Quern and millstone quarries in the north of Spain

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1. Introduction

Our interest in the process of millstone manufacture (Fig. 1) dates to the discovery of several rotary quern roughouts a few years back. This led us to the idea that archaeologists have accepted the presence of rotary querns on archaeological sites without wondering about their origin (Pascual and García 2001, 241).

Moreover, during consultation of bibliographical sources on the Jubera Valley in the region of La Rioja, we came across a quote from Pascual Madoz that would prove essential for the study of this industry. The 19th century geographer states that 'in the municipality of Robres del Castillo, there is a very beautiful stone quarry that produces flour and oil millstones' (Madoz 1849, T. 13, 529). And indeed, during our survey of the hills of Robres del Castillo, we discovered that the millstone quarry surpassed by far the account of Madoz. In the light of this find, we expanded our area of investigation of millstone quarries to the other valleys of La Rioja and published a first distribution map of millstone quarries for the whole of the La Rioja Autonomy (Pascual and García 2003, 136). Four years later, we were invited to collaborate with the research group related to the European millstone quarries database. At this moment, we began to survey other regions of northern Spain.

Figure 1. Millstone makers (moleros) from the region of Palencia. The date of the photograph is unknown. We thank the authorities of Barruelo for permission to publish the photograph.

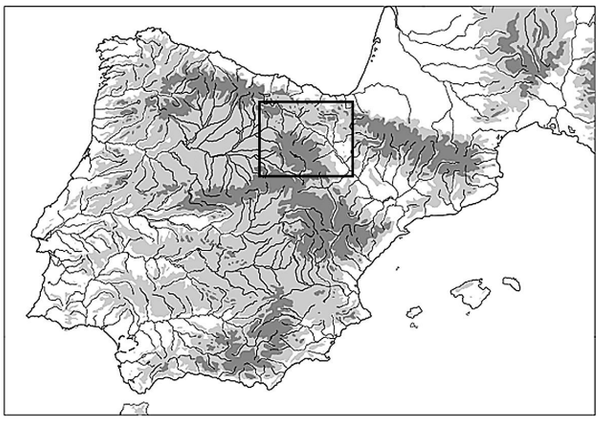

Figure 2. Survey area.

2. Study area and geology

The methodology adopted has varied in our two main study areas. In the mountain range of the *Sistema Ibérico*, we performed a systematic study, based primarily on geology and place names. In northern Burgos, Navarra, and the Basque Country, our research was based exclusively on the study of texts. From a quantitative standpoint, the results are striking in the *Sistema Ibérico* while *in* the second area, the documents consulted allowed us to approach other important issues, such as trade routes (Fig. 2).

The *Sistema Ibérico* range was formed forty million years ago during the Pyrenean phase of the Great Alpine Orogeny. Outcrops of conglomerate are visible at altitudes ranging between 700 and 1400 m, while limestone formations appear down to 500 m.

3. Millstone production in the Sistema Ibérico mountains

3.1. Toponymy as a working tool

The study of place names has been an extremely valuable means of locating millstone quarries. The author that stated that the dictionary of toponymy of La Rioja is a 'huge silent quarry waiting to be exploited' (González Blanco 1987, 35) was right. The name '*Molares'*, deriving from

Municipality	Valley	Production centre	Rock	Millstone Atlas
Aguilar	Alhama	Contre. Leucade	Limestone	530
Almarza	Iregua	Tardiego	Conglomerate	222
Almarza	Iregua	P. San Agustin	Conglomerate	251
Arnedillo	Cidacos	Los Molares	Conglomerate	194
Grávalos	Linares	Los Molares	Micro – conglom.	203
Hornillos	Leza	Peña el Zorro	Conglomerate	363
Igea	Linares	Los Molares	Micro- conglom.	200
Islallana	Iregua	Las Planas	River boulder	346
Jubera	Jubera	La Valleja	Micro – conglom.	192
Jubera	Jubera	Peña Tejero	Conglomerate	198
Luezas	Leza	Los Molares	Conglomerate	212
Muro de Aguas	Linares	La Lobera	Conglomerate	204
Matute	Río Najerilla	Crispanas	River boulder	545
Robres Castillo	Jubera	Los Molares	Conglomerate	195
Robres Castillo	Jubera	La Viñaza	Conglomerate	199

Figure 3. Production centres in the Autonomy of La Rioja.

the latin *mola* (millstone), according *El Diccionario de la toponímia actual de La Rioja* is indicative of millstone extraction (1849, T. 13, 529). This was rapidly confirmed for the case of the quarry of Robres del Castillo in La Rioja cited by the 19th century geographer Pascual Madoz.

