

The Logistics of Marking in the Baetic Amphoras. The Use of Numerals in the Organizational Systems of Ceramic Productions

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Abstract. *The objective of this study is to identify, by means of the analysis of the graffiti ante cocturam on the Roman amphoras, the different processes of production which are registered in the amphorae workshops. The olive oil produced in the Baetica served massively to nourish the western provinces of Roman Empire for more than 300 years. The standardization of the selected amphoric type, which extended over more than one hundred amphora workshops, allows us to observe certain patterns of similarity in the amphoric productions, at either a typological or epigraphic level, that allow us to understand the production organization of these amphoras. We apply here a development of the categorization of graffiti ante cocturam on these olive oil amphoras (i.e. Dressel 20) that allows us to analyze the set of the epigraphs which have been published so far from a new point of view. Our work focuses on the analysis of graffiti belonging to thirteen different archaeological surveys conducted on the surface of Monte Testaccio (Rome, years 1989 to 2000 and 2005). Before now the graffiti found in the different excavations of Monte Testaccio have been studied and published independently, and only through a global analysis can we present a joint vision of graffiti for more than a century, appreciating certain patterns or key trends which are important for understanding the different processes of production of the Dressel 20 amphorae in the production areas. The results suggest that the presence of numerals responds to a clear will on the part of the artisan collective who was dedicated to the manufacture of these amphoras to quantify the lots produced in any of the various phases of a production system. The fact that one is a part of a complex system of artisanal ceramic manufacturing at industrial levels necessitated a strict organizational control of all the productive phases. The continuity over time and the dispersion of the marking method in the territory makes us think of possible well-defined standardization processes, with learning processes common to the ceramic artisan communities and their possible mobility through the different workshops that produced the same type of amphora. The same results could be understood as part of the internal control of the contracted productions, as well as constituting a log of the internal logistics of the baking phase or for its control, when storing them in one of the first phases of formation of the amphora.*

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Rezumat. *Obiectivul acestui studiu este de a identifica, prin analiza de graffiti ante cocturam de pe amforele romane, diferitele procese de producție care sunt înregistrate în atelierele de amfore. Uleiul de măslină produs în Baetica a avut un rol important în alimentația provinciilor occidentale ale Imperiului Roman vreme de mai bine de 300 de ani. Standardizarea tipului de amforă selectat, care a fost produs de peste o sută ateliere ceramice, ne permite observăm anumite similitudini în producția de amfore, la nivel tipologic sau epigrafic, care ne permit să înțelegem modul de organizare a producerii acestor amfore. Aplicăm aici o evoluție a clasificării privitoare la graffiti ante cocturam de pe aceste amfore de ulei de măslină (adică Dressel 20) care ne permite să analizăm setul de epigrafe publicate până acum dintr-o nouă perspectivă. Activitatea noastră se concentrează pe analiza de graffiti întâlnite în treisprezece cercetări arheologice diferite efectuate pe suprafața Monte Testaccio (Roma, anii 1989-2000 și 2005). Până acum graffiti găsite cu ocazia diferitelor săpături de la Monte Testaccio au fost studiate și publicate în mod independent, și numai printr-o analiză globală putem prezenta o perspectivă de ansamblu referitoare la aceste graffiti pentru mai mult de un secol, analizând anumite tipare sau tendințe importante pentru înțelegerea diferitelor procese de fabricare ale amforelor de tip Dressel 20 în zonele de producție. Rezultatele sugerează că prezența cifrelor corespunde intenției clare din partea meșteșugarilor implicați în fabricarea acestor amfore de a ține evidența loturilor realizate în fiecare dintre diferitele faze ale procesului de producție. Apartenența la un sistem complex de fabricare a ceramicii artisanale de nivel industrial necesita un control organizațional strict al tuturor fazelor de producție. Permanența în timp și răspândirea metodei de marcare la nivel teritorial ne face să ne gândim la posibile procese de standardizare bine definite, presupunând forme de învățare comune variatelor comunități de artizani și posibila lor mobilitate în rândul diferitelor ateliere care produceau același tip de amfore. Aceleași rezultate ar putea fi interpretate prin prisma controlului intern al producției contractate, dar și ce privește evidența coordonării interne din faza de ardere sau a controlului acesteia, atunci când amforele erau depozitate într-una dintre primele faze ale procesului de producție.*

Keywords: Baetic amphoras, standardization, Monte Testaccio, Dressel 20 amphoras, production organization.

