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The Iron Age Iberian Experimental Pottery Kiln of Verdú, Catalonia, Spain

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The goal of this project is to reconstruct the operational sequence of manufacture of Iberian Iron Age pottery, from clay procurement to firing in a reconstructed kiln. Although pottery is the most characteristic artefact recovered on Iberian Iron Age excavations, most of its complex processes and production techniques remain poorly known. The first phase of this

experiment began in 2007 with the construction of a scaled replica of the Iron Age Iberian kiln brought to light at the excavation of Alcalá de Júcar (Province of Albacete). This reconstruction employed materials and techniques identified on the archaeological dig, as well as ethnographic parallels. Some parallels were drawn from the Catalonian town of Verdú, the location of the experiment. This town has an uninterrupted 500 year tradition of ceramic production. The kiln comprised two chambers separated by a grate. Four sensors installed in the kiln recorded a maximum temperature of 600° C. This temperature is probably due to the fact that the kiln was empty during its initial firing. Replicas of Iberian Culture vessels thrown by potters from Verdú were fired in a second experiment. This revealed information regarding the general firing process of vertical updraught kilns in all its complexity, as well as the techniques of temperature control and oxidation and reduction processes, subjects to be examined in future research.

> With the completion of the pottery kiln, the Verdú experiment is now in its most interesting phase. Besides the firing of more than a hundred replicas of Iberian Culture vessels, the experiment has brought to light data on how ancient kilns were loaded and arranged.

Location

This project took place in the town of Verdú in the Municipality of Urgell (Province of Lleida) in southeastern Catalonia, Spain (See Figure 1). Verdú is celebrated for its long tradition of pottery production, in particular its blackware, as seen by its s*ellons* and *càntirs,* typical vessels designed to contain water*.* In general, dark-coloured reduction pottery had a great impact in continental Europe during medieval times.This tradition was so ingrained in Catalonia that it persisted on a large scale until the 17th and 18th centuries.

Today the tradition is perpetuated in the workshops of the towns of Verdú and La Bisbal (Padilla 1984, 99). Among the traditional techniques in Verdú is the *moruno* kiln, a termrevealing a Moorish origin introduced in the 12th century but rooted further back in Iberian Culture and Roman vertical updraught, direct firing, kilns. It was in fact the Moors who introduced modifications and improvements, as noted in the research on pottery and tile kilns byEmili Sempere (1992, 187-237).

The earliest ceramic kilns in Verdú were erected along the ramparts of the town.Two date respectively to themid-13th and mid-14th centuries (Riu 1990, 112).One was built against the interior of the wall on the *Cal Salisi* Street. According to historical archives, this kiln was no longer active in 1549 (Albareda 1984, 9).In the 15th century, the kilns were relocated outside the ramparts to the *Raval* quarter and along the following streets: *Carrer Nou*, *Carrer Margorell* and *Carrer Aurora*. The *Carrer Aurora* was later also referred to as the *Carrer dels Cantirers* (street of the pitcher makers) (Boleda 1994, 117-122; Farré 1998, 118).Population expansionand the risk of fire gradually forced the kilns to be removed from the populated

areas, as seen in the cadastre of 1716 that shows them concentrated along *Sant Miquel* Street (Farré 1998, 118).

Throughout the 19th century, the roughly 30 Verdú workshops produced more than a million and a half vessels a year (*Mostra de Terrissa Catalana Popular*, 1991).The typical *terra fumada*(smoked earth blackware) technique was introduced in the second half of the 15th century by Antoni Guasch from Selva del Camp, a town in the nearby Province of Tarragona (Boleda 1994, 119).TheVerdú ceramic tradition, however, predates the arrival of this technique, as seen by the kiln from the 13th century (Riu 1990, 112).

Verdú's rich pottery tradition, still firmly entrenched today, renders it an ideal location to undertake experimental archaeology. Since no member of the experimental team is a professional potter, the project relied on the skills and experience of the following local craftsmen: Enric Orobitg, Magí Sambola, Francesc Sambola, Josep Maria Turull, and Josep Font.

Objectives

The goal of this experimentation is to identify the different phases of pottery production in the Iron Age Iberian Culture.A kiln similar to those used by ancient Iberian potters was erected, based on the large Iberian updraught kiln discovered at the archaeological site of La Casa Grande in Alcalá de Júcar (Albacete). This replica enabled the team to analyse a number of technical aspects and appreciate the complexity of the different kiln features: the stokehole (*praefurnium*), the combustion and firing chambers, the grate and its flues, as well as the lateral door for loading and unloading the vessels.

The reconstruction of the lower features of the kiln was based onarchaeological data (See Figure 2). Since the superstructure of these kilns is never conserved on archaeological sites, the reconstructing the upper part was much more complex and the result of speculation that is discussed later in this paper.The work also led to handling materials identified during the Alcalá de Júcar excavation, notably adobe and straw and the identification of the different stages of clay preparation and drying. A second objective of the experiment was to study the internal spatial arrangement of an Iberian kiln.Loading and unloading of vessels of different sizes in the chamber was not a simple task. The way the unfired vessels were arranged required the use of supports of varying shape and played a significant role in reducing vessel shrinkage during firing.The loading and unloading of the pottery, requiring the potter to penetrate through a lateral door, also conditioned the rate of work.These different operationswere very intricate and provided valuable insight into the operational sequence.

A third important step was igniting the kiln and the long firing, a process that offered information on how to control and maintain the temperature, as well as essential data on firing vessels of different sizes and the processes of reduction and oxidation atmospheres,

essential determinants of the style of Iberian Iron Age pottery and the subject of future research.

Other pottery related projects

Several members of the experimental team had some previous experience in Iberian Culture archaeology and pottery experimentation or had excavated at the Ilergetes fortified settlement (3rdc. BC) at Estinclells in the Municipality of Verdú (conducted by the Centre d'Estudis Lacetans, Iber Món Rocs SL and the Museu Comarcal de l'Urgell), a site where a large number of pot shards were brought to light.In fact, the plan to develop an experimental camp (CEP) in the field adjacent to the excavation was initiated in 2009 (See Figure 3). The objective of the future camp was to focus on the main currents of Protohistoric archaeology by conducting experiments in ancient construction, agriculture, processing of products (especially for the obtention of olive oil and wine), livestock, and ceramic production.

With respect to replicating pottery, the project also included the experience acquired from an experimental kiln erected at the excavation of La Casa Grande, Alcalá de Júcar (Albacete),as well as evidence from the ongoing work at Hortes de Cal Pons (Alt Penedès, Province of Barcelona), a site with six pottery kilns excavated by members of the experimental team. These kilns (See Figure 4), with circular firing chambers above elliptical combustion chambers, were specifically for producing *amphorae*.

Throughout 2012 and 2013,replicas of two kilns from Hortes de Cal Pons were built at the CEP experimental centre with financial assistance from the Caixa, RecerCaixa 2011.At the same time, the team was also involved in the re-excavation of an Iberian Culture kiln at Valls del Foix/els Casalots (Torrelles de Foix, Alt Penedès Province of Barcelona) (See Figure 5).

The Iberian Iron Age kiln of La Casa Grande (Alcalá del Júcar, Albacete)

The excavation of the 3rd century BC site at Alcalá del Júcar (Albacete) by S. Broncano and J. Coll (1988) brought to light the best preserved pottery kiln of the Iberian Culture to date and marked the beginning of extensive research on Iron Age kilns in the Iberian Peninsula.The fieldwork report (1987) not only provided the basic data related to building an experimental kiln, butestablished atypology of Iberian Culture kilns – a typology that remains valid today.