We therefore took the term '*Molares*' and surveyed all the towns that still retained this name. The results were positive in five valleys of La Rioja: Linares, Cidacos, Iregua, Leza, and Jubera. Furthermore, subsequent surveys conducted in the Province of Soria of the Autonomy of Castilla y Léon proved that the name '*La Cuerda*', related to certain types of geological formations that coincided with millstone extraction, shared the stage with '*Molares*'.

3.2. Millstone production in La Rioja

La Rioja is the most intensively studied area in northern Spain due to its small size (5045 km^2). The millstone production centres identified are located in Fig. 3.

Specific information concerning each site (pictures, geographical co-ordinates and bibliography) can be consulted in the online database of the European Millstone Atlas.

3.3. Millstone production in the Province of Soria (Castilla *y León)*

In the province of Soria, we have identified 25 millstone production centres. In the region of Pinares and in the mountain ranges of Madero, the Almuerzo and Carcaña conglomerates were exploited, while limestone outcrops were exploited in the municipality of Fuentelárbol (Fig. 4).

The site of Fuenteárbol is particularly interesting. In this town, located about 45 km from Soria, there is a very curious feature directly related to the millstone quarry. It is an alignment of about 225 millstones (Fig. 5) placed by the residents as a type of tribute to the authorities on the outskirts of the town. Oral tradition states that the young people who married and decided to stay in the town had the right to exploit a parcel of the quarry on the condition that the first millstone they produced would be placed in the alignment.

4. Production of rotary querns in antiquity

4.1. The Sistema Ibérico mountain area during antiquity

During Antiquity, this area formed part of *Hispania Citerior*. To the north passed the *Via* 1, '*De Italia in Hispanias*' and to the south passed *Via* 27, *Item ab Astúrica per Cantabria Caesaraugusta* of the Itinerary of Antoninus (Roldán Hervás 1973. 35-36). The enclaves of *Graccurris* (Alfaro), *Calagurris* (Calahorra), *Vareia* (Varea- Logroño), *Tritium Magallum* (Tricio) and *Libia* (Herramélluri) were located along Via 1 while to the south, along the Via 27, were the sites of *Turiasone* (Tarazona), *Augustóbrig*a (Muro de Agreda) and *Numantia* (Garray). These political, cultural, and commercial centres favoured the construction of many smaller settlements (*villae*) in their rural orbits.

The demographic vitality of this region is reflected in

Municipality	Valley	Production centre	Rock	Millstone Atlas
Calderuela	Almuerzo	La Hoya	Conglomerate	284
Canos	Almuerzo	La Cuerda	Conglomerate	304
Canos	Almuerzo	La Cuerda	Conglomerate	306
Canrredondo	Carcaña	Cuerda Larga	Conglomerate	431
Canrredondo	Carcaña	El Carrascal	Conglomerate	259
Cortos	Almuerzo	El Monte	Conglomerate	297
Cortos	Almuerzo	La Soledad	Conglomerate	295
El Espino	Madero	Las Peñas	Conglomerate	254
Fuentelárbol	C. Villa y Tierra	Pueblo	Limestone	196
Fuentelárbol	C. Villa y Tierra	Las Canteras	Limestone	207
Matalebreras	Madero	Pizarrales	Conglomerate	534
Muro de Ágreda	Madero	Cumbres	Conglomerate	310
Muro de Ágreda	Madero	Monte Oncillos	Conglomerate	312
Muro de Ágreda	Madero	Cº de Ágreda	Conglomerate	313
San Felices	Madero	Los Molares	Conglomerate	248
Trébago	Madero	Cerro Balcones	Conglomerate	260
Trébago	Madero	Peña el Mirón	Conglomerate	253
Valdelagua	Madero	El Sardón	Conglomerate	321
Valdegeña	Madero	Las Matas	Conglomerate	294
Villar de Campo	Madero	Castellanos	Conglomerate	257
Villar de Campo	Madero	Los Molares	Conglomerate	255
Vinuesa	C. Pinares	Las Majadillas	Conglomerate	460
Vinuesa	C. Pinares	La Muedra	Conglomerate	462
Vilviestre Nabos	Carcaña	El Rebollo	Conglomerate	448

Figure 5. Table of production centres in the Autonomy of Castilla y León.

Figure 5. Alignement of 225 millstones in Fuentelárbol.