1. Introduction

The archaeological record is useful for identifying the mechanisms by which humans learn from each other⁴. Thanks to the analysis of archaeological proxies, we can capture traces of social learning dynamics in large-scale standardized productions⁵. The study of graffiti *ante cocturam* on serialized productions for more than three centuries is an ideal record by which to better understand these dynamics.

⁴ RICHERSON and BOYD, 2005; EERKENS and LIPO, 2007.

⁵ SHENNAN and WILKINSON, 2001; EERKENS and LIPO, 2005, GANDON *et al.*, 2014, SHENNAN *et al.*, 2015, COTO-SARMIENTO *et al.*, 2018.

These marks were made in the ceramic's workshops, like the stamps. While it is true that graffiti has not been preserved in the same proportion as stamps, it is partly because traditionally they have been considered much less valuable, and partly because they tend to have larger dimensions and fragmentation of the pieces that their conservation is partial and does not allow for complete reading⁶.

The graffiti, unlike stamps — and this is one of its main characteristics — often allow a remarkable freedom of format and message. In some cases, these are serial messages, but in other cases they give rise to a greater margin of improvisation⁷. It should be clear that, although generally the difference of epigraphic technique used in the *instrumentum* (stamps, graffiti or *tituli picti*) reveals a different function of the inscription, this is not always the case. We often find an indistinct use between stamps and graffiti, as in the case of barrels⁸ or in cases where graffiti replaces the stamp in Dressel 20⁹.

At first level, there is a division into two types of graffiti: *ante cocturam* and *post cocturam*¹⁰. Those of the first type have been made during the production process, before the solidification of the ceramic, as a result of which they will form an original part of the finished piece. The *post cocturam* group of ceramics were incised after the firing of the support, so that they would not be related to the production process, but rather to distribution and consumption¹¹. The graffiti on Dressel 20 *ante cocturam* are recognizable because, when made on a soft surface, the resulting groove is usually thick and has a 'burr' on its sides. If a stylus has been used, there will be a fine and regular stroke. If it is a cane or branch, the stroke will likely be something wider and irregular. If the finger is used, thick strokes are found. Subsequently, the firing process equals the coloration and texture of the surface of the piece and the groove of the graffiti, something that does not happen in the *post cocturam*. The amphora was made in several phases: on the one hand, the lower bell and the pivot, and on the other hand, the upper bell. Subsequently, both pieces were assembled, and the neck, mouth and handles were added¹². During this process the different types of graffiti we know were made. The value of these marks was exclusively internal. Nominal graffiti of a

⁶ REMESAL *et al.*, 2003, 363.

⁷ BERNI 2008; MOROS 2019.

⁸ BARATTA 1994.

⁹ GARCÍA and OZCÁRIZ 2007, 549–554.

¹⁰ DRESSEL 1878, 146–147; *CIL* XV 556; RODRÍGUEZ ALMEIDA 1972, 235; CASULLERAS *et al.*, 1999; REMESAL 2007, 1181; OZCÁRIZ 2009 547–549; 555–556.

¹¹ REMESAL 1986; 1987; MARTIN-KILCHER 1987; EHMIG 2003; 2007; WESS-KÖNIG 2010; BERNI 2017; REMESAL and PÉREZ 2018; GONZÁLEZ and BERNI 2018.

¹² BERNI 2008, Fig. 1; REMESAL 2011, 120.

servile condition appear together with others in genitive, which suggests a work organization that operated in groups and in which there are specialized commissions for a specific process of the preparation of the amphora, which each depended on a foreman responsible for his work¹³. The marking of the pieces would be related to the accounting of the remittances or the date of their elaboration, since until the final assembly of the two parts all pieces had to pass a drying time. After assembly, the function of these graffiti ends completely, and those that were made near the pivot will be practically hidden and will be “upside down”¹⁴.

