

The Early Neolithic flint mine of Casa Montero (Madrid, Spain), 5350-5220 cal BC

*La mina de sílex del Neolítico Antiguo de Casa Montero (Madrid, España), 5350-5220 cal a. C.**

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In memory of Alan Saville.

RESUMEN

ABSTRACT

We present a comprehensive and interpretative overview of the evidence recovered at the mining field of Casa Montero (Madrid, Spain). We describe the technical and social aspects of flint mining in the specific historical context of central Iberia's Early Neolithic societies. Combination of all the evidence allows us to suggest that mining at the site was probably a generational phenomenon, where the acts of gathering in order to perform a collective action served as a basis for binding new political relations beyond each individual group. Strategic, tactical, and logistic preconditions were required for those gatherings, including the ability and capacity to convene, design, and organize an orderly set of actions such as those deployed at the flint mine. As with other Neolithic mining sites in Europe, understanding these social preconditions are important if archaeologists are to move beyond describing the formal and technical variability of the mines.

Presentamos una revisión de conjunto e interpretativa de las evidencias recuperadas en la mina de sílex de Casa Montero (Madrid, España). Describimos los aspectos técnicos y sociales de la minería del sílex en el contexto histórico específico de las sociedades del Neolítico Antiguo de la Península Ibérica. La combinación de todas las evidencias recuperadas nos permite sugerir que la minería en Casa Montero fue probablemente un fenómeno generacional, donde los actos de agregación de pequeños grupos para el desarrollo de acciones colectivas sirvieron de base para establecer nuevas relaciones políticas más allá de cada grupo individual. Para ello se requirieron un conjunto de precondiciones estratégicas, tácticas y logísticas, incluyendo la habilidad y capacidad para convocar, diseñar y organizar un conjunto ordenado de acciones como las que se desarrollaron en la propia mina. Proponemos que estas precondiciones sociales son clave para ir más allá de la variabilidad formal y técnica de las minas.

Key words: Iberian Peninsula; Central Meseta; Early Neolithic; Flint mine; Radiocarbon dates; Apprenticeship; Blade production.

Palabras clave: *Península Ibérica; Meseta central; Neolítico Antiguo; Mina de sílex; Dataciones radiocarbónicas; Aprendizaje; Producción laminar.*

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1. WHERE AND WHY

The Casa Montero flint mine is located in the centre of the Iberian Peninsula, in the southern Meseta, a geographical unit divided from the northern Meseta by the central cordillera. Crosscut by two main rivers, the Tagus and the Guadiana, this southern plateau has a mean altitude of 600 m above the sea level (Fig. 1) and a continental climate, with hot and dry summers (24°C mean), cold rainy winters (4°C mean), and a mean rainfall of 500 mm/yr. The valleys that surround the capital city of Madrid are abundantly watered areas that have supported a long-term occupation beginning in the Middle Pleistocene (Santonja and Pérez-González 2010).

The Early Neolithic flint mine is located on a bluff overlooking the confluence of two of Madrid's main rivers, the Jarama and the Henares (www.casamontero.org, access 28-02-2018). It was discovered as a result of an archaeological impact assessment project in advance of the construction of the third highway belt (M-50) that surrounds the city of Madrid. The highway was originally designed to crosscut the Tertiary bluffs in order to save the altitude difference between the river valley (550 m) and the higher plateau (659 m). This would involve the building of a cut-and-cover tunnel that would have directly affected the core of the flint mine (Fig. 2).

The archaeological project's first phase was a set of intensive surface surveys combined with subsurface test pits. This procedure recorded the precise location and approximate extent of the site, although its specific chronology and function remained initially undefined. The first observations and the scale of the site called for an open-area excavation of the entire zone affected by the future highway in order to provide a clear definition of the site's limits and to allow the mapping

of the entire distribution of archaeological features immediately under the plough-zone.

Excavations proceeded throughout three field seasons, from 2003 to 2006. The first season involved the excavation of 123 shafts, a random sample of approximately 2,500 shafts mapped across 2.4 hectares. This allowed an initial assessment of the variability of prehistoric flint-extraction methods and the geological

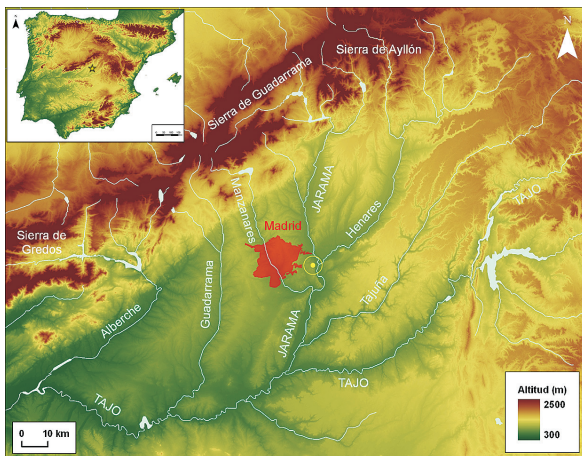


Fig. 1. Above: Location of Casa Montero in the Iberian Peninsula (in colour in the electronic version).

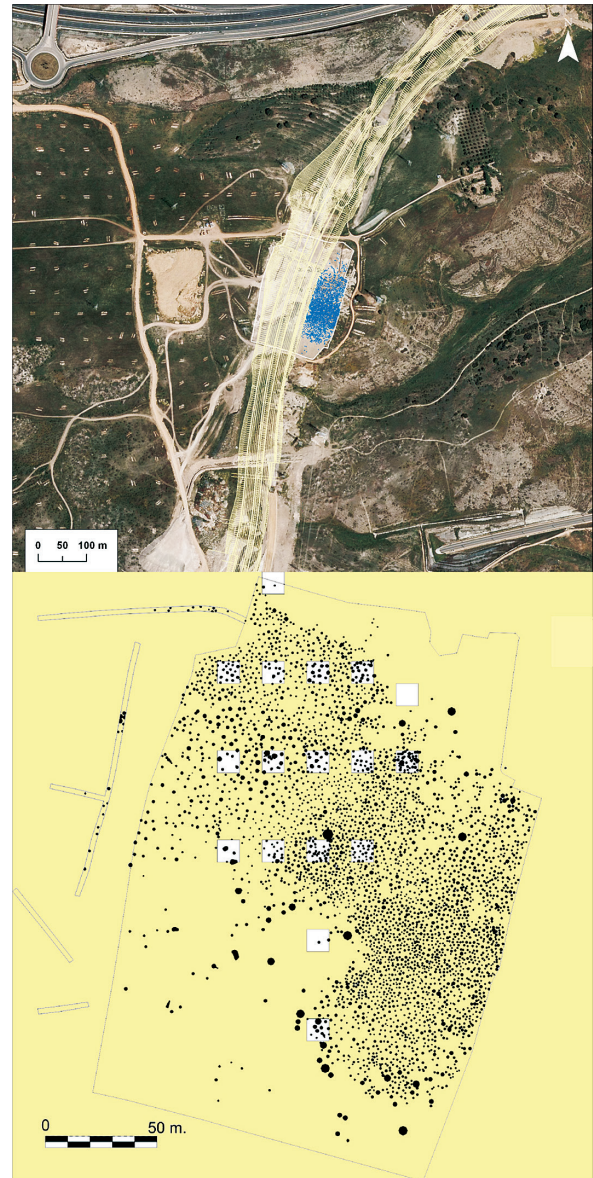


Fig. 2. Above: highway plan after the modification of the track, with the limits of the excavated site in white and preserved structures in blue. Below: plan of the open-area excavation (10 x 10 m sampling units in white) (in colour in the electronic version).

structure of the site, while a small number of characteristic Early Neolithic potsherds supplied the relative dating of some of these shafts (Consuegra *et al.* 2004; Capote *et al.* 2008).

