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Socio-economic impacts of the exposure to Roman ceramics in the inland Iron Age communities of the NW Iberian Peninsula: A quantitative approach

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ABSTRACT

How did the first ever exposure to Roman imported material culture at inland sites affect local material culture practices? What does this reveal about the speed and nature of cross-cultural influence between Roman and Iron Age communities? And about the specific dynamics of integration within the Roman Empire of inland sites? Our ability to address these key questions about the exposure of Iron Age communities to the Roman world is hampered by a research bias in classical archaeology towards the study of ceramics contexts from coastal sites. In this paper we present the first replicable quantified contextualised ceramics data analysis to address these questions, through a study of more than 150,000 sherds from inland sites in the northwestern Iberian Peninsula. We conclude that century-long gradual changes in local common wares and amphorae from Iron Age traditions to Roman-inspired forms reflect changing food production and consumption behaviours. This transition is also reflected in an increasing presence of imported Roman goods. Our results suggest very gradual but increasing integration with the Roman world and ceramic data patterns correlate with known events from textual sources: Caesar's campaign, the Augustan Cantabrian wars, and the Flavian reforms.

1. Introduction

The incorporation of new territories into the Roman Empire changed the lives of their inhabitants, and part of that change involved the effects on local practices of exposure to imported materials. However, the speed and nature of this exposure was not uniform: coastal sites, which could have received imported goods more directly via maritime routes, typically evidence much higher diversities of non-local material culture at much earlier dates as compared to inland sites. The classical archaeology research tradition reveals a bias towards the study of material culture assemblages at coastal sites and how they evidence non-local contacts throughout the ages, whereas the study of how this cross-cultural exposure might differ at inland sites has been neglected. How did the first ever exposure to Roman imported material culture at inland sites affect local material culture practices, what does this reveal about the speed and nature of cultural transmission and change, and about the differing degrees of integration within the Roman Empire of inland and coastal sites? In this paper we present the first quantified contextualised ceramics data analysis to address these questions, with replicable results. The northwestern parts of the Iberian Peninsula provide a unique opportunity to carry out such a study. Coastal sites in the region already knew Punic trade contacts from the 6th century BCE (although Punic trade is not the focus of this paper), whilst inland sites have no evidence of imports until the time of Caesar's 60 BC campaign in the area (Casiuss Dio, 37, 52–53). Our study sheds new light on the nature, speed and dynamics of the Late Iron Age to Roman Empire transition and goes some way to addressing the bias towards coastal sites.

Between the end of the 1st century BCE and the beginning of the 1st century CE, the northwestern parts of the Iberian Peninsula were progressively integrated within the Roman Empire and its administration. Despite a campaign by Caesar in 60 BC, the area only became part of the Roman Empire following the Cantabrian Wars under the Emperor Augustus (29–19 BC). The settlement pattern at the end of the 1st century BCE was characterised by fortified settlements or hillforts

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(González Ruibal, 2007; Rodríguez Corral, 2009; da Silva, 1986). Some covered more than 2 ha, aggregating large populations and acting as focal points for the surrounding areas (Prieto Martínez et al., 2017). Some of these sites continued to be occupied during Roman times whilst others were abandoned, refounded, or reoccupied, following Roman traditions or at least a local interpretation thereof (Fernández Ochoa, 1988, p. 348; Fonte, 2015; Garland, 2017; González Ruibal, 2007, pp. 624–629; Nouvel, 2012; Rodríguez Fernández, 1994, p. 158).

However, a strong dichotomy can be observed between coastal and inland settlements in the region in terms of the presence of imported objects. Coastal sites (e.g. Toralla hillfort - Hidalgo Cuñarro, 1995) have evidence of imported goods through Punic trade as early as the 6th to 4th centuries BC, and early Roman trade is also well-documented for the 2nd-1st centuries BC. Those imported objects are brought in along the Atlantic coast to reach hillforts in the northwest (Carreras Monfort and Morais, 2012, 2010; Morais et al., 2013). Perhaps this reflects a more active and dynamic interaction of coastal sites with far-away regions (Ayán Vila et al., 2008; Fernández Fernández, 2013; Ferrer Albelda, 2020; Naveiro López, 1991). Moreover, these exchanges have direct effects on the local material culture as can be seen in the sites' artefact assemblages: as the non-local products become more common, they are influencing and causing changes in the local pottery (Rey Castiñeira, 2020, pp. 423–448). The presence of imported goods has helped archaeologists to characterise and date the coastal sites from the Iron Age to Roman times, and they are therefore also a valuable tool to date local pottery wares. This picture of the coastal sites stands in stark contrast with the nearby inland regions for which far less is known. These imported goods did not penetrate inland until the end of the 1st century BCE, and even then are present in much smaller quantities: earlier contacts with Mediterranean trade were restricted to the coast. The only imported object recovered at an inland site is a Punic glass unguentarium at Valdamio, Ourense (around the 4th-3rd century BCE), which has not been published yet. However, we must keep in mind that most ceramic studies (both for local and imported products) carried out to date have focused on the coast (Naveiro López, 1991; Rey Castiñeira, 1991). Detailed quantitative studies demonstrating the long-term changes at multiple inland sites in the region are absent.

This situation reveals a research gap concerning ceramic consumption in inland areas that our study will address. We aim to illustrate the emergence of exposure to non-local ceramics in the 1st century BCE, changes in this exposure up to the second century AD, and how it influenced local ceramic material culture practices. This is made possible thanks to a quantitative data analysis of 150,239 pottery sherds from carefully studied contexts at four inland sites (Fig. 1b) that are key to understanding the Iron Age to Roman transition in the northwestern Iberian Peninsula: O Castelo de Laias (Laias), San Cibrán de Las (Las), Castromao, and A Cibdá de Armea (Armea) (Rodríguez Nóvoa, 2020). These sites are located in an inland area that developed distinct and remarkable material cultural characteristics (Álvarez González, 2019; Rey Castiñeira, 2014), located in the middle basin of the Minho river (Fig. 1), which is considered to have acted as a communication channel in the region (Fernández Fernández, 2014; Naveiro López, 1991). Our data analysis is tightly focused on three key questions in current debates:

1. How can a detailed quantitative analysis of ceramic data enhance the dating of the sites?
2. What degree of continuity from Iron Age to Roman times is reflected in ceramic material, and what was the impact of Roman pottery on local ceramic traditions?
3. What was the degree of integration with the Roman world of inland sites in the region, as reflected in non-local goods?