2. Methods and Data Structure

Starting from this premise, the construction of the database section dedicated to the graffiti on the *instrumentum domesticum* has configured a tool which is purposed for the study of graffiti *ante cocturam* by considering the nature of the graphite and its formal characteristics. This information allows for the study of the diachronic development of the different types of graffiti, and the intensity of marking¹⁵. In the same way, it allows us to make advances in the interpretation of what were the functions of the realization of the graffiti, over time, since we are able to find variants of the different types in a simple way. It also allows us to relate the production changes of the amphoras with changes in the habits of marking (e.g. if it was a matter of difference between the organizations of the *figlinae*, in the organization of the working groups, etc.), and establish more precisely the relationship between stamps, *tituli picti* and graffiti.

In summary, some of the highlighted steps are the following:

1.- Divide first into three groups: 1.- epigraphic (words, letters and numerals), 2.- marks and drawings 3.- *incerti* and unknown.

2.- The epigraphs can be divided into *nomina*, calendar, consular, alias, isolated letters and numerals.

3.- We must bear in mind that this division is established based on the searches that will be carried out, not in terms of its function within the group of amphora. For example, we know that numerals, single letters and marks can respond to the same function, but when establishing searches for practicality, we must compartmentalize them into different sets.

Parallel to this is the interest in the division of graffiti according to their exact location in the amphora and orientation with respect to the piece. The absolute or relative chronology is

¹³ RODRÍGUEZ ALMEIDA 1984, 262-264; REMESAL 2011, 120.

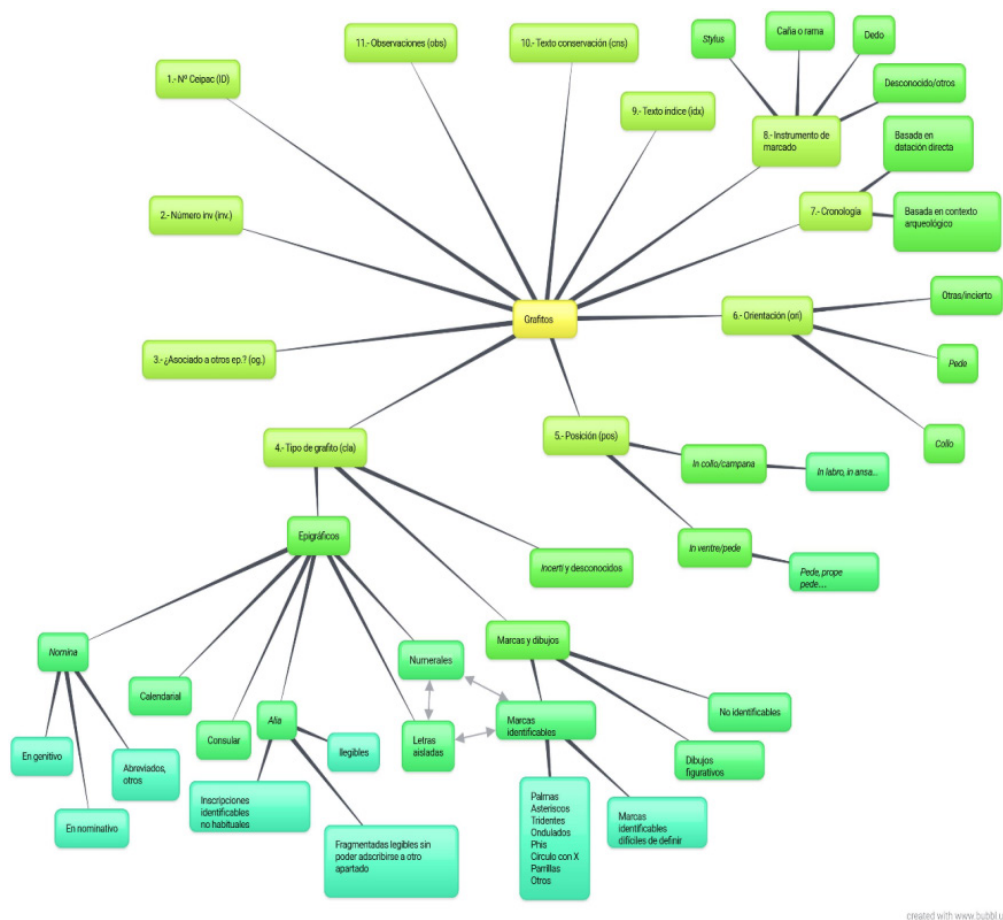
¹⁴ REMESAL 1977-1978, 87-120; RODRÍGUEZ ALMEIDA 1989-1990, 35-40; 1993, 95-106, item 96.