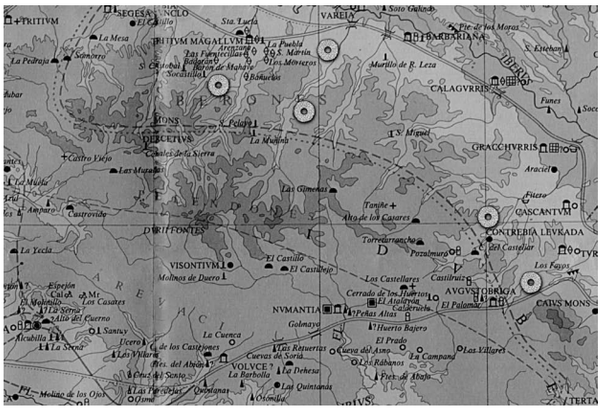

Figure 6. Centres of production of rotary querns (Hoja K-30, TIR).

the high number of sites, as seen in the figure reflecting the *Tabula Imperii Romanii* (Fig. 6). The archaeological record of millstones is, nevertheless, not proportional to the number of settlements, probably due to the logistical difficulties caused by the transport and storage of millstones recoverd on excavations. As for the origin of the millstones, the finds in this area point to local exploitations using two production techniques: the collection of surface boulders and the use of outcrops in true extractive quarries. We have not, at least for the moment, identified long-distance imports, for example, of volcanic rocks.

4.2. Manufacture of rotary querns from small boulders

Our understanding of the process of knapping rotary querns from small boulders is based on six unfinished rotary querns discovered at the Roman *villa* of Crispano (La Rioja). This first stage of the process is the collection of boulders in river beds or on alluvial terraces (Fig. 7). The stones present a size of about 40 cm in diameter. The average thickness is 30 cm for lower stones (*meta*) and 15 cm for upper stones (*catillus*). The manufacture of the lower stone begins with the choice of the boulder, which

Figure 7. Small surface boulder selected for a lower stone (meta).

Figure 8. Roughly knapped small surface boulder (meta).

Figure 9. Lower stone roughout (small surface boulder).

is then roughly carved into a cylindrical shape similar to those found in quarries (Fig. 8). The next step consists of pecking a small hole in the centre (Fig. 9.), which will serve to trace the circumference with the compass (Fig. 10.) for the subsequent carving. The carving of the upper stone also begins by roughly rounding the stone and ends with careful perforation of the eye. To avoid breaking, the eye was carved from both sides (Figs. 11-12).

Figure 10. Lower stone in an advanced state of carving (small surface boulder).

Figure 11. Unfinished upper stone knapped from a surface boulder.

4.3. Production of rotary querns in quarries

The finds of several unfinished rotary querns confirm their production in quarries. In the quarry of Tardiego (La Rioja), we have located several unfinished querns among the rubble of more recent exploitations. In Muro de Agreda (Soria), presumably the Roman city of *Augustóbriga*, we find the same situation although the querns are now stored in private homes.

In Valdegeña (Soria) a wide variety of finished and unfinished rotary querns (Figs. 13-14), probably collected from the Roman settlement of 'Los Villares', decorate the patios and façades of houses. Their cylindrical shape - without rounded edges - suggest they derive from a nearby extractive quarry and not from riverbed surface boulders like the querns found near the Roman villa at Crispano.

Archaeological excavations at the site of Contrebia, Leukade (La Rioja) uncovered holes carved into the bedrock that were interpreted as supports to brace large storage vessels (Hernández Vera 2007, 54). This hypothesis should be reviewed because these extractions appear actually to be negatives of quern extractions (Fig. 15).

Figure 12. Unfinished upper stone knapped from a surface boulder.

Figure 13. Cylinder from the Roman settlement of "Los Villares".

5. Production of millstones in the Sistema Ibérico mountains

5.1. The transition to the Medieval and Modern periods

The Roman cities and *mansios* distributed at the foot of the *Sistema Ibérico* mountain range faced invasion and destruction in the 5th century AD. The Suebis, Vandals and Alans tribes razed everything in their way. In the 10th century, there was once again conflict during the Muslim domination. The winds of war probably affected the development of the millstone industry and prolonged the use of the rotary quern. The first reports of hydraulic mills in La Rioja appear in monastic documents towards the middle of the 10th century. It is nonetheless in the 11th century that there is multiplication in the number of documents of purchases, sales, and donations to monasteries. By the 16th century, the stones that outfit the mills of Castile, Navarra, and Aragon can be counted by the hundreds.

Figure 14. Unfinished lower stones from the Roman settlement of "Los Villares".