Addressing these will allow us to revisit and significantly refine previous qualitative analyses of this material, and to identify long-term trends or patterns that could reflect the political, cultural, and economic change that is supposed to have happened since the 1st-century BCE.

2. Material and methods

2.1. Sites and ceramic data

This study includes 150,239 pottery sherds from four of the main sites in the study area (Fig. 1) occupied between 50 BC and AD 100, all of them located in the middle of the Minho river basin (Galicia, NW Spain): O Castelo de Laias, San Cibrán de Las, Castromao, and A Cibdá de Armea. These sites were chosen based on their key position in the area, the frequency of references to them in archaeological literature on the region, and the possibility to carry out a direct study of the pottery

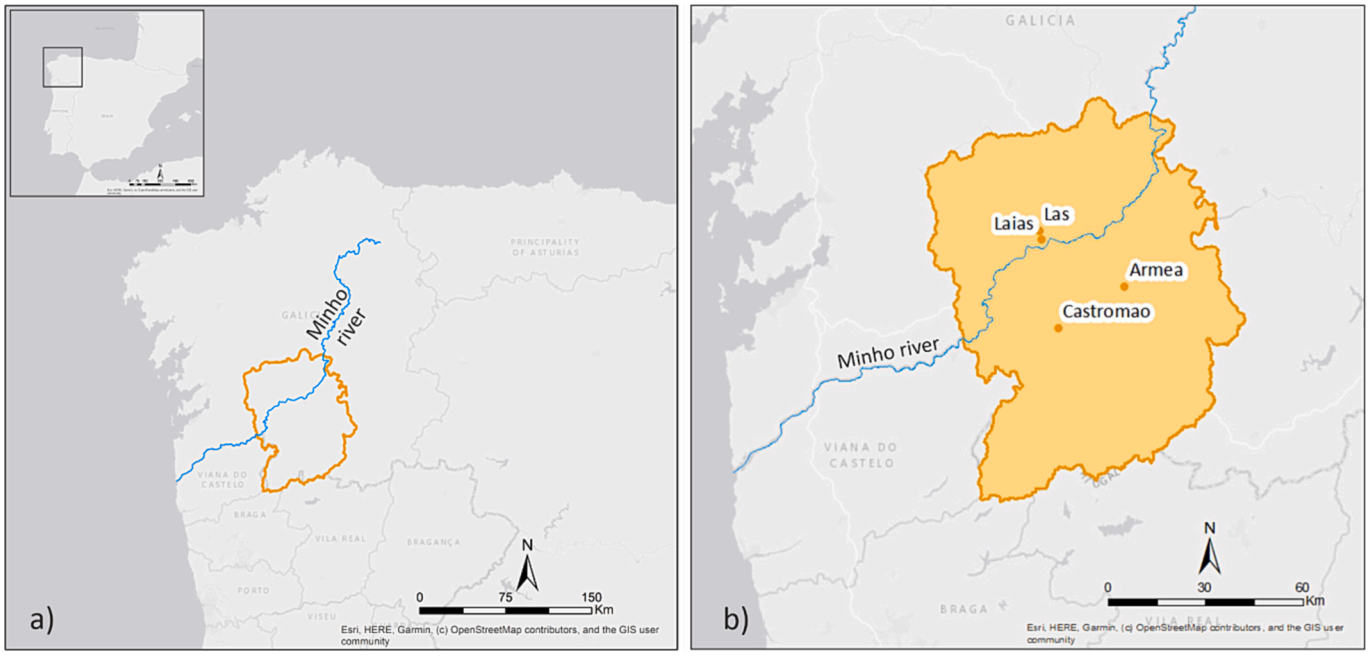

Fig. 1. A) Research area in the middle minho river basin. b) sites studied in this paper.

fragments in the museum stores (Museo Arqueolóxico Provincial de Ourense).

Laias (Álvarez González and López González, 2000; Cepas et al., 1999; Rodríguez Nóvoa, 2017; Tereso et al., 2013) (Fig. 2a) is a site located on a hillside overlooking the Barbantes river. It is organised in terraces, where houses and productive spaces (maybe related to mining) were found. On the top of the hill, there is an enclosure with a zig-zag entrance with several spaces, probably for grain storage. 14C dating has offered a wide range of dates between the 10th century BCE and the 3rd century CE (Tereso et al., 2013: Table 1). San Cibrán de Las (Pérez Outeiriño, 1987; Prieto Martínez et al., 2017; Rodríguez Cao et al., 1993) (Fig. 2b) is surrounded by an enclosure and occupies more than 10 ha. Houses, storage, and other buildings are separated into quarters by straight streets. At the top, there is a nearly empty space with a second enclosure. Inscriptions, stone ornaments, and a very rich set of materials were recovered in several excavations since the beginning of the 20th century. Radiocarbon dating suggested that this site has been frequented between 7th century BCE and 8th century CE, but inhabited mainly between 1st century BCE and 4th century CE (Prieto Martínez et al., 2017, pp. 402–405), although these dates are under discussion (Rodríguez Nóvoa, 2020, pp. 655). Castromao (Fariña Busto, 1980; Ferro Couselo and Lourenzo Fernández, 1976; García Rollán, 2004; Nieto Muñiz et al., 2005; Orero Grandal, 1994) (Fig. 2c) has an area of 2 ha in a plateau between the granite outcrops, and, similar to San Cibrán, presents some internal organization in quarters. It might have been founded around the 4th century BCE but continued to be occupied in Roman times. Armea (Conde-Valvís Fernández, 1959; Fernández Fernández and Pérez Losada, 2017; Lago Cerviño et al., 2022; Valle Abad et al., 2020) (Fig. 2d) is a Roman rural settlement founded around the turn of the Era and inhabited at least until the end of the 2nd century CE. This site has Roman type houses or *atrium* houses and stone paved streets.