¹⁵ <http://ceipac.ub.edu>; <http://www.romanopendata.eu>.

fundamental to observe dynamics in the marking and the possible marking instruments, either with a stylus, branches or fingers¹⁶. The Structure can be seen in Figure 1¹⁷.

3. Materials

To date the graffiti found in the different excavations of Monte Testaccio have been studied and published independently. This work offers a joint analysis of the epigraphs, allowing us to appreciate certain patterns or key currents to understand the different productive processes of the Dressel 20 amphoras. Once the analysis stage was exceeded from a lower granulation



created with www.bubbl.us

Figure 1. Structure of the graffiti of the CEIPAC database. Developed by Ozcáriz Gil. (Ozcáriz, in press)

¹⁶ BROEKAERT *et al.*, 2015.

¹⁷ For further information on the organization of the CEIPAC database, see the work of REMESAL *et al.*, 215 455–464; MOSCA *et al.*, 2015; CALVANESE *et al.*, 2015; 2016 and **Supplementary Fig. 1**.

level, the opportunity of being able to approach the graffiti from the abundance of data in its entirety, moving from a micro vision to a macro vision, allows us to gain a wider perspective and thereby apprehend our information more clearly. For this, the correct development of visualizations allows us greater effectiveness as scientists¹⁸.

Our study focuses on the analysis of thirteen different surveys conducted on the surface of Mount Testaccio ranging from 1989 to 2000 and 2005 (Monte Testaccio). The total number of graffiti published in the six volumes of the *Instrumenta* collection on the 'Monte Testaccio Studies' amounts to 1343 epigraphs¹⁹, which come from a total of more than one hundred tons of Baetic amphoras controlled (102 841.4 kg) This is approximately equivalent to 3428 amphoras (considering their approximate weight to be 30 kilos per amphora). This would mean that, on average, 2.6 of these amphoras were printed graphite. The marking is not necessary in all the amphoras. As a general rule, most of these graffiti were marked in the lower area of the amphora (when it was face down), *in ventre / in pede*, ca. 75% (7/8 out of 10), when this part would still not have joined the upper zone, where this type of marks would be lower, ca. 20% (2 out of 10). The remaining 5% would include marks on the lip, the handles, on the starts of the same and in areas that, due to their state of conservation, have been difficult to identify. The analysis can be seen in **Supplementary Figure 2**.

Thanks to the Testaccio excavations, we are able to contextualize these graffiti over more than a century, highlighting a series of years with a greater presence of these epigraphs. Firstly, there may appear to be a greater number of marked amphoras during certain years, such as the years 177–179, 220–224 or 252–254 AD, but the grouping of these marks in more specific chronological periods shows less variable patterns. These precise chronologies are inferred from the findings of these epigraphs, together with the painted marks known as *delta*, where the consular dating of the fiscal control exercised over the oil packed in these amphoras appears as a rule. Thus, in choosing to classify the graffiti by dynastic groups, we see that the proportions are similar. Moreover, the question whether there is an increase of these marks during the Severan Dynasty could be related to the largest number of published materials of this time or the upward trend of a greater number of stamps and *tituli picti* during the first years of the 3rd century AD. A possible increase of the epigraphs with new surveys of one or another chronology can help us to better understand if the difference between these periods was a historical reality or intended to respond to a random fact.

To the graffiti found in the Testaccio must be added the singular fact of their precise contextualization due to their consumption in Rome, the dating for which is inferred thanks to their being found next to the *tituli picti* consular *delta* type. Although it is true that the prospects in Betica allow us to increase the number of graffiti *ante cocturam*, it is rare to find

¹⁸ See for discussion LANKOW, RITCHI, CROOKS 2012, 12ff.

¹⁹ BLÁZQUEZ, REMESAL, RODRÍGUEZ ALMEIDA 1994; BLÁZQUEZ, REMESAL 1999; 2001; 2003; 2007; 2010 and 2014.

them in such a well-defined chronological context, except for the recent excavations in Las Delicias or the Mohino and of some underwater finds. This testifies to the importance of their finding in the Testaccio.

