy size of the local cobbles; when pebbles are small the production of flakes as suitable blanks for biface manufacture may be impossible. The percentage of step fractures is higher in all the quartzite assemblages studied by the author than in the flint assemblage of Oxigeno (near Madrid) suggesting that the toughness and/or the grain of the quartzite causes the flake removal to terminate abruptly and so hamper the achievement of invasive removals. Invasive flaking should then be easier to achieve on the more easily flaked flint. However there is little difference between the proportion of invasive removals in the quartzite and flint pieces studied, suggesting that grain and toughness alone do not automatically hinder the achievement of invasive removals.

The problem of the influence of raw material on stone tool production has to be addressed on a local area basis; size, shape, grain and inclusions all play a part in the intricate interaction between man and stone as do cultural bias, learning and function. The men and women who inhabited the area of El Sartalejo during Middle Pleistocene times, like their Palaeolithic counterparts elsewhere in Europe, had an understanding of the local raw material available and used it as an aid to satisfy their particular survival needs.

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