These sites have been mainly dated based on their internal structure and the type of settlement, and more recently through a large-scale radiocarbon dating program including Laias and San Cibrán de Las (Prieto Martínez et al., 2017; Tereso et al., 2013). However, three of the sites (Laias, San Cibrán, and Castromao) had not been studied in a contextual way until this current study, comparing and crossing data provided by the structures, stratigraphy, archaeological materials (specially pottery) and radiocarbon dates. This kind of study could provide more accurate conclusions to date the different phases of occupation for each site.

This study uses a contextual approach, understanding context as a group of materials that share the same stratigraphical meaning: for example, whether it is associated with a construction, occupation, or destruction phase at the site. We created a table for each context which compiles and specifies all rims, necks, walls, handles, and bases identified and the count of the minimal number of individuals or vessels (MNI/MNV) and the number of typological individuals or vessels (TNI/TNV) (see Rodríguez Nóvoa, 2020, appendices). Ceramic quantification is challenging and there are several methods to quantify vessels from sherds (for a summary see Adroher Auroux et al., 2016, 88–94). Here we work with MNI and TNI as defined by Arcelin and Tuffreau-Libre (1998), because of their wider use. MNI is an estimation of the minimum number of complete vessels represented by the rims in each context. The final number is the highest value obtained after attempting unions. TNI follows the Beauvray protocol and is a quantification based on the different rims, bases or other fragments of the same type that remain after attempting any union.

In this paper we primarily use the MNI number for our data analysis, since it is the current ceramology standard in the study area. The difference between using the MNI or TNI quantification methods on the creation of data analysis results is assessed below (Fig. 4). Our contextual approach to the study of our material culture has taken into account

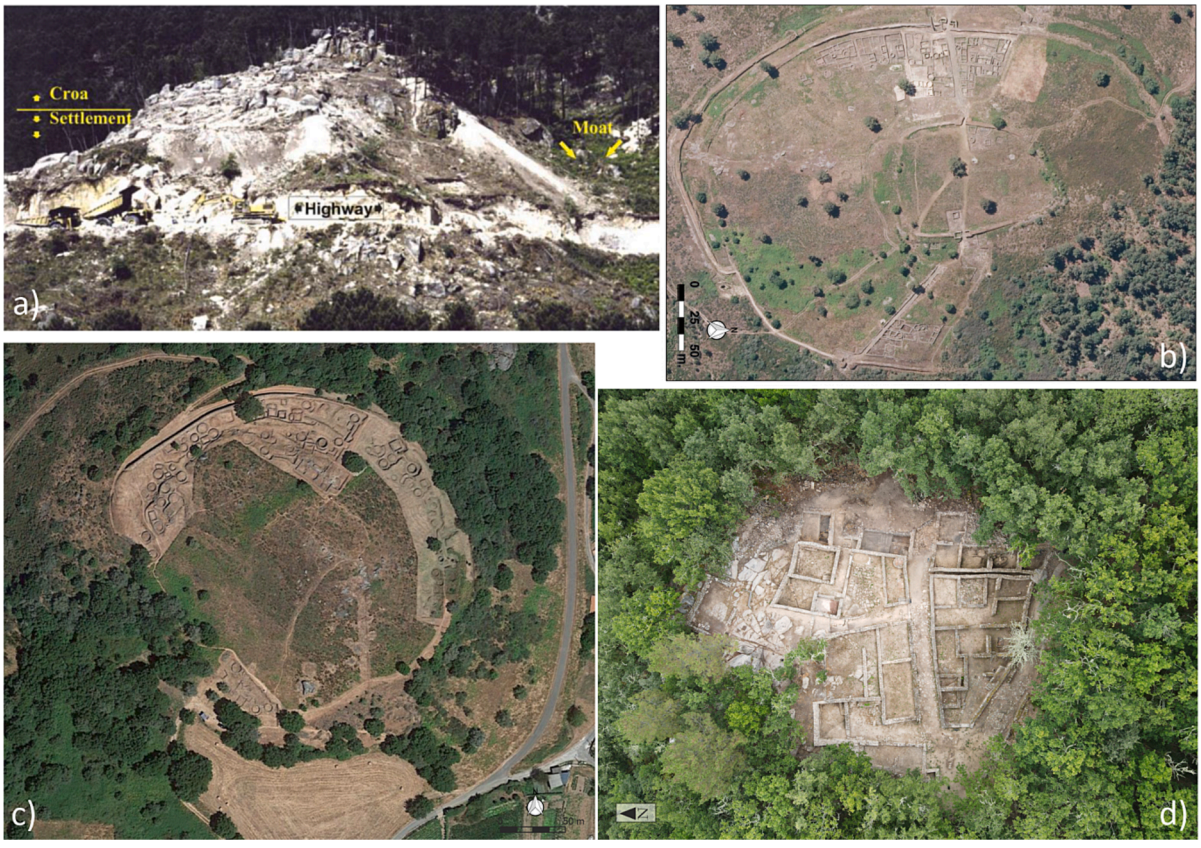

Fig. 2. A) O castelo de laias (Tereso et al., 2013:206). b) San Cibrán de Las (Google maps, modified). c) Castromao (Google maps, modified). d) Armea (Proxecto Armea).

Table 1
Example of quantification using MNI/MNV and TNI/TNV.

Site	Origin	Type	Total	Compl	Rim	Neck	Handle	Body	Base	MNI	TNI
Laias	Local	Pot	239	–	209	4	4	19	3	209	218

any element that can potentially date the site or a specific phase of the site. In the quantification table, a chronological starting and ending date has been assigned to each combination of pottery origin and form, based on two sources: typo-chronological reference works and stratigraphical context. The final dates are thus informed by both production (typologies) and consumption (contexts). Traditional typo-chronological dates at the original ceramics workshops are first derived from reference books commonly used by pottery specialists, such as Morel (1981) for black-glazed productionswares, Oxé et al. (2000) for Italian *terra sigillata* or (2007) for South Gaulish *terra sigillata* (Genin, 2007). These production-based date ranges are subsequently narrowed by the *terminus ante-quem* of the contexts within which they were found. We combined all of these dates to obtain the most probable range of years for each context deposition, taking into account their stratigraphical nature. Thus, context-specific ceramic consumption dates are obtained for these NW sites, which can be different from those in other sites or areas (for a more detailed description of the establishment of chronologies see Rodriguez Nóvoa 2020: 37–39). Dating sites based on their imported product consumption using this approach has helped us to get more accurate chronologies and occupation phases and gain better understanding about its history.