The fact that Casa Montero was the first prehistoric flint mine to be discovered and extensively investigated in Iberia provided the arguments that the Comunidad de Madrid Historical Heritage Managers required in order to recommend a modification of the highway track to a position some 60 m west of its original path. Whereas the original route would have preserved only 16% of the shafts, the 60 m change in the layout finally saved a substantial 60%, which would therefore be preserved and protected for future research. This exceptional resolution has been exemplary at a national scale, where the alteration of key linear infrastructures has been uncommon throughout two decades of the construction boom. The initial planning also involved the creation of an on-site visitor centre. This has yet to be initiated due to the financial crisis that began in 2008.

The open-area excavation was extended by 1.8 hectares, so as to assess the sector affected by the new layout, mapping some 500 new mine shafts. By that stage a four-hectare open area with approximately 4,000 mining shafts was exposed (Fig. 3), but the second field season was somewhat unsuccessful because of safety issues at the worksite. Digging beyond two metres deep was not allowed without shoring the walls of each individual shaft, something that proved to be an impossible task without compromising the quality of the archaeological record. As a result, the aims of the excavations were reassessed.

Some questions, such as mining strategies, number of pits dug in each mining event, and other related issues, could only be potentially answered by recover-



Fig. 3. Aerial view of the excavations at the Early Neolithic mine of Casa Montero (Madrid) (in colour in the electronic version).

ing information from clusters of shafts. Consequently, the strategy adopted throughout the third field season was based on an aligned systematic sampling method (Díaz-del-Río *et al.* 2007). This approach involved the complete excavation of all the shafts included in 17 squares (each 10 x 10 m in area) systematically distributed throughout the area that would eventually be destroyed by the highway track (see Fig. 2). The driving force behind this strategy was that comparing groups of shafts would be more enlightening than comparing arbitrarily selected individual pits. This sampling was accompanied by a new excavation technique of meticulously digging all the shafts included in those squares up to a depth of two metres, and subsequently removing the complete two-metre deep horizon of the affected area with a mechanical backhoe. The process was repeated three times until the excavation was completed to the base of the deepest shafts, providing both detailed information on the excavated shafts and a three-dimensional view of the geomorphology of the site.

To sum up, the total of documented Neolithic shafts amounts to 3,794. The distribution of shafts is very uneven within the excavated area, showing a clear cluster or 'exploitation belt' running northwest-southeast. This cluster has an average width of *c.* 94 m on its north-south axis, while on the east side, coinciding with the segment with a greater density of shafts (one each 2 m²), the band widens to reach 160 m. Finally, the density decreases sharply north and south mainly because of the abrupt changes in the subsurface geology, which explains the total absence of mining structures in that area. The distances between shafts in the eastern area, which has the highest density of mining shafts, are often no more than 30 cm. Despite this proximity, they do not intersect; only 3.4% of the documented shafts cut previous ones in varying proportions. All this suggests that the mining topography was overtly visible during subsequent mining actions.

2. WHAT

Madrid's regional geology is known for the abundant and ubiquitous presence of available flint. It was procured and utilized at least since the Middle Pleistocene Acheulean (Santonja and Pérez-González 2010), while the third millennium BC Copper Age signals the apogee of its use, when massive amounts of expedient tools were manufactured out of local and probably secondary resources (Díaz-del-Río 2004: 115). There is, nevertheless, no evidence for prehistoric mining in the region other than at Casa Montero. This suggests that the earliest Neolithic groups in central Iberia selected the location of their flint procurement source as a result of a combination of geological, logistical, and, above all, social motives.

The Neolithic mine is located in sedimentary rocks from the Intermediate Unit of the Miocene. The stratigraphic column is composed of beds of clay, dolomite, and silica rocks (Fig. 4). Deep sections show the existence of four major silicification episodes, each consisting of one or more silica levels (Bustillo *et al.* 2009: 178). The three upper levels are composed of opal and opaline chert, and were formed by silicification of Magnesian smectites. Silica rocks from Casa Montero form nodules arranged in discontinuous beds that may have some lateral continuity. These beds have been classified in four episodes of silicification and they appear deformed as a result of collapses of the under-

lying evaporitic units. This deformation produced a depression in which most of the shafts are concentrated, and to which the depth variability of shafts throughout the site is probably related; as a general pattern, shafts are deeper in the central area of the mine.

Casa Montero's flint was formed from smectites that later underwent an aging process (Bustillo *et al.* 2009: 193-194). This involved a re-crystallization of opal to form quartz in the inner part of nodules. As a result, there are frequent nodules with opaline outer parts and micro-cryptocrystalline quartz inner parts. This process gave the flint particularly suitable knapping qualities and perhaps a certain visual distinctiveness (Fig. 5).

Casa Montero's lithic remains have been classified in two groups of raw materials. The first group is composed of silica rocks, opals, and opaline cherts that were the object of mining activity. Although four silicification episodes have been documented at the site, Neolithic shafts only cut through and thus accessed the three upper episodes, all opaline. The main episodes used were the second and fourth, while the third was only exploited whenever it offered reasonably good knapping qualities. The second group is comprised of quartzite and quartz cobbles obtained from the Jarama river bank a kilometre away. These cobbles were necessarily obtained off-site and were used in the process of extraction, quartering, and reduction of flint nodules, constituting a minimal fraction of the overall assemblage.