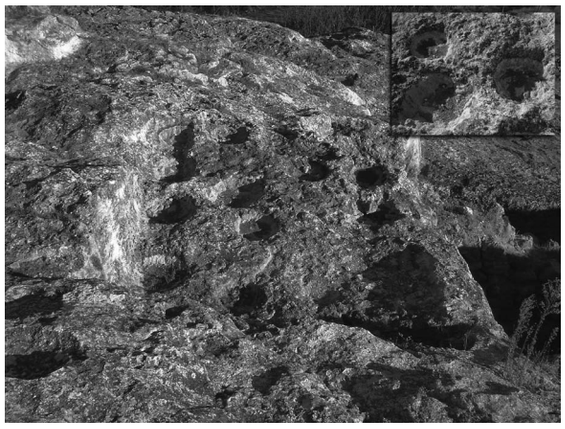

Figure 15. Circular extractions carved into the bedrock. Contrebia Leucade (La Rioja).

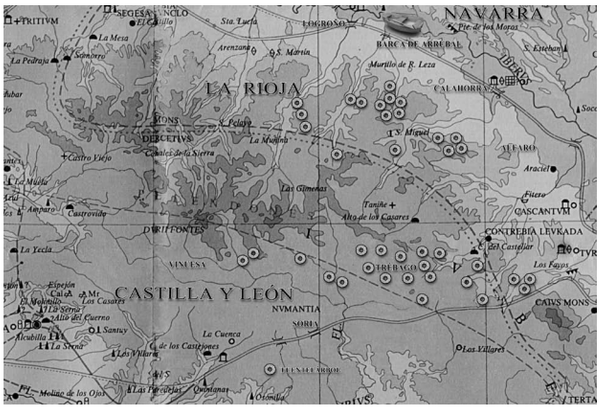

Figure 16. Medieval and modern millstone production centres.

5.2. Millstone production in the Modern period

Medieval and modern quarries in the north of the peninsula produced stones basically for both flour mills, with diameters ranging from 0.80 to 1.80 m, and oil rollers, on the average 1.00 m in diameter and 0.40 m thick (Fig. 16). There was to a lesser extent demand for stones for other

Figure 17. Trenching.

Figure 18. Extraction.

Figure 19. Circular negative.

Figure 20. Carving surface A.

Figure 21. Carving surface B.

Figure 22. Cutting of the eye.

industries, such as pulp mills (which began to decline in Spain around the 16th century).

The production centres of Igea, Grávalos, and Villarroya in La Rioja, with their millstones measuring 0.90 m in diameter and 0.10 m thick, were an exception. The extraction techniques also differed in this area. Blocks were extracted from the outcrop, roughly knapped into shape with a sledgehammer, and finally finished with hammer and chisel. The modest diameter and thickness of some millstones point to their use as sharpening stones and the tendency toward an oval shape of other millstones reveals their possible use in either the oil or the wine industry (Pascual and Arrastia 1980, 199-210).

The permanent abandonment of these exploitations probably began in the second half of the 19th century with the arrival of the railroad. This new means of transport most

likely introduced higher quality millstones from further away and eclipsed the traditional means of transport from the local traditional quarries. This explains the high number of abandoned millstones in the quarries that illustrate the different stages of production and constitute such a rich heritage (Figs. 17-22) that could be exploited for tourism.

6. Quarries and municipal boundaries

Through the study of the distribution of millstone production sites, we have observed some coincidences that are noteworthy. Although the quarries of Villarroya, Grávalos, and Igea are all located in an area called '*Los Molares*', they are separated by municipality boundaries. We find the same demarcations in the valley of Jubera. The site of Robres del Castillo was the main producer of millstones in the region. Its industrial border ends where the exploitations of Jubera and San Vicente de Robres begin. Furthermore, in the valley of Iregua, the quarries of Almarza de Cameros and Torrecilla en Cameros are cut by a line that distinguishes two jurisdictions.

This peculiar phenomenon is also found in the province of Soria (Castilla y León). At the foot of the Madero mountains, there are several villages with a long millstone extraction tradition, notably, Trébago, Matalebreras, Fuentestrún, Valdegaña, and Villar Field Valdelagua, whose jurisdictional limits scrupulously separate millstone production centres.

The curious concordance of industrial and municipal boundaries has also been detected in France, south of Grenoble, where the number of quarries on Mount Sénépy matches the number of towns (Belmont 2006, 82). An agreement reached in the 18th century between the councils of the municipalities of Valle Redondo, Brañosera, Celada of Roblecedo, Salcedillo, and Herreruela might bring light to this subject (Basterra 2003, 149-268).