Our dataset has some specific features that need to be taken into account because our results could be sensitive to them and they could affect our interpretations. Access to pottery sets can be sometimes a big problem for researchers, and we cannot always study complete sets or all the pottery recovered from all the excavations for a site. In our research, we have been given access to all the sherds from San Cibrán de Las, from the western and eastern quarters. Table 2 reveals that the number of sherds and objects from this site is much higher than that at the other sites. In Laias, five excavation areas were included. The ceramics data for Armea has been excavated by two of the authors (AFF and ARN), so we have access to all the information for this site. In contrast, for Castromao we could only analyse a few relevant fragments from two excavations of an area in the southwestern quarter for which we have stratigraphic information, including mainly rims or identifiable sherds. The sensitivity of our results to these different sample sizes of the four sites is explored below (Fig. 3), and it is explicitly taken into account in our discussion and interpretation of the results.

2.2. Data analysis methods

To allow us to address our three research questions with our ceramics data, we developed a data analysis method that focuses on revealing changes over time of the frequency and diversity of ceramics using a probabilistic aoristic method, coded in Python, and openly available in a fully documented iPython Notebook (See online supplementary material). The notebook allows for the replication of all data analysis figures presented in this paper.

The data tables described above first published by Rodríguez Nóvoa (2020, appendices) were combined into a single.csv that includes all information including the following fields that are key to performing our queries (Table 3): 'origin_h1′ and 'origin_h2′ are used to explore provenance and imports; 'forma_h2′ is used in queries that explore the Roman inspired and Iron Age traditions, and terrestrial vs maritime amphorae patterns; 'mni' and 'tni' include the ceramic frequencies; 'start date' and 'end date' are used for revealing temporal patterning.

To identify temporal patterning in the ceramic data we use the probabilistic aoristic method (Ratcliffe, 2000) commonly used for archaeological ceramic data analysis (Crema, 2012; Johnson, 2004; Roberts et al., 2012) and previously applied to Roman era ceramics (Bes, 2015; Carrignon et al., 2020; Fentress et al., 2004). For each ceramic entry with a unique 'form', 'start date' and 'end date' combination (i.e. each row in the spreadsheet), we calculate the probability of the ceramics being present in one year as

$$P[t_i] = \frac{F}{\Delta^\circ C} \tag{1}$$

where t_i is the portion of time in question (in our case one year), F is the frequency of the ceramics (in our study we mainly use MNI, but we also compare with TNI), and $\Delta^\circ C$ is the duration of the timespan between the type's start date and the end date. For each year t_i, we add up the probabilistic ceramic frequency values of ceramics where t_i lies in the range between their start date and end date. This results in a probabilistic ceramic frequency value per year of the ceramics relevant to answering the query in question, which we represent as a linegraph where the x-axis represents time and the y-axis represents the summed probabilistic ceramic frequency. In addition, we also present similar linegraphs where the y-axis represents the count of unique ceramic categories (field 'class', Fig. 10) or specific product origins (field 'production', Fig. 11) that are either present or absent at a site.

3. Results

Our data analysis method allows us to evaluate the impact of the differential ceramic sample size of sites and of the ceramic quantification method used ('tmi' vs 'mni'). Moreover, we identified seven key observations that allow us to address our research questions:

1. Imports are present at inland sites from the middle of the 1st century BCE
2. Two profiles of import consumption can be distinguished
3. The three main import origins show different temporal consumption patterns
4. Diversity through time in ceramic categories imported
5. Diversity through time in ceramic type diversity
6. Our ceramic data analysis allows more detailed site dating
7. Clear temporal trends in Roman influence on Iron Age ceramic tradition

We present these data analysis results briefly in turn here and discuss them within their archaeological and historical context in the next section.

Table 2
Summary of the data (for all data used, see supplementary material).

Site	Contexts	Sherds	Complete	Rims	Handles	Neck/Body sherds	Bases	MNI	TNI
Laias	1 to 7	41.444	43	2.661	59	37.350	868	**2.733**	**2.763**
Las	8 to 19	100.024	26	5.015	304	93.100	1.579	**5.143**	**5.022**
Castromao	20 to 23	396	11	183	24	128	50	**209**	**249**
Armea	24 to 29	8.844	4	953	68	7.387	429	**1.016**	**938**