Despite not having (yet) a sample of each of the years in which the Testaccio annony dump was active, the different surveys conducted allow us to present intermittent chronological evidence every 15/20 years, with some variation between the middle of the second century AD and mid-third century AD. This situation is key to make visible possible changes in the marking processes.

4. Discussion

At this point, our study proposal focuses on the group which is most represented in the set of graffiti *ante cocturam*, namely the numerals, which as a rule have only been presented descriptively, generating perhaps less interest among specialists. The graffiti that we have interpreted as numerals are the most widespread in the marking of the amphoras during this productive phase (ca. 60%), and, for the first time, an approximation allows us to see how the complex system of epigraphic marking could work on this production²⁰. The frequency marking of this amphoric type can be seen in **Figure 2**.

A representation of all the numeral graffiti published in the Testaccio surveys in chronological order allows us to see how the tradition of marking these amphorae persisted over time. **Figure 3** shows that the most used and constant numerals in time were the numbers I, II, V, X, XX, XXX, C and CX.

This marking system could have several meanings.

Perhaps it is to be related to the standardization of production processes in the workshops that made Dressel 20 amphorae, or perhaps it is an indicator of learning processes common among the community of craftsmen engaged in the manufacture of these containers. It is also conceivable that it relates to the mobility of the craftsman by the different workshops, who used the same control system for the accounting of their productions, apparently by groups or lots.

At this point we must not forget to mention the existence of Egyptian papyri relating to the contract of rent of figlinae, in which it is found that the workers were in this case contributed by the renter of the figlina and had an itinerant character²¹. However, this is not always and every time the case, as indicated in Revilla 1995. This said, if true, we could

²⁰ <https://github.com/JordiPerezGonzalez/Numerals-Ceramic-Productions.git>.

²¹ P. Mert 2, 76; P. Tebt. 2, 342; Oxyrh 50, 3595-7; P. Lond 3, 994; COCKLE 1981, 87-97; REMESAL 1991, 157-176; GARCÍA BROSA *et al.*, 2001, 317.