The classification by Broncano and Coll (See Figure 6), following the work of Duhamel (1978-79), is based on the layout of the combustion chambers, the section of the grate and the shape of the adobe bricks.The work served to establish parallels with other circular kilns in the Iberian Peninsula, notably the B6 subtype found at the following sites: Cerro de los Infantes (Pinos Puente, Granada) (Contreras et al. 1983), Cerro Macareno (La Rinconada, Seville) (Chasco and Oliva 1979), and Pajar de Artillo. (Santiponce, Seville) (Luzón 1973).

The Alcalá de Júcar excavation report also provided the dimensions of the kiln, as well as evidence of the building materials, such as the adobe bricks for walls and clay and straw for the lining.Italso yielded details regarding the combustion chamber, the *praefurnium* or stokehole, the central pillar supporting the grate, the firing chamber and the door that served to load and unload the vessels. It also provided hypothetical data on the type of superstructure based on an engineering report.The superstructure of the kiln, however, is the only feature that cannot be gleaned from the archaeological record.

TYPE I CLASSIFICATION

Kiln number	1/3
Shape	Circular or oval of type B6 (Broncano-Coll 1988)
Door orientation	20º East

Dimensions: Kiln 1		
Praefurnium	Interior length	**0.40 m**
	Interior width	**0.73 m**
Combustion chamber (fuel chamber)	Interior diameter	**2.50 m**
	Height	**1.00 m**
	Exterior diameter	**3.50 m**
	Length (including praef.) interior	**3.00 m**
Grate	Thickness	**0.23 m**
	Number of flues	**53**
Firing chamber (firing vessels)	Interior diameter	**2.85 m**
	Conserved height	**0.60 m**
Total dimensions	Length	**3.50 m**
	Width	**3.50 m**
Thickness of the combustion chamber walls		**0.50 m**
Thickness of the firing chamber walls		**0.36 m**
Wall lining of the firing chamber		**0.03 m**
Central pillar	Interior length	**0.60 m**
	Interior width	**0.70 m**
Dimensions of the pillar bricks	Length	**0.30 m**
	Width	**0.17 m**
	Height	**0.09 m**
Fuel loading door	Height	**approx. 1.10 m**
Combustion chamber door (for vessels)	Position relative to the *praefurnium*	**43º W**

	Length	0.72 m
	Thickness / depth	0.35 m
	Height	0.10 m

One of the intentions of this paper is therefore to address the question of the nature and shape of the upper firing chamber (either cylindrical or domed) of Iberian Culture kilns, an element that is always missing on archaeological excavations. We will also advance an alternative hypothesis to that formulated by the engineer J. L. A. Gastaldi regarding the Alcalá de Júcar kiln (Broncano and Coll 1988, 227).Thekiln's superstructure, according to Gastaldi, based on itsconstruction materials, with a firing chamber perimeter wall measuring 0.7 m thick and 0.36 m high (max.), a door 0.7 m wide, and an inner diameter of 2.85 m, could have vertical walls (90°) resulting in a cylindrical shape (See Figure 7). A domed superstructure is not possible, according to Gastaldi, unless the walls were inclined at angles of 51° permitting a tensile force (Broncano and Coll 1988, 227). Gastaldi goes on to postulate that a domed superstructure was not possible at Alcalá de Júcar due to the type of building materials and the absence of buttresses or clamps. Later in this paper we will present an alternative to this hypothesis.

Construction of the experimental kiln (2007-2013)

The experimental kiln was built in the workshop of Enric Orobitg situated along the road connecting Verdú to Mas de Bondia and the Xercavins River (UTM X 345316.19 / Y 460847.68 or Lat. 41 º 36 '44.12'' N / Long. 1 º 8' 36.91 ' 'E). Orobitg, an experienced potter, was not new to experimentation. He had previously replicated a traditional, Moorish-style, kiln beside his workshop. His ultimate intention is to establish an educational workshop for students, and someday develop a theme park for pottery experimentation.

Combustion chamber

The building of the experimental kiln began in 2007. The first step was to dig a circular pit (3.5 m in diameter and 1.8 m deep) with a backhoe, following the model of the Alcalá de Júcar kiln.The lower combustion chamber was therefore below ground level and had a slightly inclined base, following the surface of the bedrock, and was oriented toward the West, protected from the local dominant winds.A ramp was builtto access the chamber. This was followed by building the kiln's perimeter wall with 236 bricks measuring 48 x 24 x 9 cm distributed in ten rows of 17 bricks each and two rows of 33 bricks (See Figure 8).

The lining or plastering of the combustion chamber began along the base of the chamber, in the case of the original feature, at the bedrock. The first five rows of the wall of the combustion chamber were staggered; the larger bricks following the “stretcher” technique and bonded with the same clay used to make the bricks. From the sixth row upwards, the

bricks began protruding slightly inward, in the fashion of a corbel arch dome (false dome). From the tenth row, the bricks were placed following the "header" technique.

Central pillar

The central pillar supporting the grate was erected with 176 adobe bricks measuring 30 x 15 x 9 cm. The bricks were distributed in eight rows comprising 22 bricks following the size of those of the kiln at Alcalá de Júcar. They were staggered in the "stretcher" orientation; the same pattern as the outer wall. The outer wall bricks, however, began to corbel from the third row upwards (See Figure 9), following the curvature of that of the original Iberian Alcalá de Júcar kiln.

The bricks of the central pillar supporting the grate were made with clay from the tile factory “Excavaciones Vilalta SL Turguet” in Arbeca. They were sifted through a mesh of 1 cm and then mixed with water in a decantation basin in the workshop of Enric Orobitg. After adding straw (proportion circa 20-25%), they were packed into wooden brick moulds. Once dry, they were fired and tested for resistance at high temperatures in a Pujol industrial kiln. Two models (48 x 24 x 9 cm and 30 x 15 x 9 cm) were first subjected to temperatures between 30º and 120º C to remove the hygroscopic water before gradually raising the temperature to 450° C to eliminate structural water (process of dehydration or dehydroxylation). Subsequently, they were fired at 1060° C. The result was positive as the three samples resisted the high temperatures without cracking.

Grate and flues

The most complex aspect of the reconstruction of the kiln was fashioning the flues of the grate. According to the excavators of Alcalá de Júcar, the original kiln had 53 (See Figure 10). Those along the centre and perimeter were modelled at the same time as the pillar, whereas the others were made upon completion of the grate. The process of the construction leads us to assume that all the flue holes were fashioned during the building process. This consisted of placing circular boughs 8 cm in diameter set diagonally in the gaps between the bricks of the false dome (cf. See Figure 9). In this manner their position coincided exactly with that of the original flues of the grate. In the final stage, the grate was smoothed from the top by filling the gaps with leftover adobe and clay. Before the clay dried, the boughs were removed by a slight twisting motion to prevent sticking which would complicate their removal (See Figure 11).

Firing chamber

The task of building the firing chamber was complicated by the heavy winter rains of 2008 and 2009 that caused it to collapse on two occasions. Finally, in September 2009, a shelter was installed above the kiln to protect it from the elements (Cardona *et al*. 2011, 417-423).

With the logistical problems solved, the team could focus on the complexities of the firing chamber. Up to this point, the reconstruction was based on well-conserved evidence gathered in the field. As noted, at this stage, the archaeological record did not provide sufficient data. For example, only a few centimetres of the elevation of the Alcalá de Júcar kiln was preserved. Broncano and Coll (1988) therefore resorted to an engineering report to establish their interpretation of the superstructure to establish that the firing chamber was cylindrical (not domed) and required 929 bricks measuring 30 x 15 x 9 cm (46 bricks per row x 20).