The siliceous raw materials represented in the archaeological record were characterized macroscopically and petrographically for a detailed analysis of the physical and cultural features which had determined their selection or rejection. The macroscopic characterization distinguished seven types of raw materials

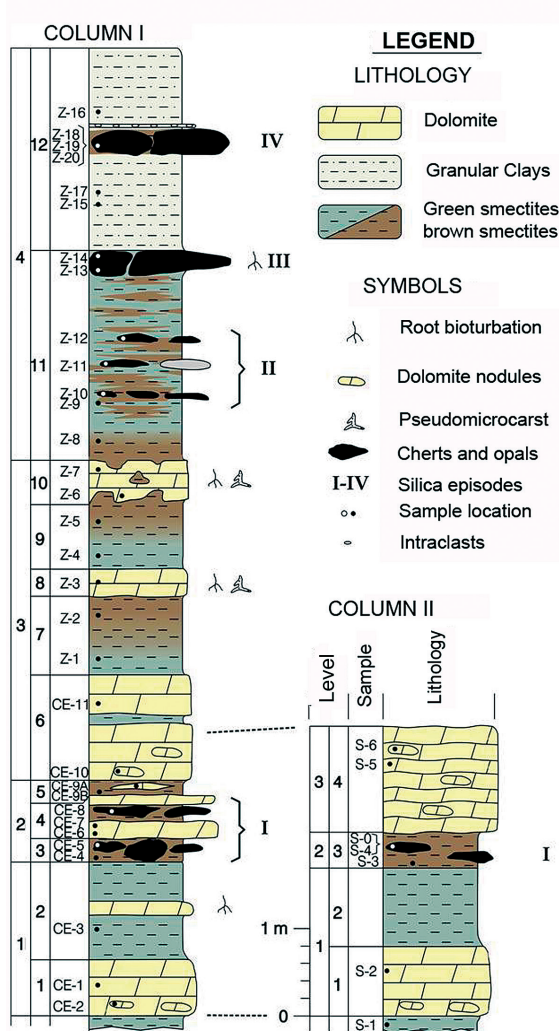


Fig. 4. Stratigraphic column showing the disposition of the four silicification episodes at Casa Montero (Madrid) (in colour in the electronic version).



Fig. 5. Flint from Casa Montero (Madrid). Note the opaline outer parts and micro-cryptocrystalline quartz inner parts (in colour in the electronic version).

and, subsequently, the petrographic study defined the properties of the opaline cherts (Bustillo *et al.* 2009). The visual and petrographic distinctiveness of the Casa Montero flint has now been confirmed by the first set of geochemical analyses performed on a selection of regional flint (Bustillo *et al.* 2010). The sampled remains belong to seven different flint sources: one from the actual site of Casa Montero, the second located less than one kilometre away, two samples from 30 km south from the site, and three from more than 60 km to the northeast, in the province of Guadalajara. The Casa Montero flint is statistically different from any other flint source in the region, including the closest sampled source from less than one kilometre south from the site. These results have led to new research aiming at a systematic geochemical sampling of flint from various Neolithic archaeological sites in order to define the variability of their sources through time, which will hopefully produce its first results in the near future.

Refits and *chaîne opératoire* analyses have provided evidence indicating that the raw material chosen for lithic exploitation is chert from the inner part of the nodules. The reduction strategy is organized in order to remove the opaline flint when nodules have a significant opaline outer part. Relative knapping quality is behind this selection. The higher the content in opal the less resistant to fracture it is and, consequently, less suitable than chert as a blank. A consequence of this choice is an inevitable large quantity of discarded raw material (Criado *et al.* 2010; Castañeda *et al.* 2015b: 481-482).

Flint from Casa Montero also exhibits a high degree of heterogeneity, mainly due to its continental genesis. This heterogeneity, basically a result of impurities and a variable amount of re-crystallized flint, is the cause behind the discard of at least 32 per cent of the cores during the knapping process (Castañeda 2014: 321). Neolithic miners and flint knappers designed a systematic strategy in advance in order to optimize the available flint resources and the required labour invested throughout the process. This strategy can be seen in all the phases of the *chaîne opératoire*, from procurement to abandonment, including the recycling and re-use of waste. It was defined so as to fulfill three objectives: reducing the risk of failure, minimizing the quantity of discarded raw material, and giving precedence to blade production.

In order to reduce the risk of failure, knappers tried to avoid impurities such as geodes or veins, primarily by selecting big flakes rather than nodules as blanks. Nodules at Casa Montero vary considerably in size, ranging from five to 60 cm in maximum dimension. The way in which knappers proceeded with the reduction process also depended on the volume of a nodule (Castañeda *et al.* 2015b: 482). Those nodules weighing more than 800 g were not reduced directly, but instead big flakes

that would serve as blanks were extracted by means of bifacial removals (Fig. 6). The use of large flakes as blanks also minimized the quantity of discarded raw material; the shape of a flake is already very similar to that of a blade core without excessive investment in its configuration, so blades can either be extracted after a simple configuration or straightaway from an edge.

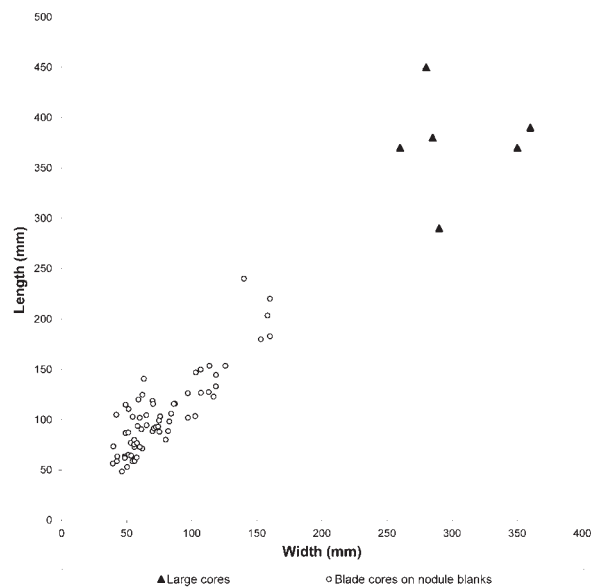


Fig. 6. Comparison of the way in which nodules were reduced according to their size. While small nodules were directly reduced to produce blades, big nodules were used to obtain large flakes. These flakes were the preferred blank for blade production. None of the small nodule-based cores is bigger than 24 x 16 cm. These dimensions are equivalent to 800 g.

Nodules that weighed less than 800 g were directly reduced, although they frequently had an opaline and therefore useless outer part. In those cases, configuration was performed on that opaline portion and there was no specific work in order to remove the cortical surface. That is, cortical surfaces were eliminated with the same blows that were aimed both at removing opaline chert and at configuring the core (Castañeda 2014: 160-168). The task of shaping the core involved two phases whenever the opaline part was present and abundant. The first involved outlining the shape of the core by removing sizeable flakes. The second was aimed at defining surfaces, convexities, and the initial crest. Although blade manufacture was the priority, other secondary activities were carried out by recycling the remaining by-products and resulting waste. For example, exhausted blade cores were reconfigured so as to

detach flake blanks for tools (Castañeda *et al.* 2015a), while it seems that a significant amount of waste served as a source of raw material for apprentices (Castañeda, in press)¹.