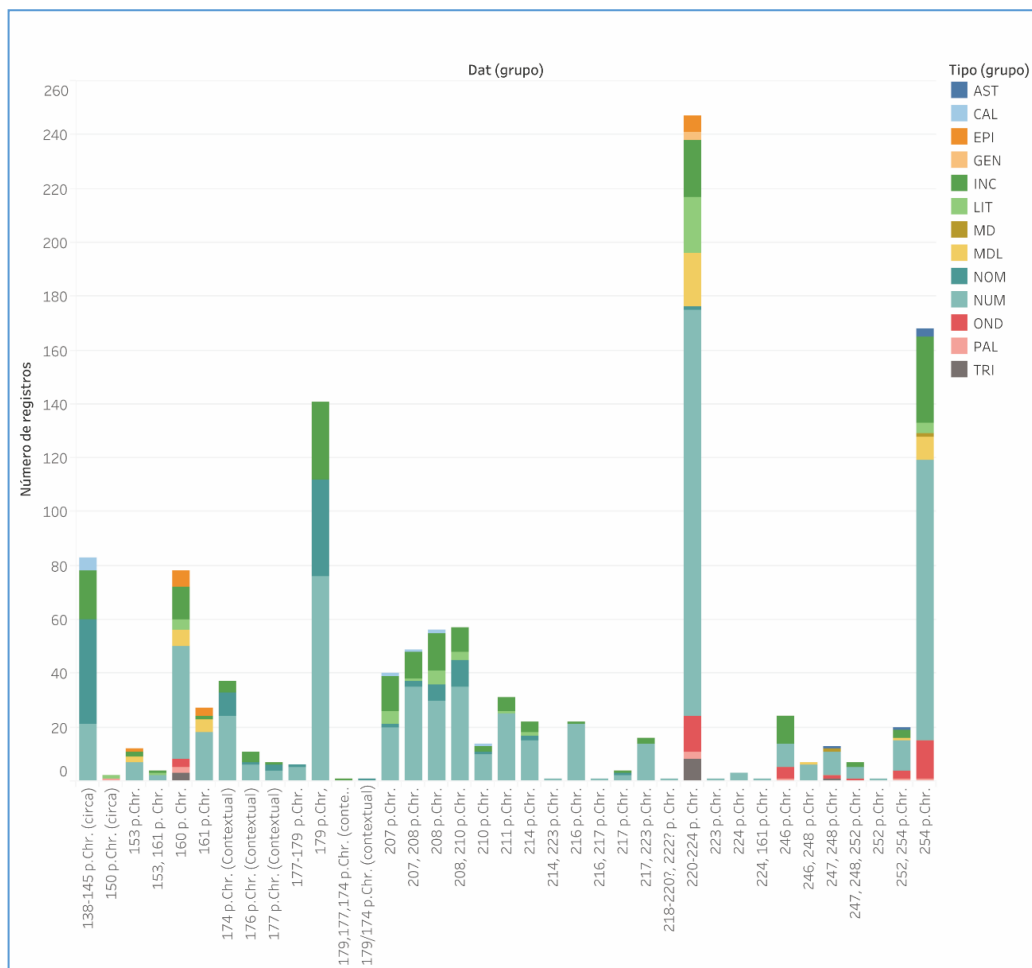


Figure 3. Chronological distribution of graffiti *ante cocturam* found in the excavations of Monte Testaccio (Rome). AST = asterisks, CAL = Calendarials, EPI = Epigraphic, GEN = Genitives, INC = Uncertain, LIT = letters, MD = Marks, Drawings; MDL = Marks, Drawings and Letters, NOM = Nominal, NUM = Numerals, OND = Wavy, PAL = Palms and TRI = Tridents

propose the existence of this mobility of the craftsman by the different *figlinae*, who would make the same type of marks on their productions.

Another dimension of the evidence points to the singularity of Monte Testaccio, as there is no well-defined land or strata, but only amphoras, where you can only excavate creating an artificial system, which has been dividing into 1m packages square. From them 20 materials extracted in 20 cm would allow us to know the possible origin of the epigraph. Recently, a new analysis method has been proposed to derive the correlation between the materials that we cannot physically unite and those from whose union information can be recomposed

at a micro-historical level about the identity of the specific places from where the amphora was exported in the *Baetica*, together with the *tituli picti* and the graffiti²². The current state of research on the stamps in Dressel 20 allows us to deduce the place of production in the *Baetica* of many of these productions. In this connection, the analysis of the numeral graffiti of the surveys of the years 1991 (220–224 AD) and 1993 (ca. 138–145 AD) shows numerals (eg. X {10}) represented in the three *conventus*, a fact that could demonstrate how the control systems carried out by these graffiti in the initial life-processes of the amphora had spread throughout the workshops of the *Baetica* region. Results can be seen in **Figure 4**.

Other hypotheses suggest that the numeral would indicate the number of pieces that could enter a batch; or the number of amphoras produced by a worker in a given period; or it may indicate a number related to remittances or purchase orders, etc. Remesal defended through experimental practice the possibility that a current worker of a pottery workshop could produce during a day ca. 30 amphoras, hence the authors propose that the marked figures indicate the volume of daily production²³. Now, Remesal in his study of the pottery kiln of La Catria estimated a maximum capacity of the furnace of 79 amphoras, of which the lower ring had to be loaded with 36 amphoras²⁴. Regarding the capacity of these kiln, their load would be arranged vertically and with the mouth upwards in concentric circles, of an approximate quantity of four, twelve and twenty from the smallest to the largest²⁵. This hypothesis is reinforced thanks to the discovery of a few 'lebrillos' that could be used both for the purposes of production and for the cooking of the amphoras. On the other hand, in the recent excavations of furnace 3 of Las Delicias, an occupation of 191 amphoras disposed in 28 basins has been proposed as support in overlapping rows of 28 and 17 amphoras alternated in three heights. According to this hypothesis, the approximate quantity of each load of amphoras could be corroborated, according to the records of 'lebrillos' found and at the same time making a comparative calculation of the percentage of said supports that have been calculated in each baking process²⁶. In parallel, in the excavations of the Mohíno pottery workshop, it has been considered that the kiln batteries could ensure a fortnight of cooking cycles per year, calculating an annual production of about 9700 to 9900 amphoras Dressel 20. This production has been calculated in one of its most productive phases (phase 4B between 100/120 to 140 AD) in a battery of 4 ovens, with an approximate capacity of 250 cubic meters²⁷.

²² PÉREZ GONZÁLEZ *et al.*, 2018, 253ff.