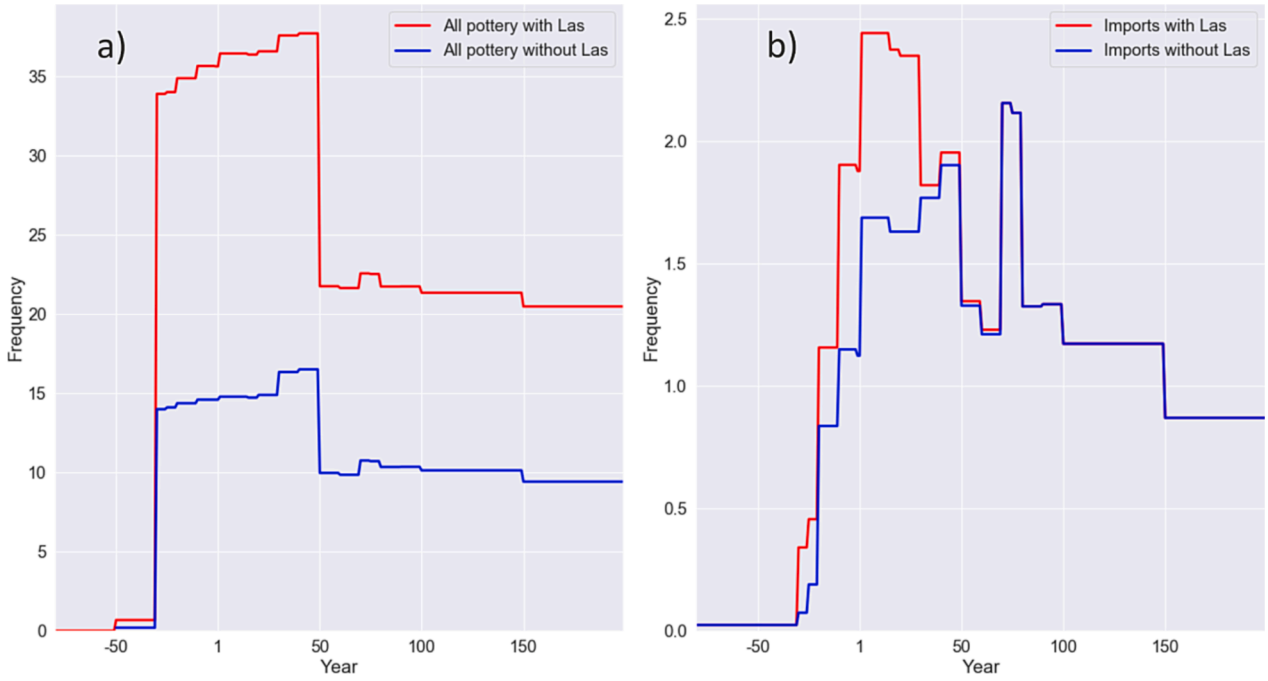

Fig. 3. A) Comparison of the MNI per year between the entire dataset [n = 150239 sherds; 9101 MNI] (red) and without San Cibrán de Las [n = 50215 sherds; 3958 MNI] (blue). b) Comparison of the MNI for non-local pottery per year between the entire dataset [n = 1593 sherds; 384 MNI] (red) and without San Cibrán [n = 531 sherds; 235 MNI] (blue). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

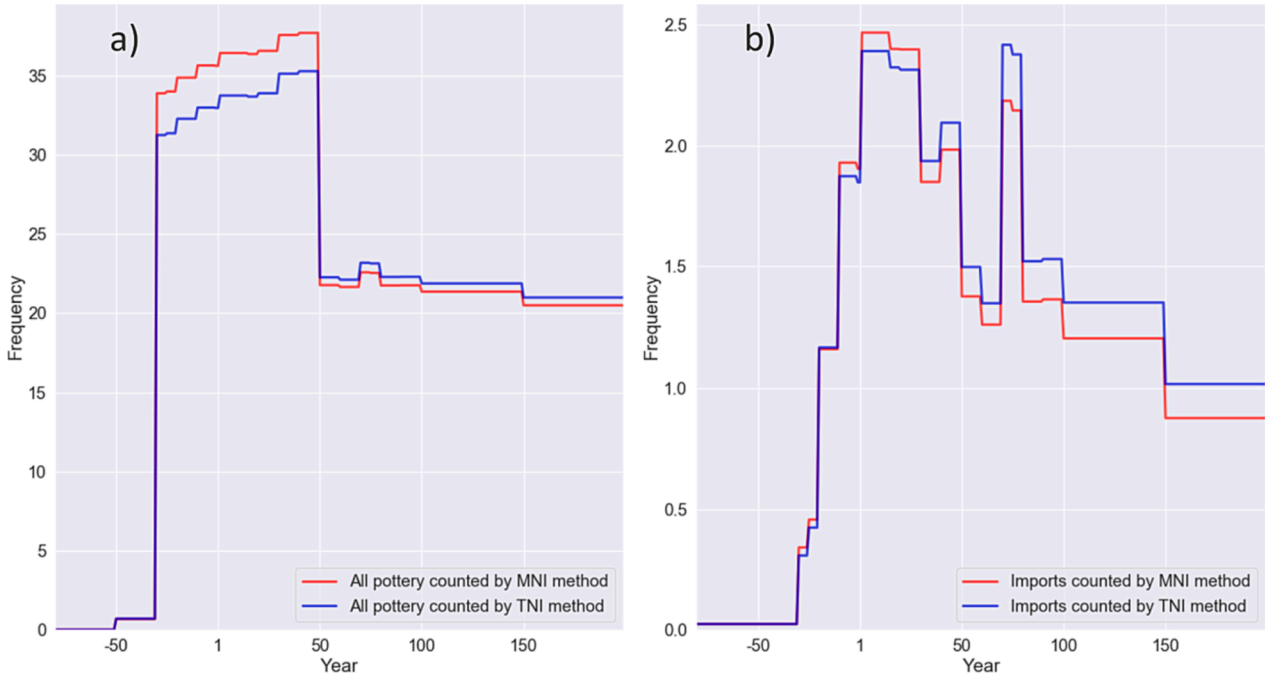

Fig. 4. A) Comparison between TNI [n = 150239 sherds; 8972 TNI] (blue) and MNI [n = 150239 sherds; 9101 MNI] (red) for local and non-local wares. b) Comparison between TNI [n = 1593 sherds; 412 TNI] (blue) and MNI [n = 1593 sherds; 384 MNI] (red) for imported goods. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Impact of site sample size: As mentioned above, San Cibrán de Las has a far higher frequency of ceramics than the other sites (Table 2). Fig. 3a shows that excluding San Cibrán de Las retains the general pattern when considering the entire dataset but, predictably, reduces it in absolute numbers. Importantly, the reduction is greatest between 50 BC - AD 50 during the site's main occupation phase (similar to Laias). Fig. 3b shows the site's impact when only considering imported materials. Their presence starts around 30 BC and the number slowly increases until AD 50, but the San Cibrán materials reveal a huge peak in this period which is not shared by the other sites' assemblages. The pattern is not affected as much in the peak of the second quarter of the 1st century, because this phase is better represented in Armea or Castromao. These results reveal the importance of San Cibrán to illustrate the first phases of Roman trade in the region, whilst the general pattern is less sensitive to the frequency

Table 3
Description of fields in the input data used.