Nonetheless, many interpretations of firing chambers of ancient updraught kilns suggest domed roofs. These interpretations are based on data from either Roman or later periods when domed kilns were the norm. These arguments are not founded on either archaeological (where the firing chambers are rarely preserved) or architectural studies. Hence, the idea of a domed superstructure was not retained.

A second potential interpretation of the kiln superstructure is based on iconography, in particular from ancient Greece. Ancient engravings depict kilns of different sizes topped with helmet-shaped roofs interpreted as domes. The collection of archaic votive tablets from Penteskouphia in Corinth has 83 scenes of kilns and 16 other scenes related to ceramic production. In these cases the superstructures always appear dome-shaped. It could be argued that this is not sufficient empiric evidence to prove the existence of domed superstructures because the images are schematic and may well represent cone-shaped covers made up of tiles. In fact, we cannot be certain of the type of superstructure depicted in these images (See Figure 12).

A third type of evidence regarding kiln superstructure is obtained through ethnography. It is particularly valuable because it relies on the observation of kilns currently in use, for example, in the Ourika Valley in Morocco and other places in the Mediterranean, notably Verdú itself. Ethnography shows kilns equipped with both permanent and temporary covers. Those most often using temporary covers are associated with the firing of large vessels, whereas those with permanent covers are most often related to reduction kilns and/or kilns with doors. However, there is no single pattern that governs the type of superstructure of updraught kilns.

Based on these arguments, a study was commissioned to the architect Antoni Martí Falip to assess the feasibility of an upper firing chamber with a corbel arch brick superstructure (false dome) with adobe bricks equal in size to those of the Iberian Culture. The results of Martí Falip's report (Martí, 2011), contrary to the engineering report previously advanced by Broncano and Coll (1988) and based onthe criterion of the thickness of the wall of the Alcalá del Júcar kiln, has led us to envision the possibility that the firing chamber was capped by a corbeled false dome cover (See Figure 13).

The first step to erect this type of feature consisted of laying bricks vertically to a height of 0.7 m, respecting the maximum height observed at Alcalá de Júcar. From this level, equivalent to the fourth layer of bricks, the twenty rows of bricks were laid protruding slightly inward from 4 to 5 cm. This feature was capped by an opening or chimney 0.7 m high that either fully or partially covered it, serving to control the ventilation of the exhaust (See Figure 14).

The initial firing of the kiln (2012)

Before the initial firing (without pottery), and in order to ensure the general stability to the structure, in particular the grate, a lining was applied to the interior of the firing chamber by moistening the bricks and plastering with a thin layer of clay (See Figure 15). This was a difficult task, especially in the upper part of the chamber where the corbelling was more pronounced. Subsequently the small cracks provoked by the drying of this clay were sealed and smoothed over with a wet brush. This lining eventually cracked in some areas due to lack of moisture or because it was too thick.

Applying the finishing touches to the *praefurnium* by sealing the bricks of the upper rows of the corbel arch was completed prior to the firing. It must be noted that thelength of the *praefurnium* is hypothetical because it was not preserved in the original Iberian kiln.An average length, however, was established from otherexamples.Stairs were also shapedconnecting the working area with what the archaeologist interpreted as the door of the firing chamber were vessels where loaded and unloaded (See Figure 16).

In May 2012, the inspection of the lining of the firing chamber revealed numerous cracks and large segments which were at the point of falling off, especially in the upper corbelling in the centre.It is also of note thatthe clay lining wasbetter conserved in the zones where it was deliberately thinner.

To partially cover the 0.7 m opening or chimney of the firing chamber, long tiles were fashioned in the same moulds used to make the bricks for the walls of the kiln. To attain thinner bricks, the moulds were only packed halfway. After drying in the sun, they were fired in Enric Orobitg's conventional kiln. The firing failed, probably because the 900° C temperature was too intense for the low quality material. Given the need to pursue the experiment, the kiln was therefore covered with modern interlocking bricks measuring 90 x 25 x 4 cm. The choice of these modern bricks only adulterated slightly the spirit of the reconstruction, which otherwise used exclusively, material observed in ancient Iberian kilns.

Toward the middle of June 2012, the external cracks were sealed with sifted earth diluted in water. The chamber was partially backfilled with earth to assure stability to the structure and prevent damage from contraction and dilatation. This process required erecting another row of bricks above *praefurnium* to contain the earth. In addition, all the cracks of the upper firing chamber were sealed, the work area at the mouth was cleaned, and wooden stairs were

constructed leading to the door. In addition, a stone mortar bound wall was raised to each side of the door that served to contain the backfill.

The firing took place on July 12, 2012 (See Figure 17). The lateral door was sealed with small adobe bricks and a mixture of sifted earth and water. A technician from the SAF Company of Verdú installed four temperature sensors. The first, Sensor 0, inserted through the door and wall before it was backfilled, was placed at the level of the grate. Sensor 1 was set before building the wall on top of the side door. Sensors 2 and 3 were slipped through the chimney and placed at different heights. A datalogger collected information from the sensors at intervals of 30 seconds, 60 seconds and 5 minutes. Firing began at 9:00 o'clock. Small cracks in the walls and the side door, signalled by smoke, were sealed with a fine, red, diluted clay. After 18 hours, at 3:10 am, the cooling phase began by sealing the mouth of the kiln.

The kiln remained sealed until the 21st of July. The first photographs of its content were taken through its chimney. The grate had hardened considerably and the interior of the kiln appeared in good condition. Only some zones near the door needed slight repair. Pyrometric data from the sensors in the firing chamber indicated a peak temperature of 600° C (See Figure 18). No data, however, was collected in the lower chamber. In any case, the maximum temperature never exceeded 600° C, a fact attributed both to the large volume of the chambers and that it was fired without vessels. This phase of the experimentation, in fact, did not pretend to achieve more than a first consolidation of the grate and other delicate features, and assess the kiln's general resistance.

The fuel, estimated at about 1.5 tonnes, was Flanders pine bark. This was a pragmatic choice due to the absence of archaeological data. The excavators (J. Coll) of the Alcalá de Júcar kiln, for example, did not recover samples of ash or coal for analyses (Broncano and Coll 1988).

Replicating Iberian Culture pottery

After the successful firing of the kiln, the Sambola brothers of the Sambola workshop of Verdú were contracted to make over a hundred replicas of Iberian vessels (See Figure 19). The mandate specified that they should be thrown on a potter's wheel, and preferably be large so as to simplify the loading of the kiln. An essential element that conditioned the project was the cost of modelling the 160 replicas. Three institutions covered these expenses: the University of Lleida through the RecerCaixa bank group, the Grup de Reconstrucció Històrica IberCalafell (Group of Historical Reconstructions of IberCalafell) and the Ciutadella Ibérica de Calafell. It must be noted that the Sambola brothers embraced the challenge and modelled the replicas respecting the original thicknesses of the ceramic walls.

Given the complexity of the project, the potter Magi Sambola advised, prior to firing, to undertake a study of kiln capacity by means of the computer application *Google SketchUp 8* (See Figure 20). This analysis resulted in a scheme of how to arrange the vessels in the

chamber. The study also revealed that the chamber's capacity was larger than the number of vessels initially planned to be fired. Therefore, ten additional *gerres cerveseres* ("beer jugs") were made so as to guarantee a homogeneous positioning. Spaces and gaps were filled with small pots, as will be discussed later.