²³ REMESAL 1977–1978, 96–97; 2004, 356; CASULLERAS *et al.* 1999, 60, note 60.

²⁴ REMESAL 1977–1978, 96–97, note 29.

²⁵ REMESAL 1977–1978, 95–96.

²⁶ CARRATO *et al.*, 2018; 312–313.

²⁷ GONZÁLEZ TOBAR *et al.*, 2018, 319–344.

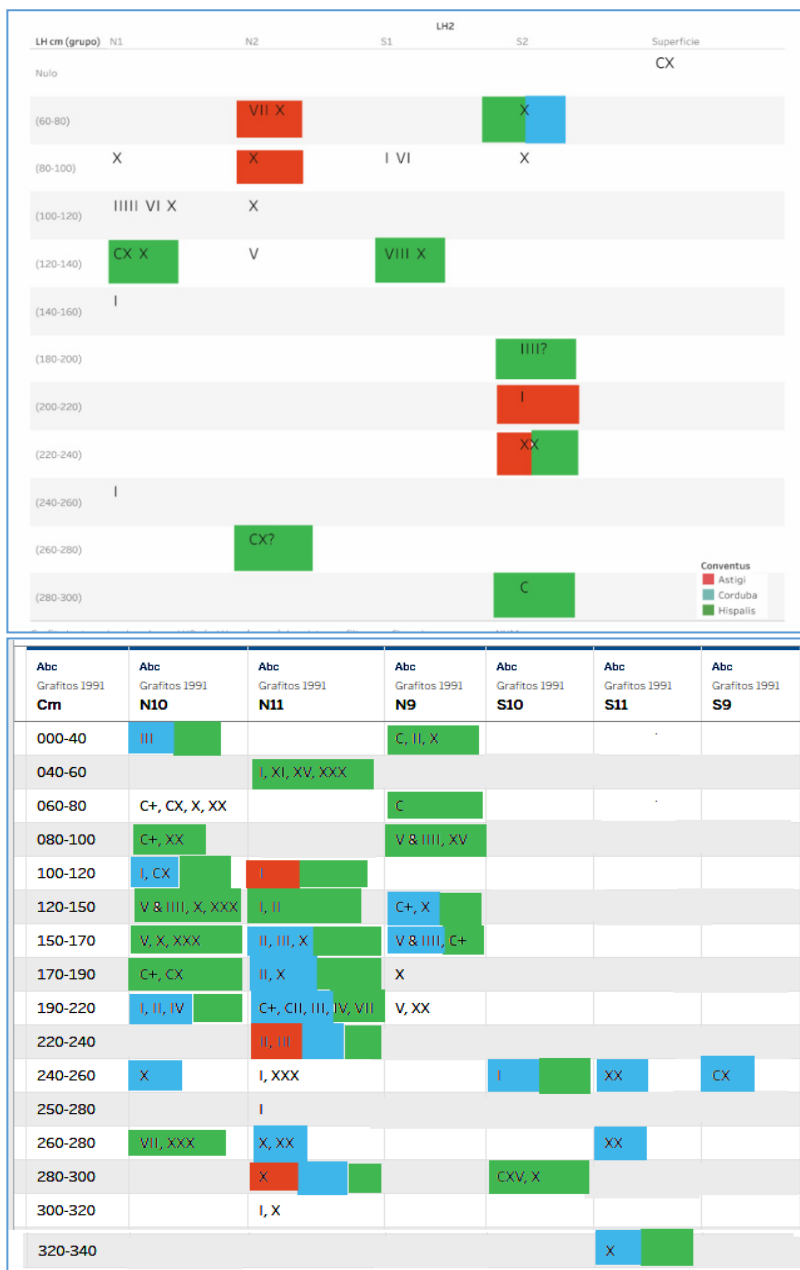


Figure 4. Relation of the numerals graffiti together with the stamps whose origin is known from its *conventus* producer in the *Baetica*. Above: the archaeological excavation in 1993 (ca. 138–145 AD) from the surface to 3 meters divided in square meters N1, S1, N2 and S1. Below: the archaeological excavation in 1991 (220–224 AD) from the surface to 3 meters 40 cm. Observing e.g. the numeral X, we see how in both probes it appears represented in more than one *conventus*, which stands as proof of the extension of the marking formula in the ceramic workshops or of the mobility of a same group of specialists

The logistical quantification of these ceramic productions would help to control the drying processes and to differentiate between the different lots²⁸. The notion that the figures exceed the hundreds (if the brands we have associated with this numeral come to mean this) was proposed in previous work which indicated the amphoras produced in the *figlinae* in a working day, considering that human performance and the number of workers are variable²⁹.