Field name	Type	Description
id	integer	unique identifier for each entry
site	text	site at which the ceramic entry was excavated
context	integer	excavation context within which the ceramic entry was found
class	text	either anfora (amphora), vajilla fina (fineware), ceramica comun (common ware), lucerna (lamp)
production	text	[cf. product/ware] specific production; it could refer to a spatial origin and/or a specific type of pottery. E.g. Ts = terra sigillata; ITS = Italian terra sigillata; HTS = Hispanic terra sigillata; SGTS = south Gaulish terra sigillata; barniz negro itálico = black-slipped wares from the Italic Peninsula; paredes finas emeritenses = thin walled pottery from Emerita Agusta, …
origin_h1	text	spatial origin of workshops, hierarchy 1: e.g. Italy, Iberian Peninsula, …
origin_h2	text	spatial origin of workshops, hierarchy 2: e.g. Baetica, local, Arezzo
form	text	specific shape or type of each fragment. For "class" = "ceramica comun" the could be olla (pot), plato (dish), vaso cilíndrico (cylindrical vessel), jarra (jar), …; for "class" = "amphorae"= Ovoide 4, Haltern 70, …; for "class"= "fineware"= Consp. 21, Drag. 15/17, Drag. 27, Hisp. 4, Hips. 29, Hisp. 37…
form_h2	text	shape or typology based categorization used in the querries. For "class" = "ceramica comun" the values can be either "Roman inspired", "both", "iron age" or blank; for "class" = "anfora" the values can be either "maritime" or "terrestrial"; for "class" = "vajilla fina" the values can be either "plato", "copa", "tapadera" or "jarra"
total fragments	integer	total number of sherds for a specific class and form for each context
complete	integer	total number of complete profiles for a specific class and form for each context
rims	integer	total number of rims for a specific class and form for each context
necks	integer	total number of necks for a specific class and form for each context
handles	integer	total number of handles for a specific class and form for each context
body sherds	integer	total number of walls for a specific class and form for each context
bases	integer	total number of bases for a specific class and form for each context
mni	integer	minimal number of individuals for a specific class and form for each context
tni	integer	typological number of individuals for a specific class and form for each context
start_date	integer	start date of production/consumption for each type
end_date	integer	final date of production/consumption for each type

of San Cibrán.

Impact of ceramic quantification method: We have used two methods to count individuals in the creation of the dataset, TNI and MNI. We used MNI in our analyses because it is the most used among pottery researchers. However, the number of individuals obtained by each method are not very different and the results reveal that general patterns are not very affected (here illustrated for all pottery in Fig. 4a and only imported materials in Fig. 4b).

3.1. Imports at inland sites

Our results provide the first quantitative confirmation that the inland middle Minho river basin received imported products at least since the middle of the 1st century BCE, with numbers increasing over the 1st and 2nd centuries AD (Fig. 3b and 4b and Fig. 15). Despite the number of individuals being low (***n* = *384 MNI***), there is a remarkable diversity of types identified at these sites.

3.2. Differences in import consumption between sites

Two different consumption patterns of imports can be distinguished, probably related to the dating of the sites (Fig. 5):

- **Pattern 1** (Las and Laias): A higher number of imported products between 50 BC and AD 50. San Cibrán de Las knew a remarkable presence of imported products but we have to remember that more sherds were studied for this site. Nearby Laias presents a similar pattern.
- **Pattern 2** (Armea and Castromao): A lower number of imported products between 30 BC and AD 70, and an explosion of Roman trade from the end of the 1st century CE.

3.3. Different origins of imports

There are three main geographical origins of the imported products (Fig. 6). The highest numbers of imports are from Hispania, beginning around 80 BC (amphora type Ovoid 4) and continuing in the 1st and 2nd centuries (hispanic *terra sigillata [HTS]*). The Italic products are present in the few decades before and after the year AD 1, and just one Italic Roman amphora was found. Gaulish imports are recorded for a very specific period: the middle and end of the 1st century BCE.

3.4. Diversity in ceramic categories

Imports from these different regions also reveal diversity in ceramic categories (Fig. 7a): Gaulish ceramics are exclusively fine wares; Italian ceramics are mainly fine wares (although there are some lamps, common wares, and one amphora type); Iberian ceramics started with amphorae and common wares, then fine wares and lamps in the 1st century CE, and only common wares and fine wares from the end of the century. Fine wares and amphorae are the first imported goods reaching inland sites in the Late Iron Age (Fig. 7b). Finewares continue being consumed in the first and second centuries AD, but amphorae consumption decreases in the middle/late first century. Common wares show a similar pattern. Lamps were documented in very small numbers, but mainly appear in contexts dated around the turn of the Era.

3.5. Ceramic type diversity

Exploring workshop areas in more detail (Figs. 8 and 9), Baetican workshop both from the coast and the Guadalquivir valley seem to be the main suppliers of the NW sites, also with a high variety of forms (e.g. Amphorae Haltern 70, Dressel 7–11 and Ovoid 4, and common wares like pots, jars, or mortars). The other relevant Iberian product is Hispanic *terra sigillata* from Tricio with several forms, especially in Armea, but the most common forms are Drag. 15/17, Drag. 27 or Drag 29 and/or 37. From the mid-1st century CE, workshops at conventus capitals (Lucus Agusti, Bracara Augusta, and Emerita Augusta) were distributing their products (pots, jars, and dishes, red-slipped or not) all over the northwest, including Armea or Castromao. From Italy, there is mainly Italian *terra sigillata* [ITS] from Arezzo and other workshops. There are also fragments from Campania (black-glazed fine and red-slipped wares among the common wares), Etruria (fine wares), and Lipari (amphorae). Gaulish materials are only south-gaulish *terra sigillata* [SGTS] sherds from La Graufesenque, with the most common forms represented (Drag. 15/17 or Drag. 27).