The following number and types of vessels are recommended for a kiln of these dimensions: 30 Iberian Culture *amphorae,* 20 *gerres cerveseres* ("beer" jugs), 30 *calathi,* 40 jugs with handles, 20 small pots or goblets, and 20 cups.

The Verdú potters used ordinary clay for the replicas because at this stage of the project it was not possible to contemplate processing clays collected from the surrounding area.

Reproducing the Iberian Culture ceramic clay

The final phase of the project, still to be undertaken, is to identify and reproduce the clays for the Iberian pottery replicas, by emulating the clays found at the Iberian Culture site of Hortes de Cal Pons (Alt Penedès, Barcelona). The first step of this future research will be to analyse samples from an archaeometric and petrographic standpoint. Three types of analyses are planned, starting with microscopic research to establish a preliminary clay characterisation from observations of the surface of the ceramic. SecondlyXRF analysis by means of X-ray florescence spectrometry will be undertaken to establishceramic reference groups. Finally XRD analysis by means of X-ray diffractionwill characterise the ceramic minerals to identify primary phases, phases of firing, and secondary phases related to its use.

Once the Iberian Culture ceramic is characterised, archaeometric analyses will be undertaken on clays sampled from nearby geological deposits. The clay must be malleable and reddish, and interbedded with ochre, grey gypsum and carbonates corresponding to the Keuper, Mesozoic layer. These future analyses will focus on whether Iberian potters procured their clay from local (or exogenous) deposits. These analyses will consist of firing pre-treated samples from nearby deposits for subsequent XRF and XRD analyses. Additional analyses are planned to determine the temperature of the firing chamber. Throughout these analyses one must consider the many alterations the ceramic paste has undergone from the moment of its extraction to its firing. It therefore may not be possible to establish parallels between the clays and the ancient pottery, either because the clays were extracted in pits beyond the local sphere or because they are, due to their age, too severely altered. For this reason the results of the procurement analyses will not be a prerequisite to pursue experimentation, but simply another element to take into consideration.

After the characterisation of clays and ceramic pastes, the project will proceed to model Iberian Culture pottery using the same clay as that from the Hortes de Cal Pons site. In addition, the experiment will attempt to reproduce the inclusions in the clay identified by the archaeometric analysis.

Once the replicas are made and fired in the experimental kiln, the project will enter into its last phase, which is to undertake a comparative archaeometric study of the original ceramic pastes sampled from the site of Hortes de Cal Pons with those fired in the experimental kiln.

Conclusions

With the completion of the pottery kiln, the Verdú experiment is now in its most interesting phase. Besides the firing of more than a hundred replicas of Iberian Culture vessels, the experiment has brought to light data on how ancient kilns were loaded and arranged. Furthermore, the fashioning of the ceramic replicas, a major challenge to the Verdú potters, was thoroughly documented for comparison with the archaeological evidence.

What is certain is that some technological details regarding Iberian Culture ceramic production can be answered by firing modern replicas in an experimental kiln. The economic investment and time devoted to loading a kiln of this size reflects a large investment of labour by the ancient potters. The experimentation also explains the use of spacers to arrange the vessels of complicated forms such as *amphorae*. Experimentation is proving that it was equally difficult to erect a kiln that could guarantee a successful firing. It must however be noted, that once fully loaded and ignited, no potter could control all the processes occurring inside the kiln. In fact, a tradition of the potters of the town of Quart (Province of Girona), before igniting their kilns, was to make the sign of the cross, and utter *Que déu hi faci més que nosaltres*(That God do more than us). With the assistance of the Verdú potters and data collected from the archaeological record, the Verdú experimental kiln now enters its definitive phase. As a precaution, a few apotropaic phrases have been prepared to be uttered before the next experimental firing.

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Gallery Image

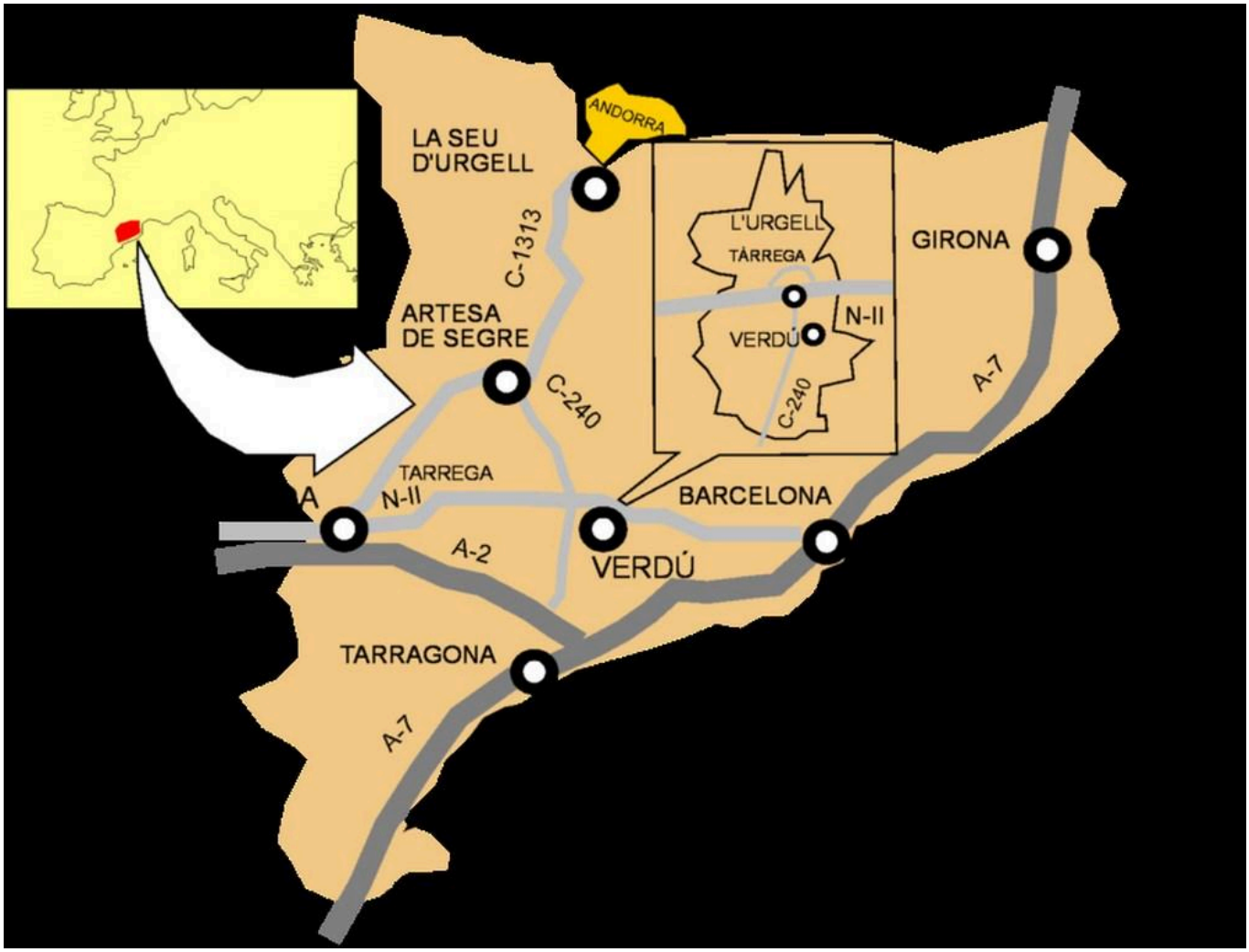

FIG 1. LOCATION OF THE TOWN OF VERDÚ (CATALONIA), THE SETTING OF THE EXPERIMENTAL KILN.