3. HOW

Neolithic flint mining at Casa Montero is mostly characterized by shafts that allowed access to the siliceous levels under exploitation. However, there is some evidence of open-air quarrying, exceptionally documented in six cases, mostly small in size (four of them did not exceed 3.5 m², although one was 56 m²) and all accessing outcrops of the upper flint episode. Their chronology is difficult to assess. Stratigraphic analyses confirm that at least two of these quarries were in use before the first shafts were opened in the area. The third one, the biggest of them all and documented in sampling unit E3, was contemporary with other shafts. There are no useful stratigraphic data to determine the chronology of the remaining three. Shafts are indisputably the main extractive method at Casa Montero. The excavated shafts amount to 338 throughout the three excavation seasons, that is 8.91% of the total recorded in the four hectare open-area excavation. Sixty-eight of them were not completely excavated because of safety reasons (see above). These shafts are mostly deep and narrow cylindrical features cutting through the geological substrate, with a mean diameter of 1.15 m, a mean depth of 4.74 m, reaching a maximum depth of 9.26 m. Some morphometric variability exists despite their apparent homogeneity at the surface. At least 23 test shafts were identified which appear to have been dug in order to assess the underground accessibility of flint. These shafts have an average depth of 1.27 m and never exceed 1.66 m. Their spatial distribution is also suggestive of their probable function; they are distributed within the limits of the mining area and recurrently reach a silty clay layer of the lower part of the Miocene Intermediate Unit of the Madrid Basin, a layer that stratigraphically signals the absence of flint at depth.

All the characteristics of these shafts constitute a safe and effective mining system. Their narrowness prevented the loss of wall humidity, minimizing the risk of collapses. It also minimized the amount of labour invested in soil extraction, while allowing

convenient access to flint nodules of a required size. The presence of a set of features aiding the mining operations increased the effectiveness of the process; ledges (209 cases in 151 shafts) and tapering (230 cases in 193 shafts) reduced the diameter of the shaft walls with depth and consequently increased safety for miners during extraction. Postholes at the base (9 cases in 6 shafts), cavities arranged in the form of steps on the walls (18 cases in 6 shafts), ledges and tapering, all facilitated the movement of miners up and down the shafts, while opposed postholes probably accommodating a horizontal beam at the mouth of a single shaft suggest the occasional use of a winch to support the rapid extraction of spoil.

The narrowness of the shafts suggests that digging and extracting flint could only be performed by one individual at a time, permanently supported by the presence of at least one other person who would pull out both the spoil and the raw material. The marks left by tools on the walls reveal some other aspects of the mining process. On the one hand, their homogeneity points to the regular use of the same type of tool. No antler or wooden picks have been recovered at Casa Montero, but the detailed analysis of certain flint items have revealed the existence of various types of flint wedges and picks which would have been used both for the excavation and the removal of flint nodules (Terradas *et al.* 2011). On the other hand, a series of marks, oblique and long in the upper part and short and vertical in the lower shafts, suggests that the lack of space did not allow either perpendicular blows or the use of hafted picks from a certain depth onward.

Although mining at Casa Montero was obviously an arduous task, not all the evidence points towards an intensive exploitation of flint levels. As a matter of fact, many ledges are a result of the under-exploitation of these levels, while certain large flint nodules were occasionally abandoned inside shafts with almost no evidence of extraction. In contrast, lateral excavations are often the result of a systematic overexploitation of flint levels through cavities that are extremely narrow galleries in which it was hardly possible to manoeuvre. Eighty-four per cent of the 259 lateral excavations documented occur at the base of the shaft, having been made when the shaft had reached the desired depth and before its abandonment, thus minimizing the risk of collapse. Lateral excavations occur at different depths in the remaining 16% of cases, although they are generally of very small size, and in most cases a result of the extraction of only one or two flint nodules. Occasionally, miners did extract flint by expanding horizontally throughout the perimeter of the shaft. This is the case in sampling unit D4, with two different sets of extensive lateral excavations that configure a real —although narrow— system of galleries and chambers

¹ Castañeda, N.; Consuegra, S. and Díaz-del-Río, P. in press. Placing the transmission of technical knowledge in the system of blade production. A case study from the Early Neolithic flint mine of Casa Montero (Madrid, Spain). 7th International Conference of the UISPP Commission on Flint Mining in Pre- and Protohistoric Times: *Mining and Quarrying. Geological Characterisation, Knapping Processes and Distribution Networks during Pre- and Protohistoric Times*, Mons-Spiennes, 2016.

at different depths (Fig. 7). The upper gallery is only 1.2 m below the surface and connects seven shafts, while the lower connects eleven shafts at a depth of 5.6 m. The stratigraphic sequence suggests that the whole system was probably dug in only two mining episodes, both dated to the Early Neolithic. Shaft fillings are characterized by a low degree of human alteration and most frequently an absence of organic remains. Excavated spoil and the remaining knapping debris was dumped into adjacent exhausted shafts as mining proceeded.

Overall, although the mining process appears to have been substantially uniform throughout the Early Neolithic, there were obvious different technical choices that would have been selected depending on circumstances such as variation of flint demand or the size and capabilities of each set of miners. Procedures for both the extraction and the required quantity of mined flint seem to have social as well as technical motivations.



Fig. 7. Above: a chimney-shaped shaft with a ledge half way down. Below: an example of one of the lateral excavations from Sampling Unit D4 that configure a real —although narrow— system of galleries (in colour in the electronic version).

4. THE PRODUCT

As in many other mines in Europe, the raw material at Casa Montero was both procured and processed at the mining site. This resulted in a massive amount of lithic refuse; remains recovered from the 338 excavated shafts weigh 65 tonnes, and amount to more than ten million items. When considering the approximately 4,000 documented Neolithic shafts, the estimates would amount to 769 tonnes or 128 million items produced and discarded at the site.

Knapping residues form the majority of the remains. Unlike many other European Neolithic flint mines, aimed at the production of axehead roughouts, the main goal of these intense knapping activities at Casa Montero was the production of short and robust blades (*c.* 5 x 2 x 0.5 cm in size; Figs. 8 and 9) (Castañeda *et al.* 2015b: 483-484).

The production of blades was conditioned by the need to predetermine the length of the blanks. This was achieved by choosing the orientation of the initial nodule or big flake blank in order to obtain a flaking front with a length of at least five centimetres. Whenever the result was longer than this desired length, the flaking front was shortened by removing a tablet (Castañeda *et al.* 2015b: 483).

As a result, the relationship between core dimensions changes. Depending on the orientation of the initial blank there were three reduction schemes corresponding to three types of cores. The length of the blade core front is always similar, but proportions vary: the first type is thick and wide (Fig. 10A), the second is thick and narrow (Fig. 10B), and the third type has equal width and thickness (Fig. 10C). The execution of the configuration of the three types of cores is analogous throughout the mine, with only one striking platform and only one unipolar flaking front (Castañeda 2016: 2).

The full reduction process took place at the mine but, after selection, the best, correctly shaped and standardized blades were transported to consumption sites in order to be used as sickle blades. As a consequence, the blade assemblage from Casa Montero is composed of rejected by-products (Castañeda *et al.* 2015b: 483). It is the biggest sample of blades from the Early Neolithic of central Iberia, comprising 4,565 recorded examples. Considering their size, almost 75% of these can be considered blades, about 20% bladelets (width < 12.5 mm), and fewer than 7% microblades (length < 30 mm). However, the absence of a bimodal distribution of the sample does not allow the distinction of these three groups as independent productions (Castañeda 2016: 5).