This legislation was intended to control the quality and quantity of millstone production to avoid deterioration of the market, and also to maintain a balance of benefits and avoid potential conflicts between producers. The sizes of the millstones were perfectly regulated. In addition, the legislation included penalties that could be as high as 300 *reales* for fraudulent millstones. This sum represented a fortune at the time.

7. Commercial routes

Trade routes played an essential role in the millstone industry. An excellent example comes from the commendable work of the ethnographer Inés Sainz Azuelo on the well-preserved archives of the municipality of Mendavia (Navarra). According to accounts between 1690 and 1805, the municipality purchased 19 millstones from eight different production centres. Until the middle of the 18th century, the mill of Mendavia purchased its stones from the La Rioja quarries (Robres del Castillo, San Vicente de Robres and Jubera), located about 35 km away. However, in the second half of the century, the quarries of La Rioja are overshadowed by the quarry of Trébago (Soria), located 80 km away.

Between 1764 and 1783, the authorities of Mendavia ordered two millstones from Estella (Atlas, entry 323) and made small purchases from the quarries of Arbaitza (Atlas entry 345), but in the 19th century, the only known supplier of millstones was in the area of the Condado de Treviño.

The commercial dynamism observed in Mendavia is also seen elsewhere in the north of the peninsula. Toward the middle of the 19th century, Pascual Madoz states that 'the Condado de Treviño is famous for its stone quarries located in the villages of Arana, Dórdoniz, Armentera, Pedruzo. and Torre, from which are hewn millstones exported to the regions of Aragón, Vizcaya and Burgos' (Madoz 1849,T. 15, 153-154; Atlas entries 236, 237, 242, 359, 356, 361, 408 and 409).

In his study of the production centres of the mountains of Palencia, Basterra Adán states that the Palencia productions rivalled those of La Rioja, Segovia, and Navarra, while the quarries of the Gorbea mountains sold their millstones to millers of Alava and surrounding areas of Vizcaya, Burgos, and La Rioja (Iturrate 2001, 129).

These documents present us with an image of the last few centuries of the commercial map of millstones in northern Spain. An impoverished network of roads nonetheless hindered this commerce. Larruga describes it as follows: 'Another very serious calamity is the pitiful state of the roads of La Rioja, suffice to say that from November to May cannot travel without serious dangers and delays, and that even in Summer very few coaches transit through the country road. This is a county you can only reach by air!' (Madrazo 1984, 260).

Nevertheless, commercial necessity by far surpassed the inconveniences. An example is the transport of a millstone measuring two *varas* (approximately 167 cm) by Santiago Garcia in 1766 between Trébago in the Sierra del Madero and Mendavia (Navarra). The first obstacle was crossing the Iberian mountains with passes exceeding 1000 m. Then his team of oxen had to cross the La Rioja territory to reach the right bank of the Ebro River. From the edge of the La Rioja region, with sights into Navarra, the quarryman had to make one last effort to load oxen, cart, millstone into a ferry at Arrúbal (cf. Fig 16.) and cross the river with the strongest-flow current in Spain before arriving a few miles later at the mill Mendavia.

We assume that Santiago García would remember the

details of this extraordinary adventure again and again while returning to Trébago. The return was more bearable given that the commercial transaction of an upper stone was worth nothing less than the price of 704 *reales* paid by the authorities of Mendavia, a large sum at the time.

8. Conclusions

In this article, we have attempted to summarise our research on millstone-producing centres in northern Spain. For the moment, our research has only been published in local reviews and in specialised journals. When we started our research in 2000, not a single line about millstone quarries in La Rioja had been written since the work of Pascual Madoz in 1850. However, much work remains to be undertaken to understand the scale of this specific industrial world. We conclude with two final reflections.

There is a need to focus research on the earlyquern and millstone production sites dating to Protohistory and to Roman times. This would help correct the imbalance between the finds from settlements and from quarries, given that every residence counted one or two rotary querns among their possessions.

Trade routes also offer an interesting field of study if we are able to analyse them beyond simply the geographical distance separating the production centres from the settlements where the millstones were used. For example, the transport of commercial goods between Castilla and Navarra required crossing the Ebro River. This condition certainly did not escape the insatiable royal and noble tax collectors. The merchants and carriers had no choice but to increase the price of their products to offset the cost of taxes and tolls at bridges and barges.

Finally, an enormous amount of information remains to be recovered in archives and in field surveys to assists us to piece together the daily life of the past and to bring the reader closer to this aspect of molinology.

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