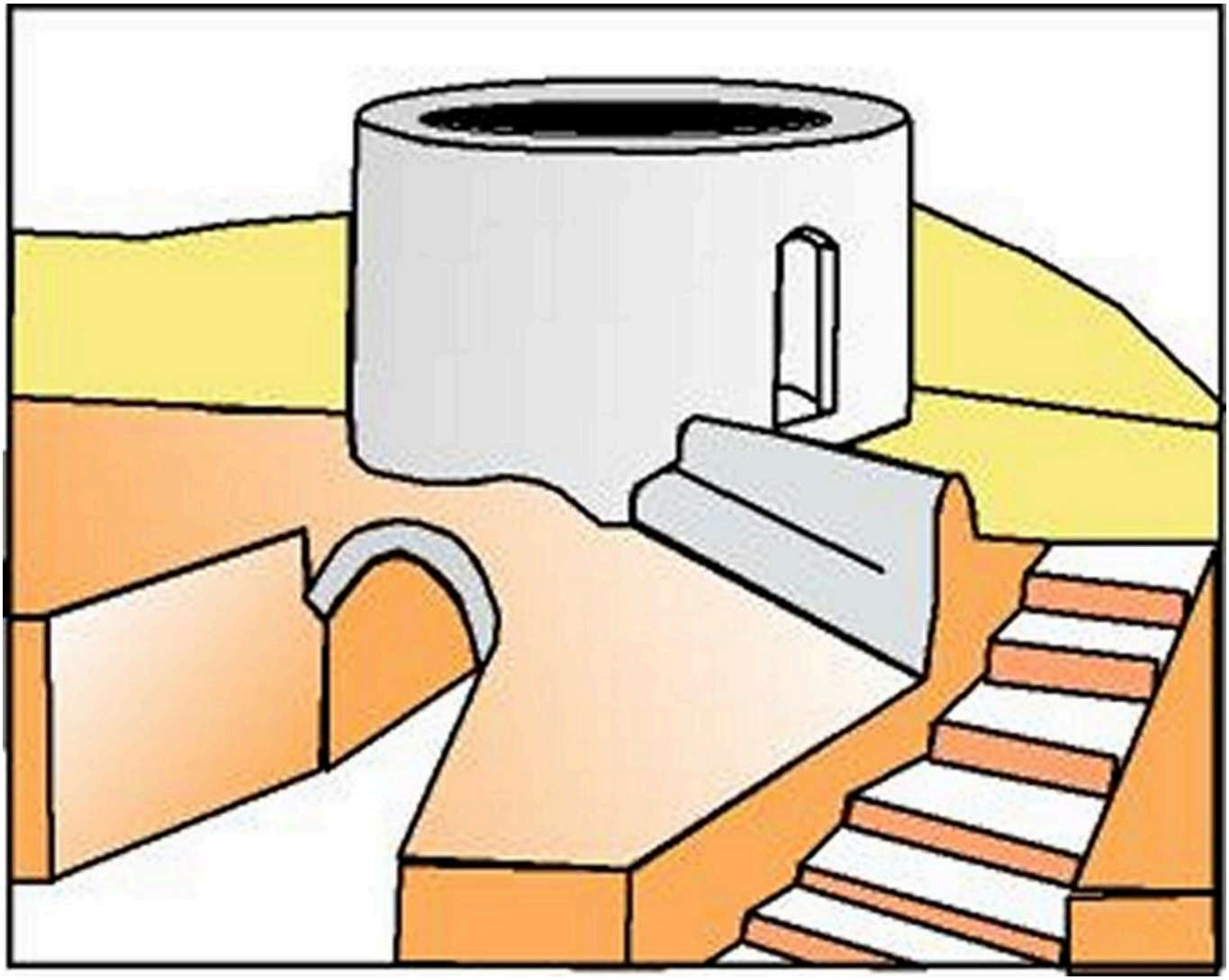

FIG 2. GRAPHIC RECONSTRUCTION OF THE IBERIAN CULTURE POTTERY KILN OF ALCALÁ DE JÚCAR. THE SHAPE OF THIS KILN IS INTERPRETED AS CYLINDRICAL.

FIG 3. VIEW OF THE IBERIAN CULTURE SETTLEMENT OF ESTINCLELLS (VERDÚ, L'URGELL). THE INSTALLATIONS OF THE PROTOHISTORIC EXPERIMENTAL CAMP ARE IN THE FOREGROUND.

FIG 4. VIEW OF THE IBERIAN CULTURE POTTERY KILNS AT THE SITE OF HORTES DE CAL PONS (PONTONS, ALT PENEDÈS).

FIG 5. IBERIAN CULTURE KILN AT THE SITE OF VALLS DEL FOIX/ELS CASALOTS (TORRELLES DE FOIX, ALT PENEDÈS).

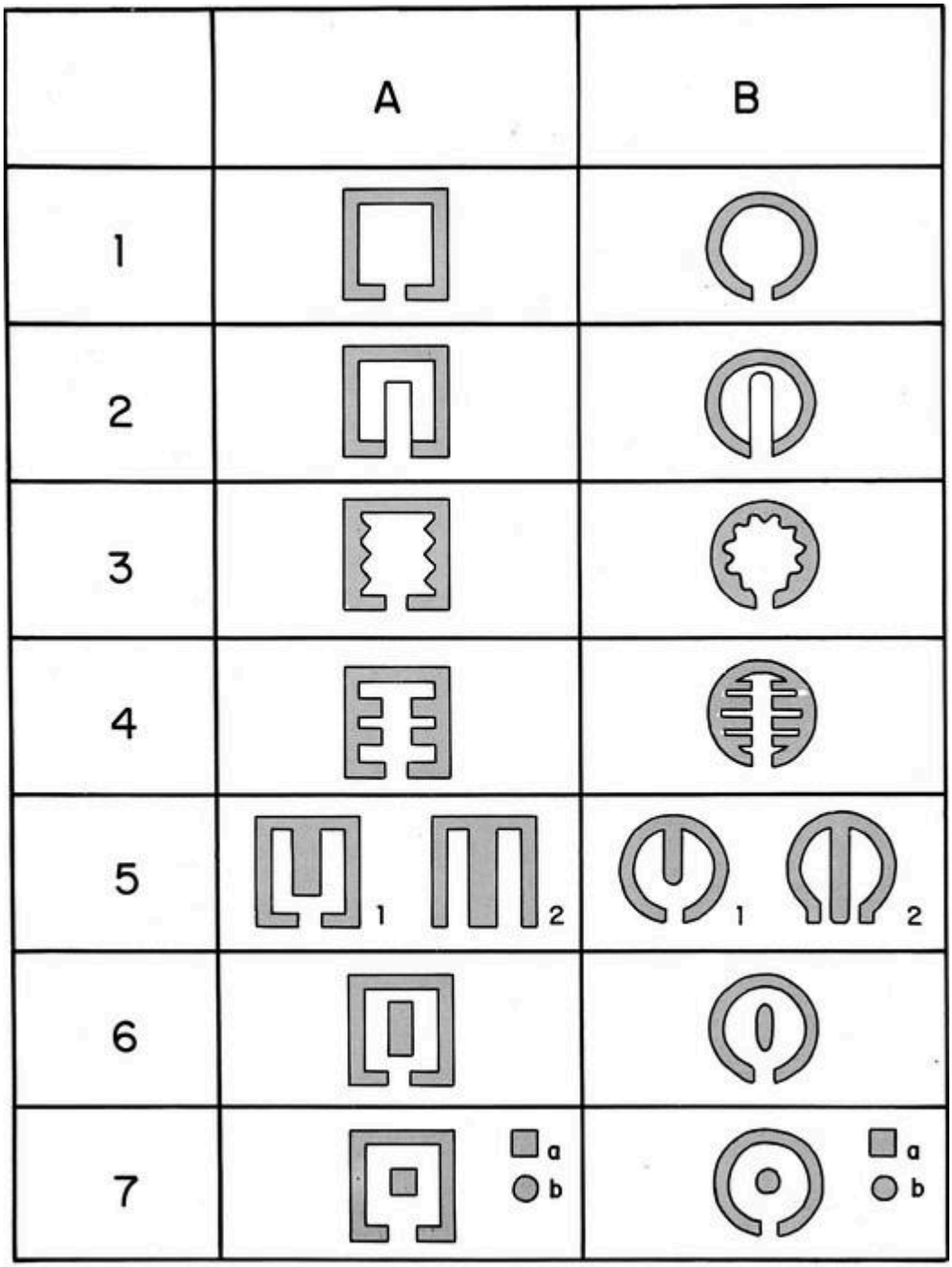

Fig. 36. Tabla tipológica de los hornos ibéricos.