The analysis of the size and technical parameters of these products suggest they were produced with direct percussion with a “soft” stone hammer technique

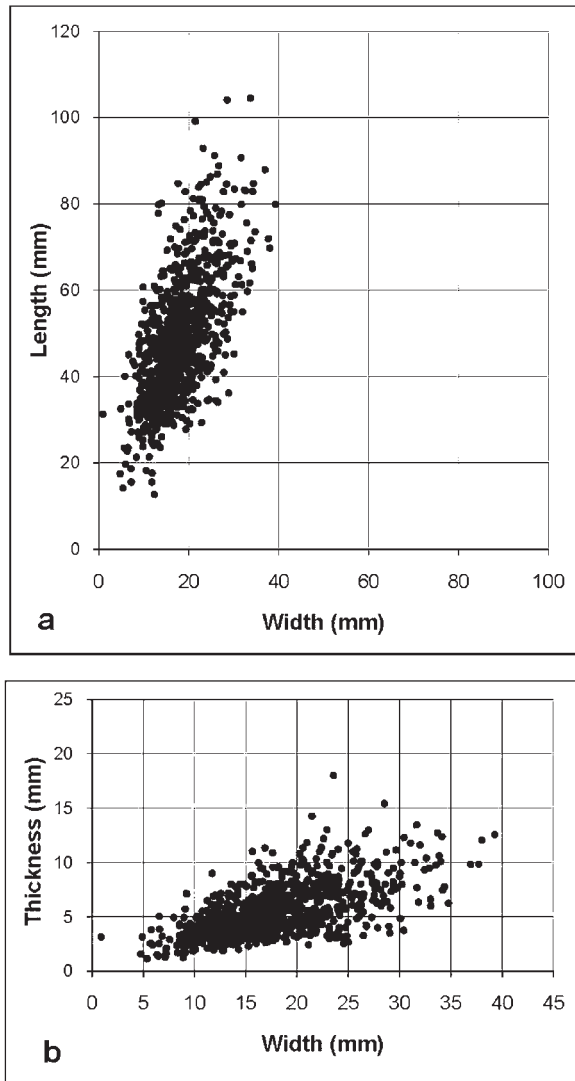


Fig. 8. Scatter plot showing the size of production blades according to (a) their width and length and (b) width and thickness.

(Gallet 1998; Pelegrin 2000; Roussel *et al.* 2011; Castañeda 2016: 5). We estimate that at least 63 blades of the required standard were produced and taken off site from each mining shaft. More than 250,000 blade blanks may have been produced while the mine was in use (Castañeda *et al.* 2015b: 484-485; Castañeda 2016: 5-7).

Mining entailed the need to perform other tasks like rigging, wood working, and food processing. Two *chaînes opératoires* were developed in order to provide tools for such activities. Some of these tools were obtained by predetermined flake production (1.65%) but most of them by recycling flint residues (62.31%).

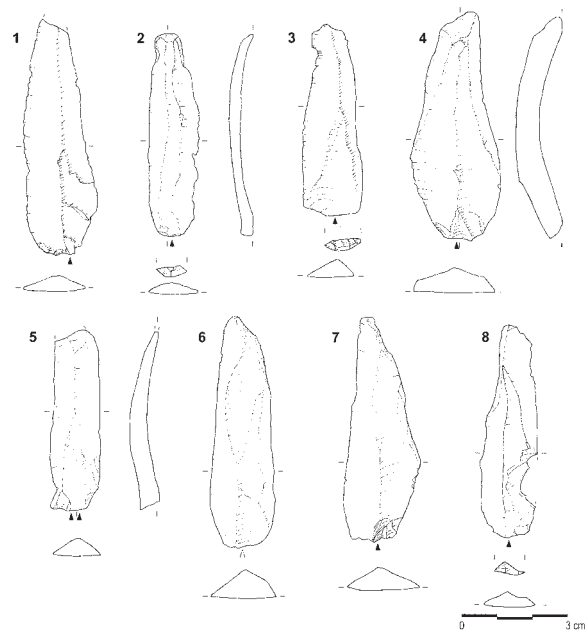


Fig. 9. Blades from the production phase discarded at the mine for not meeting technical requirements. Drawing by F. J. Fernández.

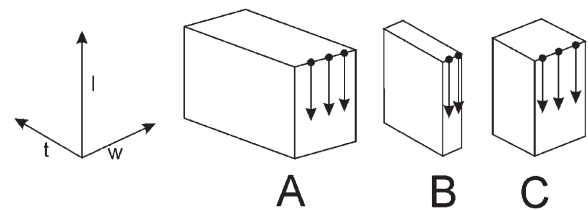


Fig. 10. Scheme showing the reduction strategy of the cores. Depending on the orientation of the initial blank (nodule or flake), and maintaining a constant length of the core front in approximately 5 cm, three types of cores were resulting. L: length, w: width, t: thickness. Type A: $T > L \approx W$; type B: $T \approx L > W$; type C: $L > W \approx T$.

These tools are characteristically diverse, not only in the kind of blank used but also in their degree of elaboration and the form of the final product. There is a relationship between the selection of the blank and the types of tools made. The best and more elaborate blanks are destined to produce the most specialized and reliable implements with specific shapes, such as perforators, notches, and end scrapers. On the other hand, the tools made from recycled elements have versatile and simple morphologies, for example in the case of simple scrapers (Castañeda *et al.* 2015a).

One of the major results of the analyses of knapping waste and especially of cores and refits from the

mine has been the possibility of defining the presence of different degrees of skill: novice, advanced apprentice and expert (Fig. 11). The way in which unskilled knappers tried—and sometimes failed—to reproduce the same schemes developed more successfully by others suggests that apprenticeship was a significant component of the activities performed at the mine (Castañeda 2014; Castañeda in press).

The transmission of skilled knowledge is critical in the reproduction of any small-scale society. As most of the practical knowledge required in the process of mining for flint and transforming the raw material into finished blades was available at Casa Montero, its transmission would inevitably have involved the

presence of different stages of apprenticeship. The site was the locus for both observing and practicing the procedures involved in mining and flint knapping. No doubt different age groups would have participated in most mining events and the transmission of knowledge and *savoir faire* would be embedded in the collective labour that took place at the mine.

5. LOGISTICS

Strategic and logistical matters would have been key issues in the mining process. Mining events probably required specific social preconditions and involved complex organization and decision making at all stages, including the orderly distribution of the final products through whatever rules of sharing (or not sharing) that may have existed. Some of these aspects are difficult to assess given the archaeological record available; others, such as certain logistics, can nevertheless be easier to confront.