3.6. Refinement of site dating

Laias: the earliest dates based on imports are around 30 BC, with the highest numbers around the turn of the era and AD 50 (Fig. 10). This could be the main phase of occupation of the site, at least for the studied contexts. There are a few materials that can indicate the site was occupied through the first century, but if we look at the small amount of

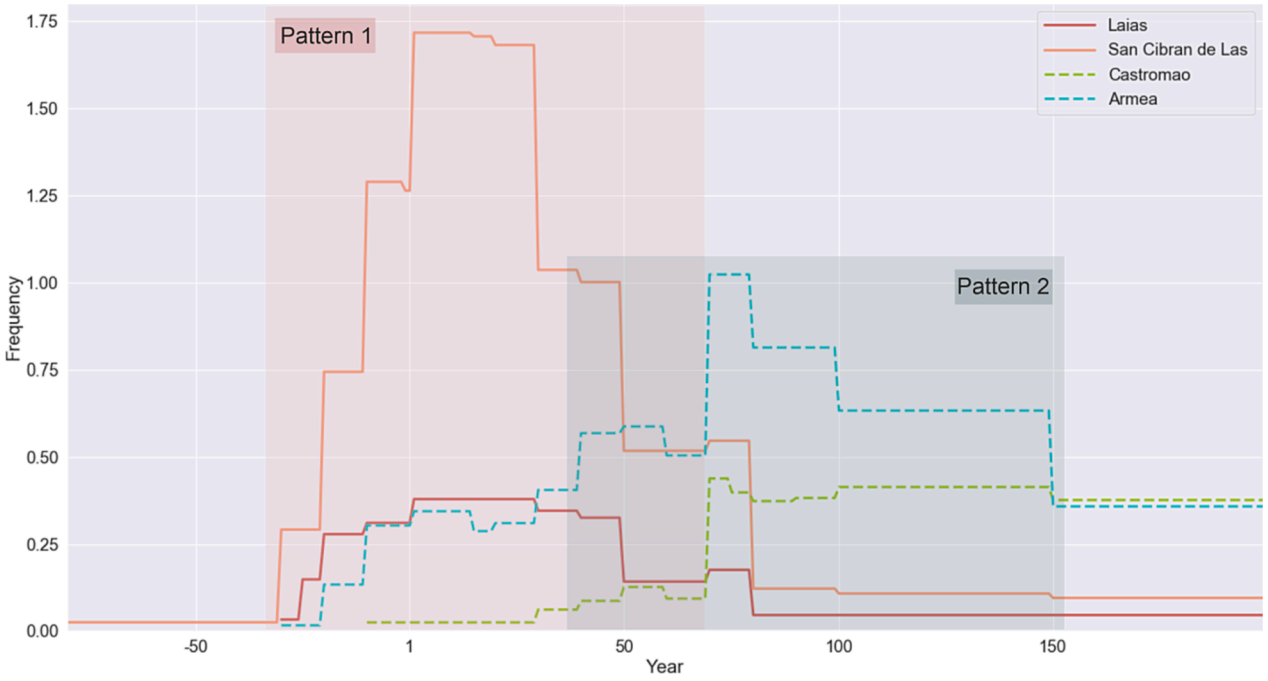

Fig. 5. Frequency of imported products per year per site [n Laias = 103 sherds; 35 MNI; n Las = 1062 sherds; 149 MNI; n Castromao = 106 sherds; 57 MNI; n Armea = 322 sherds; 143 MNI].

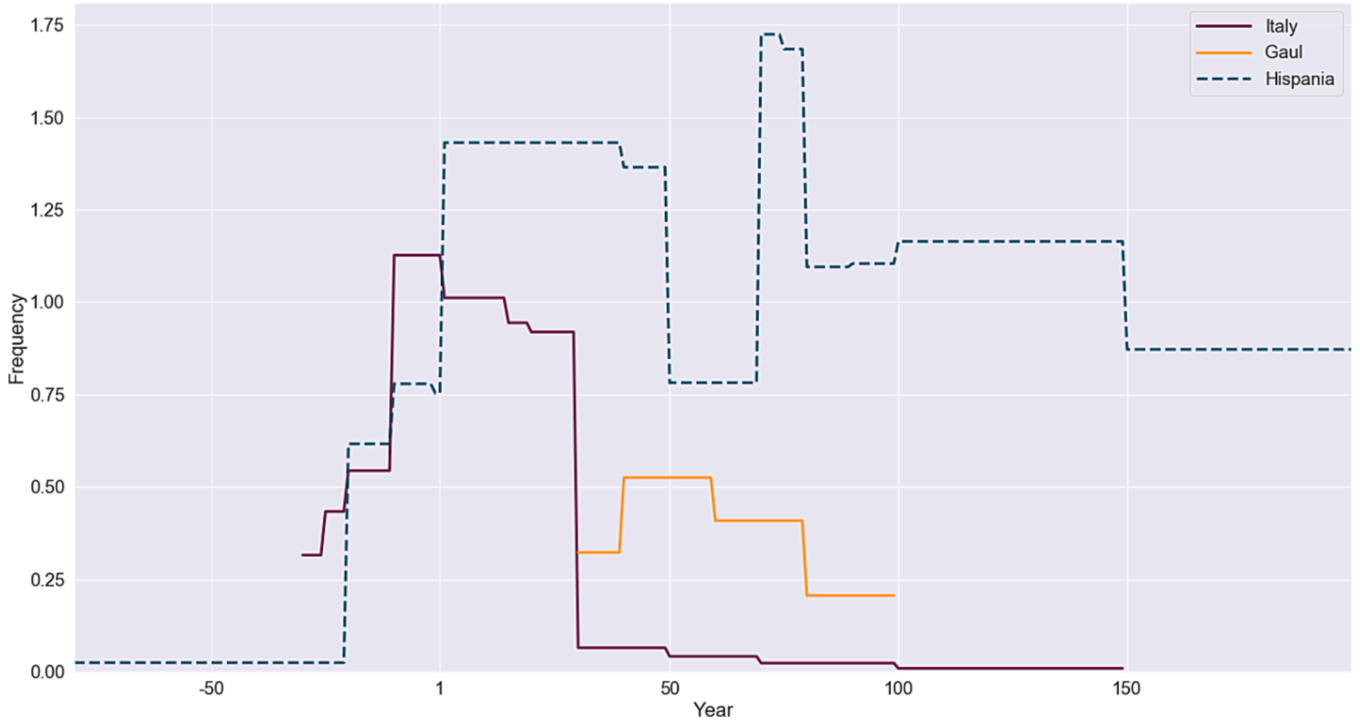

Fig. 6. Frequency of imported products per origin. Includes sherds with known origin but of unknown type [n Italy = 72 sherds; 54 MNI; n Gaul = 60 sherds; 26 MNI; n Hispania = 1355 sherds; 245 MNI].