FIG 6. TYPOLOGICAL SCHEMA OF IBERIAN CULTURE KILNS (BRONCANO AND COLL 1988).

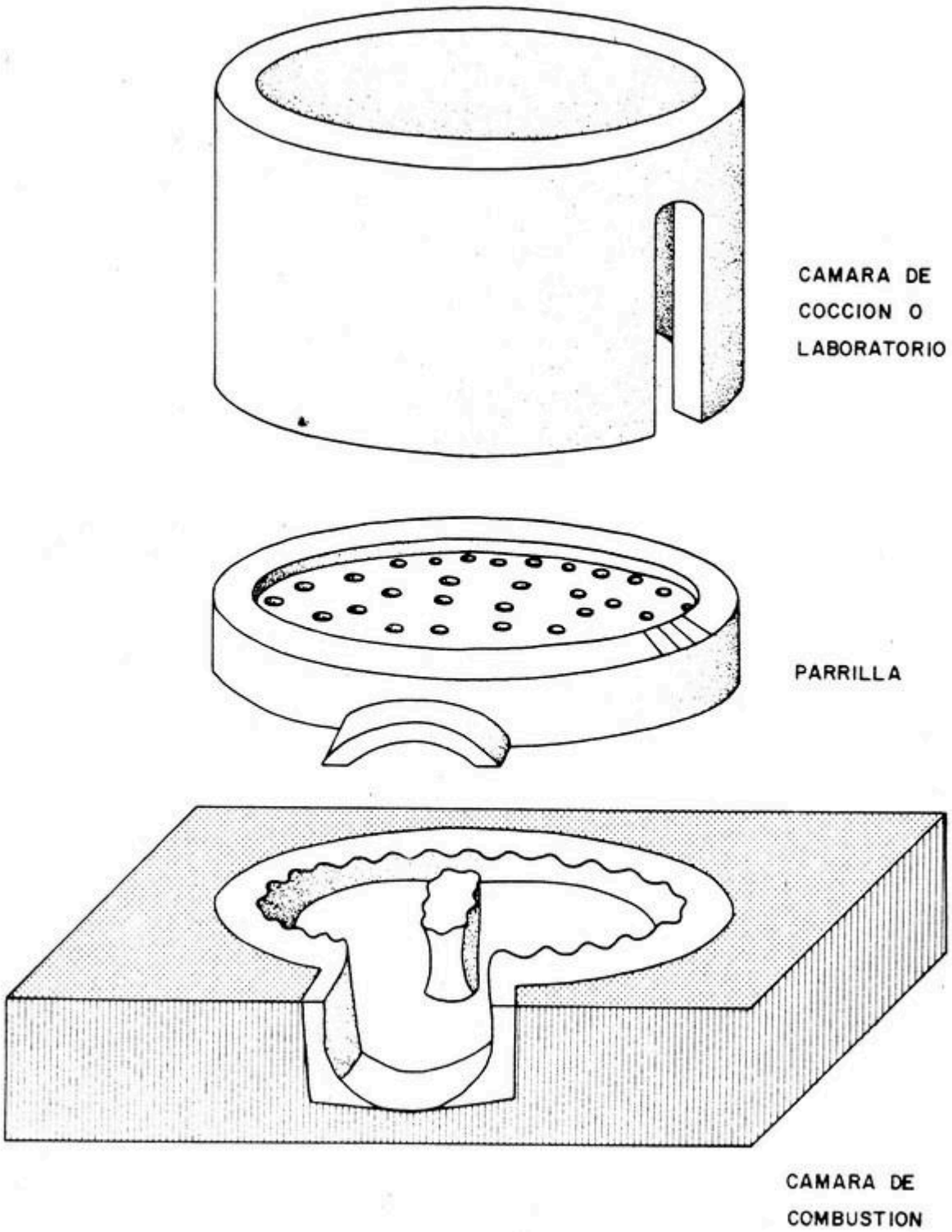

FIG 7. SCHEMA OF THE PRINCIPAL FEATURES OF THE KILN OF THE SITE OF ALCALÁ DE JÚCAR (BRONCANO AND COLL 1988, FIG. 34).

FIG 8. CONSTRUCTION OF THE COMBUSTION CHAMBER AND THE CENTRAL PILLAR OF THE EXPERIMENTAL KILN OF VERDÚ.

FIG 9. VIEW OF THE CENTRAL PILLAR AND THE BOUGHS PLACED TO SUPPORT THE GRATE DURING CONSTRUCTION OF THE EXPERIMENTAL KILN OF VERDÚ.

Lám. V. 2. Parrilla con las toberas destapadas.

FIG 10. GRATE AND FLUES OF THE IBERIAN CULTURE POTTERY KILN OF ALCALÁ DE JÚCAR (BRONCANO AND COLL 1988, PLATE V.2).

FIG 11. RECONSTRUCTION OF THE GRATE OF THE EXPERIMENTAL KILN OF VERDÚ.

FIG 12. DEPICTION OF A KILN ON AN ANCIENT VOTIVE TABLET (PENTESKOUPHIA TABLET, MNB 2858, LOUVRE MUSEUM, PARIS).