At Casa Montero, the easiest way to tackle such issues is through analysis of types of items that are proportionally a minority of the sampled collection. These are mainly the cobble tools, pottery, animal bones, and other non-local remains, which may offer some clues to who the miners were, their origin, or the scale of their interaction spheres.

Cobbles were brought from the Jarama river terraces, no more than one kilometre down the hill from the mine. It nevertheless seems that it was not a least-cost strategy involving a straightforward on-the-way gathering of all the percussion tools required for each mining episode. The refitting of cobbles recovered from multiple different shafts suggests that mining events were bigger than expected, involving an estimate of 50 tons of percussion tools (Capote 2013: 285). The way in which these cobbles were selected, used, and finally discarded suggests that individual events were somehow planned as to their infrastructural needs. Each event not only involved a significant number of people, but was organized in order to transport—in quantity and quality—as many stones as required for the specific circumstances. The size of the workforce mobilized could vary considerably from one episode to another. The way percussion tools were used did not change much, however, suggesting relatively stable working procedures (Capote 2011).

Pottery is also relatively scarce at the mine when compared to the amounts of discarded flint. Nevertheless, it probably constitutes the best and most complete Early Neolithic collection from central Iberia. Pots are impressed wares characteristic of this time period (Fig. 12). Their production details suggest that they share similar if not identical technological traits,

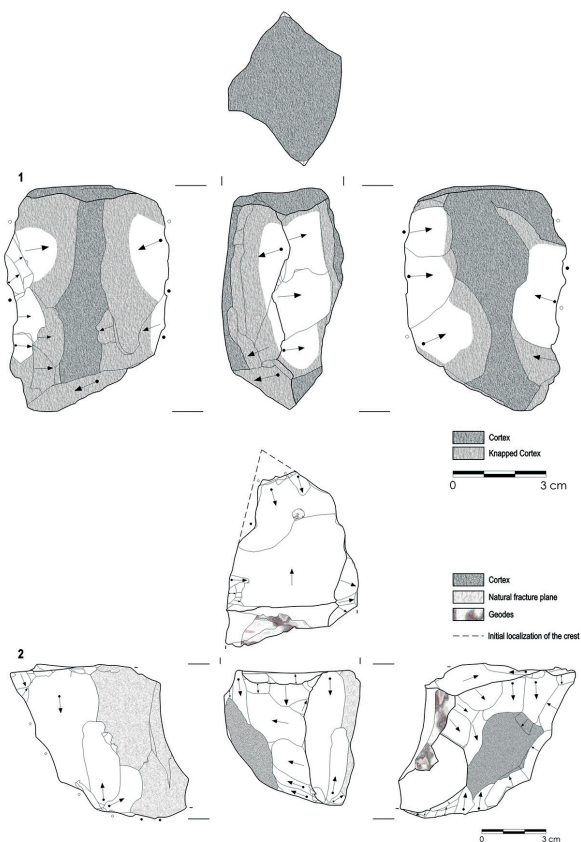


Fig. 11. Examples of probable unskilled knappers as seen through the analysis of flint cores. 1. Represents a case of the selection of an unsuitable nodule. The knapper should have known from the very beginning of the reduction sequence that there was not enough useful (recrystallized) chert inside. In spite of this, the crest and surfaces were configured, albeit roughly. 2. Represents a case of the incorrect execution of removals. In addition to the fact that the result of the configuration was an asymmetric and unbalanced core, the knapper was unable to remove the initial crested blade from the correct place. Drawing by F. J. Fernández.



Fig. 12. Characteristic Early Neolithic ware from Casa Montero. Both bottle and bowl were recovered together, suggesting they should be considered a set. Photograph by J. Latova (in colour in the electronic version).

both in the components of their raw materials and in the way that they were decorated and finally fired. All pots seem to be made from local clays, but of kinds that could not be obtained at Casa Montero itself. This obviously suggests that all pots were brought to the site by miners, who probably normally took them back to their respective base camps, to judge from the relatively low presence of ceramics at the mine. Nevertheless, there are at least two instances in which sets of pots were intentionally left inside mining shafts in an orderly fashion. Most ceramics also share a very particular feature, in that they were produced by mixing clay with microscopically fragmented bone temper. This characteristic seems to be endemic in the region, with a tradition of this type of tempered fabric beginning in the mid-6th millennium BC, lasting for at least 3000 years, and having its closest contemporary parallel in some of the Cardial wares of southern France (Díaz-del-Río *et al.* 2011).

The pots found at Casa Montero appear to have been brought as sets of drinking/eating, serving, and storage/transporting containers. Very few fragments show clear traces of burning, which suggests that the kind of consumption taking place at the mine may have been mostly raw and/or already cooked food such as bread, cheese, and dried or smoked beef, or alternatively, that pottery was not directly involved in the cooking process. Some burnt cobbles and fragments could have been used for heating liquids inside these vessels, but evidence for hearths is lacking throughout the site, suggesting either a loss of the evidence through post-depositional processes and/or relatively little pyrotechnical activity on site.

What the miners ate left little material evidence. Starch and silicophytolith analyses on sediments and pottery fragments point toward the presence of cereals,

legumes, and acorns², all of which are known to have been milled and baked into bread by many historical groups, and which may otherwise leave no evidence of processing or consumption. As happens at many other European flint mines, faunal remains are almost absent from the site. More than 66% of the 43 macrofaunal remains are not the result of consumption on site but relate to bone-working (Fig. 13). Apart from a few bone points, ring production is the main component of this limited collection. Traditionally, these bone rings have been interpreted as personal ornaments and they are characteristic of the earliest Neolithic in Iberia. However, both their relative abundance and the recovery of the complete production sequence at the site points to a more functional —although as yet unidentified— use for these objects (Yravedra *et al.* 2008: 245-246).

The few antler points recovered have shown no evidence for their use as picks. Both wild (deer, boar) and domestic (sheep, goat, cow, perhaps pig) species are represented in the collection. Other remains provide excellent evidence for the seasonality of at least some of the mining events, such as the recovery of a swallow in the lower filling of one of the deepest Neolithic shafts. All in all, it seems that miners visiting Casa Montero did not cook or consume meat on site, except perhaps for meat from which the bones had been removed elsewhere. In fact the totality of the



Fig. 13. Bone industry from Casa Montero, including rings (lower left) and utilized shafts (right). Photograph by J. Latova (in colour in the electronic version).

² Chevalier, A. in press: "Análisis de silicofitolitos y granos de almidón en muestras de sedimento y vasijas neolíticas (Casa Montero, Madrid)". In S. Consuegra and P. Díaz-del-Río (eds.): *Casa Montero (Madrid). Una mina de sílex del Neolítico Antiguo*. Consejo Superior de Investigaciones Científicas. Madrid.

available evidence suggests that their subsistence while mining was premeditated, with food probably taken in ready-to-consume form, as would be reasonable for short-term expeditions.