To conclude, what does seem clear from this statistical analysis is that it was not necessary to mark all the production, noting only a certain number of amphoras. Now, what was the need for marking? Taking into account that surely this marking system did not have any meaning beyond the phase of preparation of the container before its firing, could it be related to a control of ceramic production by the craftsman himself for his justification, in front of an inspection of the work of a later phase? or perhaps related to a control of ceramic production for internal control? If there was a salary for the workmen, would it be carried out according to the work done or the work days?

We believe that thanks to the exposed results we are closer to approaching a solution to these types of questions.

It seems that there is no doubt that the presence of figures responds to a willingness to quantify, within the various phases of a complex production system of these artisanal industries³⁰, phases that involved various artisans and in which it would be necessary to differentiate the work of each of the members who participated in the manufacture of a container produced in a series.

5. Conclusion

The categorization of the graffiti *ante cocturam* on these oval amphorae Dressel 20 allows for the analysis of the set of published epigraphs from a new point of view. The work focused on the analysis of more than 1300 graffiti belonging to thirteen archaeological surveys carried out in Monte Testaccio (Rome, from 1989 to 2000 and 2005) presents a joint study for the first time. The detailed chronology known in the Testaccio allows for homogeneous analysis of materials over a century, something which represents a fundamental fact to determining the existence of patterns or trends in the marking of the Dressel 20 amphorae. This itself is deemed key to understanding the different production processes of the potteries of the *Baetica*.

²⁸ GARCÍA BROSA *et al.*, 2001, 310, on the lots: REMESAL, MOROS 2019 and MOROS in press.

²⁹ GUDEA 1996, 475-482; GARCÍA BROSA *et al.*, 2001, 312.

³⁰ CASULLERAS *et al.* 1999, 60-61.

The results obtained suggest that the presence of the most notable of these graffiti, the numerals, responds to a clear desire to quantify within the productive logistics of the complex system linked to the ceramic industry of the Baetica. This finding would indicate one of the processes of making the amphora, acting in one of the first phases. The continuity in time and the dispersion of the method of marking by territory allows us to think about the standardization of these processes by the various workshops, perhaps through common learning processes of the ceramic craft communities and the possible mobility, through the various workshops, of producers of the same amphoric type. The same results could be understood as part of the internal control of the contracted productions, as well as constituting a log of the internal logistics of the baking phase or for its control, when storing them in one of the first phases of formation of the amphora.

In the future, we will continue to expand the sample, a fact that should not alter the proportions identified in this hypothesis, which captures a homogeneous and well contextualized situation thanks to the Testaccio dates³¹. We will also study graffiti from phases previous to those known in the Testaccio, among which the studies in the Roman camps in the limes³² or in underwater deposits³³ can be very useful. And finally, we will compare this documentation with other consolidated craft traditions, such as the world of Gallic potters or with Italic productions³⁴.

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³¹ REMESAL 2018, 215–236, fig. 4; PONS PUJOL, PÉREZ GONZÁLEZ 2018, 285.

³² REMESAL 1986; 1987; MARTIN KILCHER 1987; EHMIG 2003; 2007; WESS-KÖNIG 2010; BERNI 2017; REMESAL and PÉREZ 2018; GONZÁLEZ and BERNI 2018.

³³ AMAR, LIOU 1984; 1989; BRENTCHALOFF, RIVET, 2003; COLLS *et al.*, 1977; COLLS, LEQUÉMENT 1980; LIOU 1975; MÁRQUEZ VILLORA, MOLINA VIDAL 2005 and NIETO PRIETO *et al.* 1989.

³⁴ BAKKER, GALSTERER-KRÖLL, 1975; FEUGÈRE 2004; FEUGÈRE, LAMBERT 2004; LAUBENHEIMER 2005; ALONSO RODRÍGUEZ, PÉREZ LÓPEZ, NÚÑEZ RUIZ 1999.

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