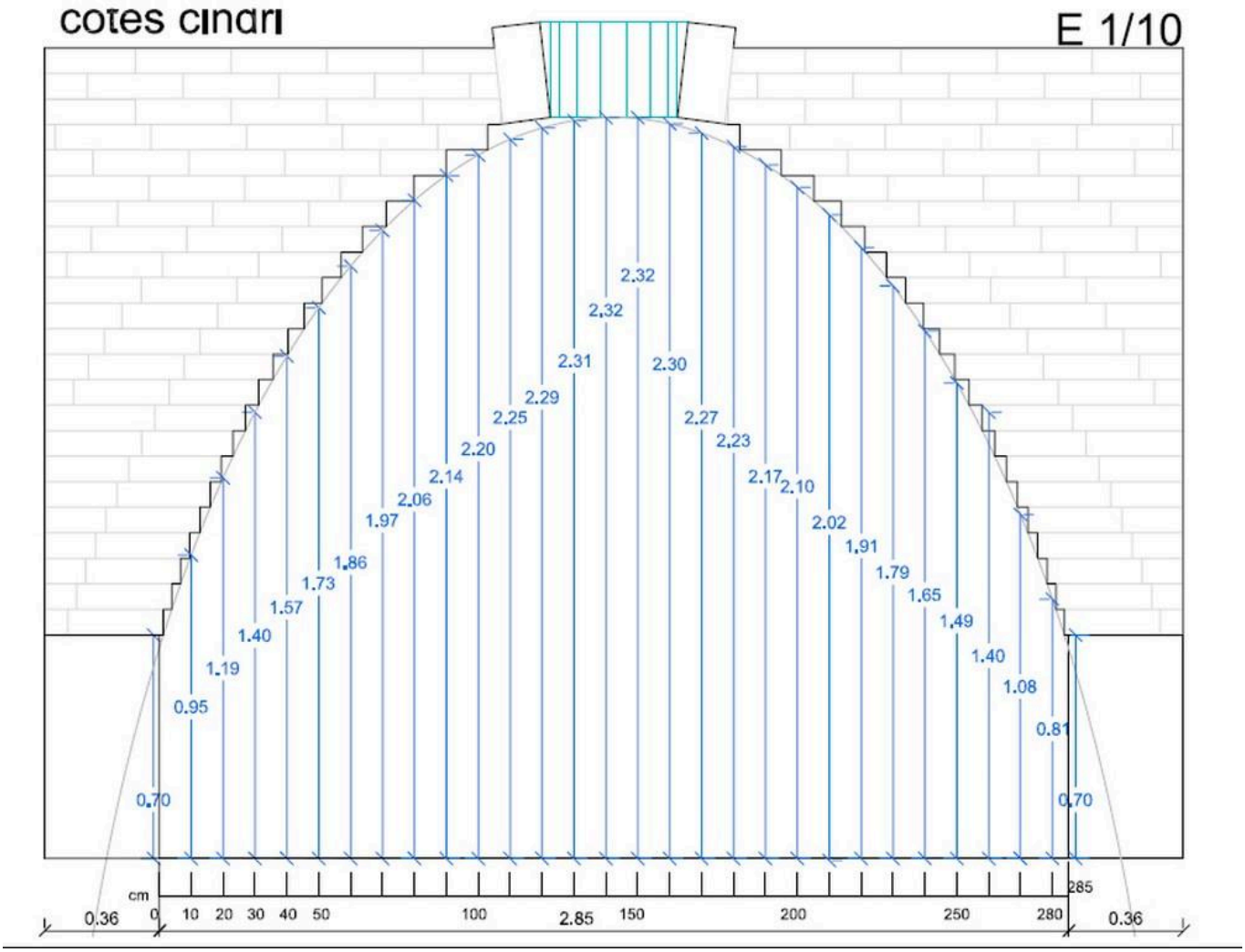

FIG 13. ARCHITECTONIC STUDY OF THE FIRING CHAMBER OF THE EXPERIMENTAL KILN (ANTONI MARTÍ FALIP).

FIG 14. VIEW OF THE BRICK-BUILT FIRING CHAMBER OF THE EXPERIMENTAL KILN OF VERDÚ.

FIG 15. PLASTERING OF THE INTERIOR OF THE FIRING CHAMBER OF THE EXPERIMENTAL KILN OF VERDÚ.

FIG 16. VIEW OF THE VERDÚ EXPERIMENTAL KILN BEFORE ITS INITIAL FIRING.

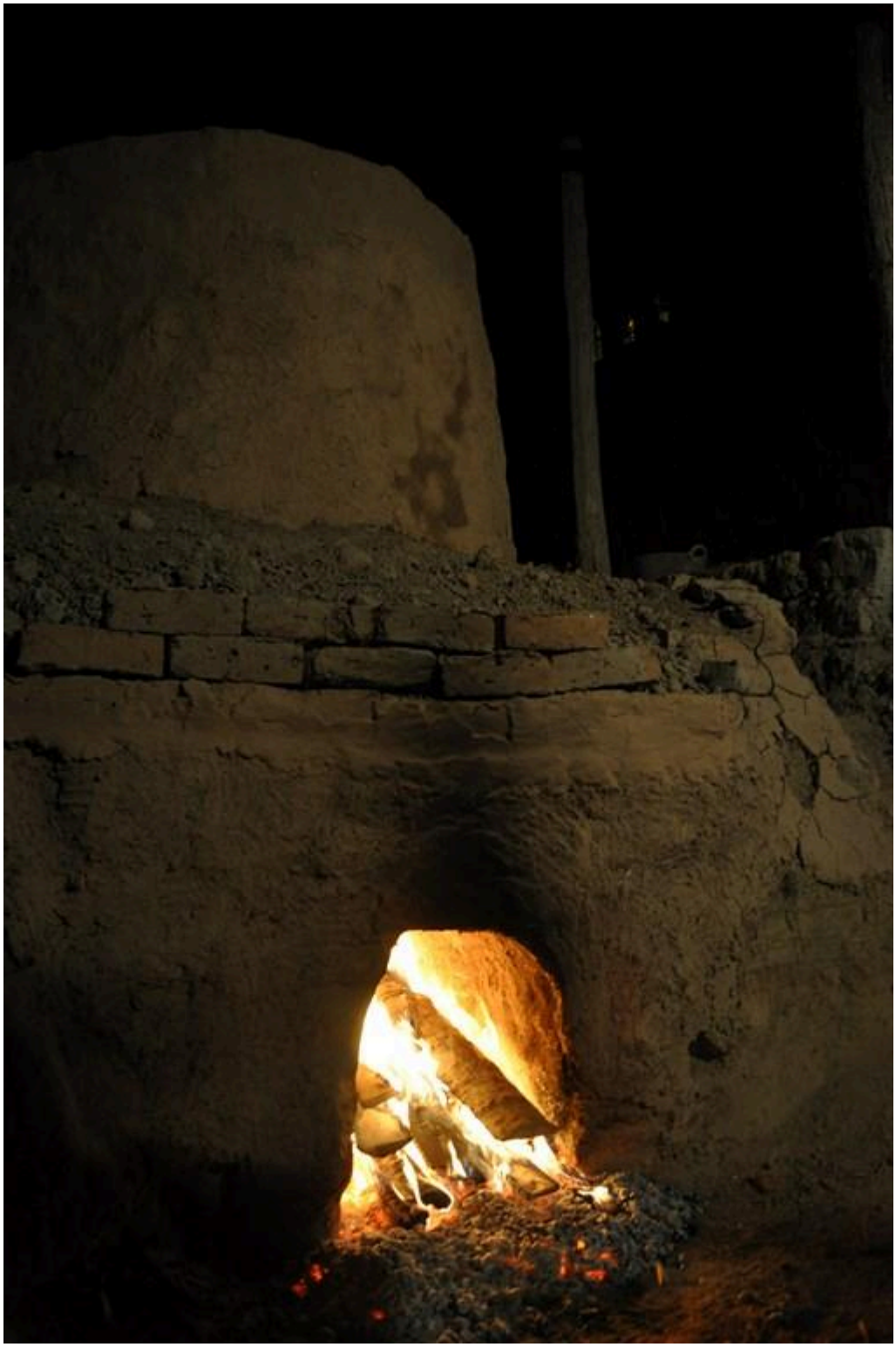

FIG 17. INITIAL FIRING WITHOUT POTTERY OF THE EXPERIMENTAL KILN.