The possibility that these Early Neolithic groups were rather mobile is also suggested by the presence of at least two kinds of red pigment: ochre and cinnabar. While the former was most probably obtained in the surroundings of the central mountain chain, 40 km north of the mine, lead isotopic analysis has defined the origin for cinnabar in the Almadén mining district (Ciudad Real), some 200 km south from Casa Montero (Hunt *et al.* 2011). Many flint and quartzite fragments, and all the bone implements, have traces of red pigment, while one 2 kg ochre lump and many small red pigment lumps have been recovered throughout the mine. Pigments have abrasive qualities that may have been useful in bone tool production and stone tool hafting. However, the wide distribution of pigments seems to be inconsistent with any practical tool production/transformation hypothesis, and suggests that ochre and cinnabar were probably used in some other generalized activity, perhaps in body decoration (*e.g.*, Watts 2002).

The existence of other ‘non-productive’ activities at the mine is also supported by three extremely rare decorated objects recovered inside different mining shafts, two of them produced with non-local raw materials and thus probably brought to the mine as finished objects. The first, produced from local soil, is a clay fragment intentionally beveled and decorated with incised motives, mostly unrecognizable except for a solar representation. This object was recovered within the same shaft as a red quartzite stone with pecked decoration that seems to evoke a human representation carrying objects in both hands. Finally, another shaft contained a limestone fragment artificially shaped and decorated with multiple incisions that are difficult to explain in functional terms and that has been interpreted by specialists as part of a stele, perhaps the oldest Neolithic transportable object of the kind from Iberia³. As happens in many societies that we know through the ethnographic record (Burton 1984; Childs 1998; Moretti 2007), prehistoric mining activities may have been charged with magical and ritual values (Topping 2011a), suggesting social practices that would give full meaning to these singular objects recovered at Casa Montero.

It is likely there was something other than a utilitarian motive behind the mining operations at Casa Montero. Mining events may not have been a cyclical

activity with strictly functional purposes, but extremely meaningful and timely social acts, where social identities were both displayed and created. The resulting use and exchange value of the flint products may have played only a minor part in the material and immaterial value of the actual mining process as a ‘total social fact’ (Mauss 1990).

6. WHEN

As happens at many Neolithic flint mines (Consuegra and Díaz-del-Río 2018), most of the datable organic remains recovered at Casa Montero were charcoal fragments and, in much lesser quantity, a small collection of bones. The latter was mainly composed of rings and processed shafts, obviously with a rarity value and museographic qualities. Thus, only two bone samples were considered for radiocarbon dating in order to calibrate the possible ‘old wood’ effect (Schiffer 1986) of the series of twelve C14 dates obtained from individually identified charcoal samples. Only one of the former, a femur of *Ovis aries*, had enough collagen to be dated. Table 1 lists details of all the dated samples.

The charcoal material dated belongs to holm/kermes oak (*Quercus ilex/coccifera*) and common juniper (*Juniperus communis*). The samples were selected in order to observe the potential temporal growth of the mine field and are thus distributed throughout the area of the excavated mine (Fig. 14). At 1 σ the Bayesian model of the dates suggests that mining activities started by 5380/5320 cal BC and ended by 5290/5180 cal BC (5350 to 5220 cal BC mean) with a span of 30 to 170 years of activity (110 years mean). The results indicate a probable time span of approximately four generations (Díaz-del-Río and Consuegra 2011)⁴ and have important implications. On the one hand, most of the dates are undifferentiated so they cannot be used to build a sequence. Regarding their distribution across the site, they do not show any temporal pattern in the expansion of the mine field whatsoever. The fact that there are few insignificant stratigraphic relationships between mine pits precludes the possibility of any sequencing of mining events, and we are thus left to accept the probability that Casa Montero may have been in use for about a century.

This hypothesis requires support other than from the radiocarbon dates. At least four sets of data could support this interpretation. First is lack of intersection between shafts. It seems that miners did recognize previous mining pits, something not necessarily easy

³ Bueno, P. and Balbín, R. in press: “Manifestaciones simbólicas y minería neolítica: Casa Montero”. In S. Consuegra and P. Díaz-del-Río (eds): *Casa Montero (Madrid). Una mina de sílex del Neolítico Antiguo*. Consejo Superior de Investigaciones Científicas. Madrid.

⁴ At 2 σ results are as follows: start mining 5440/5310 cal BC, end mining 5300/5130 cal BC. Span: 20 to 230 years. A_{model} : 191.

#	Lab Code	Sample #	S.U.	Shaft #	Strata #	Dated Material	Date BP	13C/12C	Cal BC 1 σ	Cal BC 2 σ
1	Beta-206512	CM/05/2384/2382	–	2384	2382	<i>Quercus ilex/coccifera</i>	6410±40	-24.2 o/oo	5468–5357	5471–5322
2	Beta-206513	CM/05/2701/2229	–	2701	2229	<i>Quercus ilex/coccifera</i>	6270±40	-26.2 o/oo	5300–5221	5324–5077
3	Beta-232884	CM/05/95/B1/7242/1	B1	7244	7242	<i>Quercus ilex/coccifera</i>	6360±40	-25.4 o/oo	5462–5303	5469–5227
4	Beta-232885	CM/05/95/B2/7562/1	B2	7564	7562	<i>Quercus ilex/coccifera</i>	6280±40	-24.9 o/oo	5303–5225	5359–5080
5	Beta-232886	CM/05/95/B3/7482/1	B3	7490	7482	<i>Quercus ilex/coccifera</i>	6350±40	-25.6 o/oo	5452–5234	5466–5224
6	Beta-232887	CM/05/95/D1/7963/1	D1	7967	7963	<i>Juniperus communis</i>	6290±40	-22.2 o/oo	5309–5225	5367–5085
7	Beta-232888	CM/05/95/D2/8142/1	D2	8147	8142	<i>Quercus ilex/coccifera</i>	6240±40	*	5303–5081	5310–5066
8	Beta-232889	CM/05/95/D3/15842/1	D3	15849	15842	<i>Juniperus communis</i>	6290±40	-22.3 o/oo	5309–5225	5367–5085
9	Beta-232890	CM/05/95/D4/16303/1	D4	16309	16303	<i>Quercus ilex/coccifera</i>	6500±40	-25.6 o/oo	5512–5383	5534–5370
10	Beta-232891	CM/05/95/D5/8614/1	D5	8615	8614	<i>Quercus ilex/coccifera</i>	6320±40	-26.2 o/oo	5338–5225	5460–5214
11	Beta-232892	CM/05/95/E3/9323/1	E3	9332	9323	<i>Quercus ilex/coccifera</i>	6270±40	-26.2 o/oo	5300–5221	5324–5077
12	Beta-232893	CM/05/95/E4/9622/1	E4	9630	9622	<i>Quercus ilex/coccifera</i>	6330±40	-25.6 o/oo	5363–5228	5463–5217
13	**	CM/05/95/G3/16221/1	G3	16229	16221	<i>Sus sp.</i> Femur frag.	–	–	–	–
14	Beta-295152	CM/05/95/D4/15363/1	D4	15367	15363	<i>Ovis aries</i> Femur	6200±40	-19.2 o/oo	5218–5068	5296–5045

Tab. 1. Complete list of radiocarbon dates obtained from charcoal and bone samples recovered at Casa Montero (Madrid, Spain). Sample 13 lacked collagen.

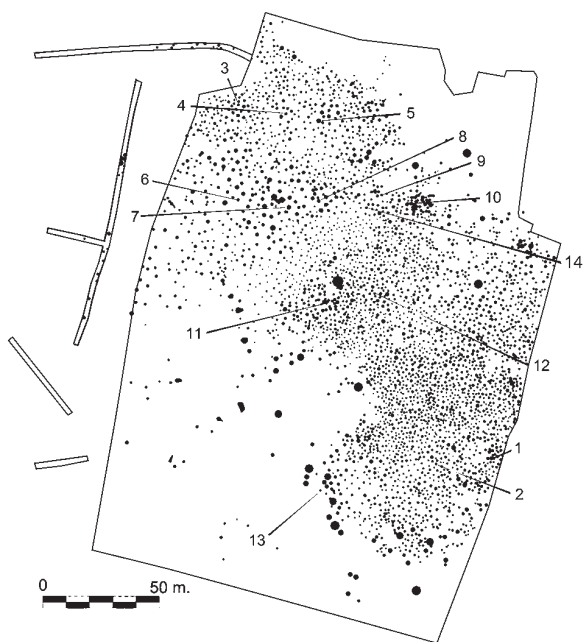


Fig. 14. Distribution of the radiocarbon dated samples from Casa Montero (numbers relate to table 1).

considering the density of shafts; 0.37 m to 1.08 m between shafts in the areas with the highest concentration. Second, there is striking uniformity throughout the site of the mine pits, their fillings, and in the reiterative pattern of the lithic *chaîne opératoire*. Third, the Early Neolithic chronology of all the pottery and other recovered artefacts is extremely consistent. Finally, quartzite cobbles were brought from the nearby river terraces by miners and used for percussion activities during the extraction and production process. Many broke while being used, and became part of the infill of open shafts. The refitting fragments of quartzite cobbles within and between mine pits reveal that many were actually filled in a single mining event (Capote 2013). The refitting of two fragments of pottery recovered from two shafts approximately 60 m apart also suggests that mining events may have been bigger than expected.

To sum up, most of the evidence recovered at the site suggests that the complete time span of Casa Montero may well have been a century. The timing of each one of these events could have been seasonal, perhaps in spring, as suggested by Topping (2011b) for the English mines. At Casa Montero, timber or flint tools would have been easily blunted by muddy clay during the winter rainy season, while in summer drought-hardened soil would have increased the labour investment in the actual digging as well as the danger of landslide caused by the cracking of extremely dry terrain. In tactical

terms, the best moment to programme such activity would either be spring (May to June), or autumn (September to October), when the probability of rainfall is reduced and temperature has not reached, or has passed, its maximum. The recovery of a swallow in the lower stratigraphic unit of shaft 7,209 favours the former as the best hypothesis.

Additionally, the seasonal and programmed visiting of the mine would have avoided the problems of concentrating enough labour force in a single spot in the context of a nonhierarchical decision-making system. This is a reasonable scenario considering what we know about the number and size of early Neolithic groups, and the possibly limited capacity of individuals to mobilize larger-scale labour teams beyond the immediate domestic spheres.

7. WHO

Early Neolithic evidence is scarce in the 8,000 km² of the Madrid region, an area with intense —although patchy— archaeological activity. Only 20 locations are known to have Neolithic remains, 14 of which have been systematically excavated in recent times. The overall pattern seems to suggest the existence of a certain combination of both residential and logistical mobility. All sites suggest short-term occupations, either in caves and rockshelters (5 cases) or in river basins (11 cases). The latter share the presence of a low density of pits, some of which could reasonably be related to storage facilities, occasionally (2 cases) associated with small (*c.* 24 m²) circular timber houses (*e.g.*, Díaz-del-Río and Consuegra 1999). Eight sites have available radiocarbon dates, three of them contemporary with those from Casa Montero: two caves and nearby indications of flint extraction at El Cañaveral (Baena Preysler *et al.* 2011), in the immediate vicinity of Casa Montero. The Casa Montero project design included a 60-minute buffer-zone surface survey surrounding the flint mine. This intensive survey has not increased the number of possible Neolithic sites. In fact, none have been recognized to date.

Adjacent extra-regional evidence is also scanty. Only six sites have been thoroughly excavated and analyzed by modern standards. One of them is the cave of La Vaquera, with a long-term stratigraphic sequence beginning in the Early Neolithic, around 5400 cal BC (Estremera 2003). The information recovered from this site serves as a reference for most of the central Iberian Neolithic, but the limited excavated area does not allow a functional interpretation that would connect these exceptional cave occupations with the more frequent open-air sites. These two categories of sites can suggest a more or less dichotomous model involving a pastoral economic orientation for caves and

an agricultural economy for lowland riverside sites. Unfortunately, and perhaps because of its fragmentary nature, the evidence does not seem to support substantially different functions. To date, this overall pattern suggests that the earliest Neolithic groups in the inner regions of the Iberian Peninsula were apparently very small and considerably mobile. The comparison between population density and size/nature of Neolithic camps and the scale of mining events suggested by the evidence recovered at Casa Montero points to the mobilization and cooperation of a sizeable part of these groups in a set of collective actions.

8. CONCLUDING REMARKS

The different mining actions between the first and last events at Casa Montero may have possibly been the result of a few generations of early Neolithic aggregations (Fig. 15). Flint mining at the site was thus a generational phenomenon where the acts of gathering in order to perform a collective action served as a basis for binding new political relations beyond each individual group.



Fig. 15. An artist's view of the last mining event at Casa Montero (*c.* 5200 cal BC). Illustration by J. M. Álvarez Cebrián (in colour in the electronic version).

Of course, all strategic, tactical, and logistic preconditions were required for those gatherings, including the ability and capacity to convene, design, and organize an orderly set of actions such as those deployed at the flint mine. When comparing with other Neolithic mines in Europe, it seems that these social preconditions may be the key to move beyond their formal and technical variability (Capote and Díaz-del-Río 2015).

At Casa Montero, labour was shared throughout the extractive activities, while the transmission of knowledge and *savoir faire* laid the foundations for the reproduction of groups. Beyond those acts of social production and reproduction, mining may have built the foundations for a quite different society while creating some fixed collective places in the landscape. This last factor may have allowed the emergence of newly materialized territorial principles shared by the constituent groups. Thus, in some way mining may have become a political act, founding society anew.

Casa Montero was abandoned sometime after 5200 cal BC. There is no other evidence of human activity there for more than 36 centuries. By the Bronze Age (1600-1400 cal BC), a small group inhabited the immediate proximity, and considered the mining field significant and/or convenient enough to make use of it as a burial ground.

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