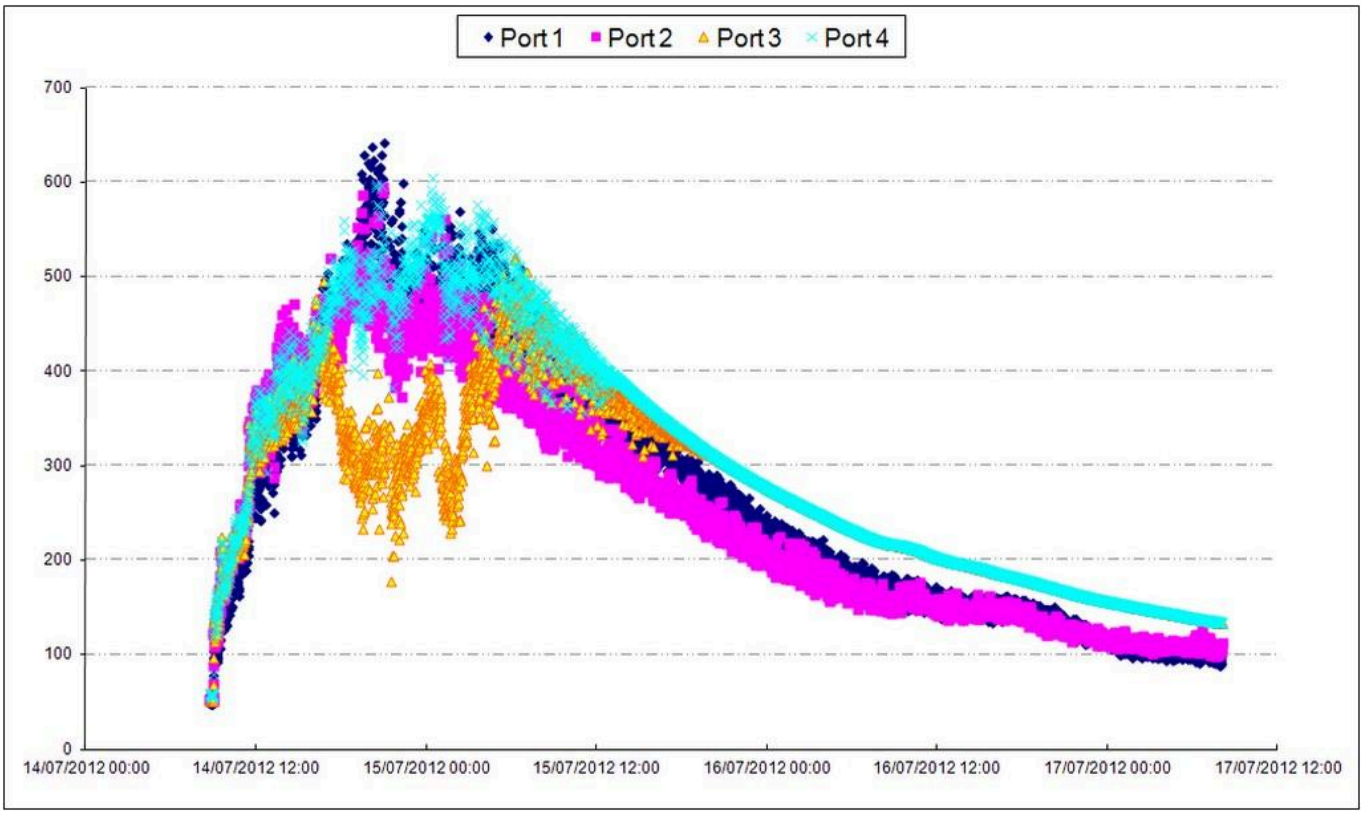

FIG 18. PYROMETRIC DATA OF THE INITIAL FIRING OF THE KILN. THE FOUR DIFFERENT SENSORS ARE REPRESENTED BY THE FOUR COLOURS. TEMPERATURES ARE REPRESENTED BY THE VERTICAL AXIS.

FIG 19. REPLICAS OF IBERIAN CULTURE POTTERY IN THE WORKSHOP OF MAGÍ SAMBOLA.

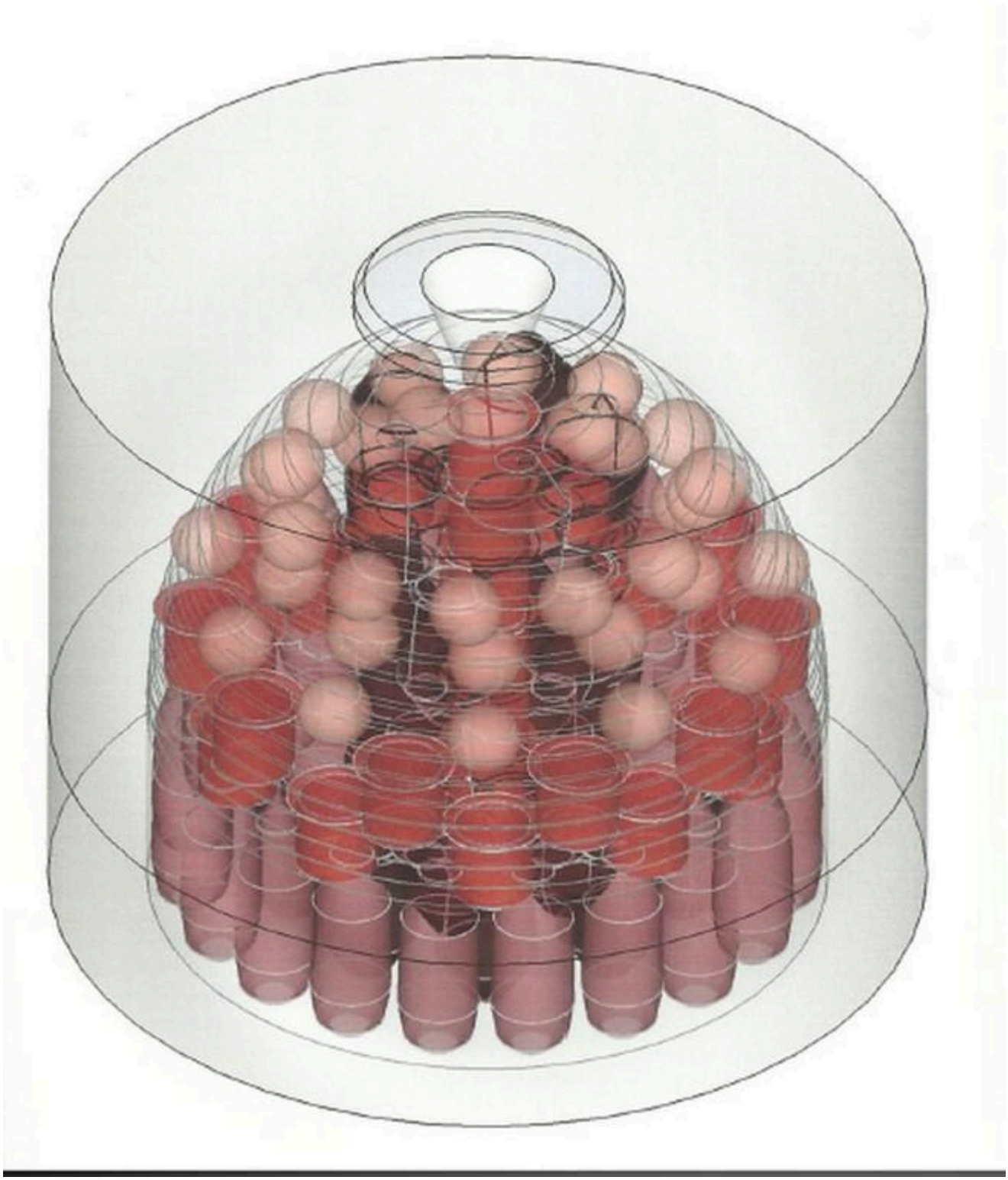

FIG 20. STUDY BY THE POTTER MAGÍ SAMBOLA OF THE CAPACITY OF THE KILN.