Hispanic *terra sigillata*, for example, this could suggest an abandonment at the end of the 1st century (AD 80–90). **San Cibrán de Las**: a similar pattern to Laias, the earliest phases may represent its founding around the late/mid-1st century BCE, and Hispanic *terra sigillata* reflects occupation from the late 1st century BCE to early 2nd century CE. **Castromao**: imported materials dated from 30/20 BC, but a rise in the number of materials dated around AD 50–70 with continued occupation up to the 2nd century judging by the imported pottery (Hispanic *terra sigillata* but also Lucus and Bracara common wares). **Armea**: imported ceramics and glass since the end of the first century BC, increasing progressively through the beginning and middle of the first century AD (South Gaulish or Hispanic *terra sigillata*), continuing through the 2nd century CE.

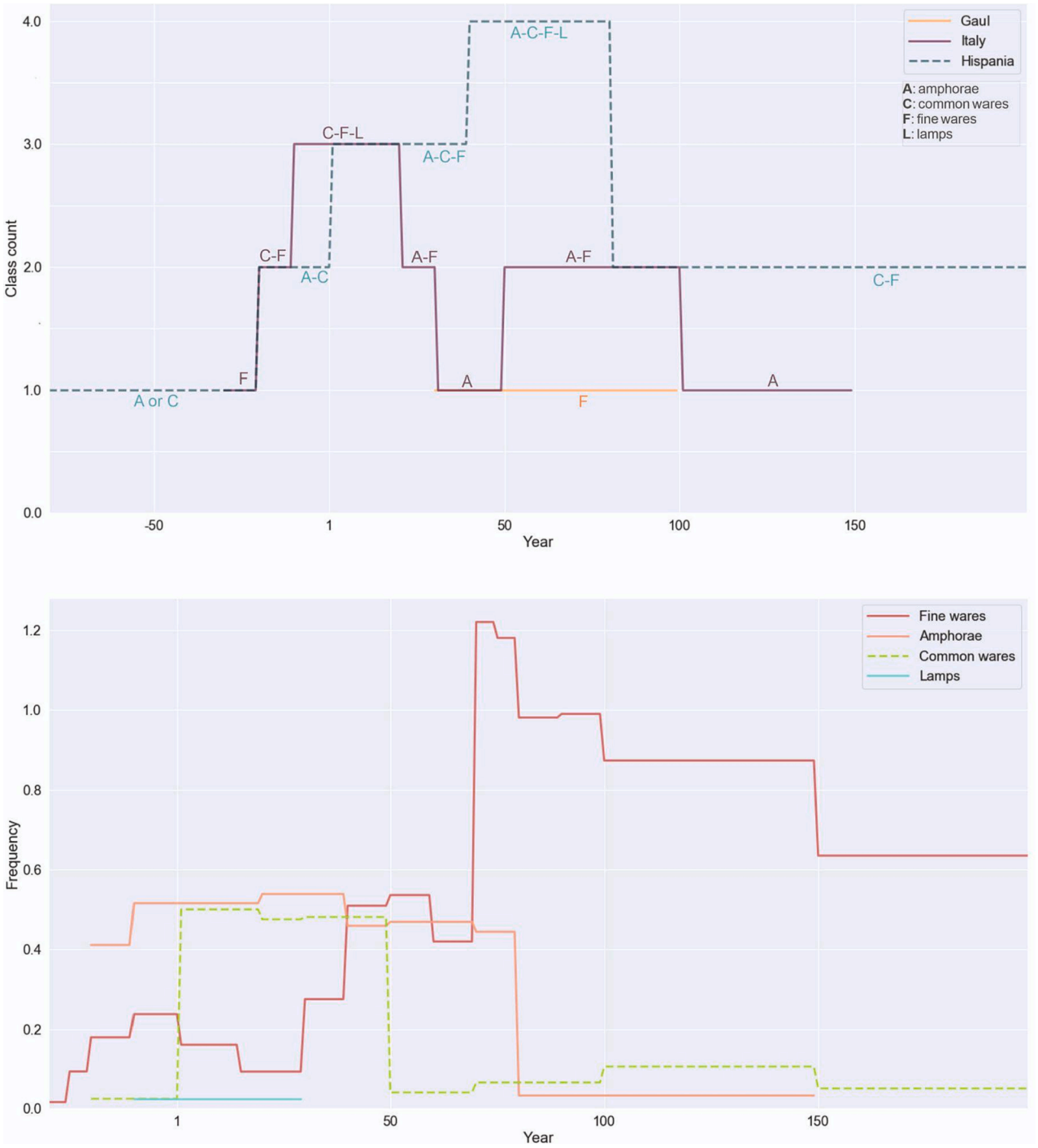

Fig. 7. 7a) Count of unique categories per origin [n Italy = 72 sherds; 54 MNI; n Gaul = 60 sherds; 26 MNI; n Hispania = 1355 sherds; 245 MNI]; 7b) Frequency of imported products per class [n Italy = 72 sherds; 54 MNI; n Gaul = 60 sherds; 26 MNI; n Hispania = 1355 sherds; 245 MNI].

3.7. Iron Age traditions and Roman influence

The diversity of unique forms from workshops in the region reveals a slow increase at the end of the 1st century BCE (Fig. 11). By the first third of the 1st century, local potters start to copy Roman type common wares, especially open forms (dishes, mortars, bowls) but also liquid-related forms such as vessels for drinking and jugs with several profiles, and flat-bottom amphorae (Fig. 12). So we can see a peak in diversity at this moment (Fig. 11). From around AD 50, the diversity starts to decrease, Iron age forms are not produced anymore although some of them could remain in use (e.g. cylindrical vessels, Rodríguez Nóvoa et al., 2022). By this time local products have evolved: they are a mix between useful Iron Age vessels and copies or inspirations of Roman common wares. Some other forms cannot be assigned to the Iron Age or Roman traditions (e.g. pots which evolved over time without major variations we can assign to Roman influence).

4. Discussion

These data analysis results contribute to our understanding of the research area and the Iron Age to Roman transition in three key ways:

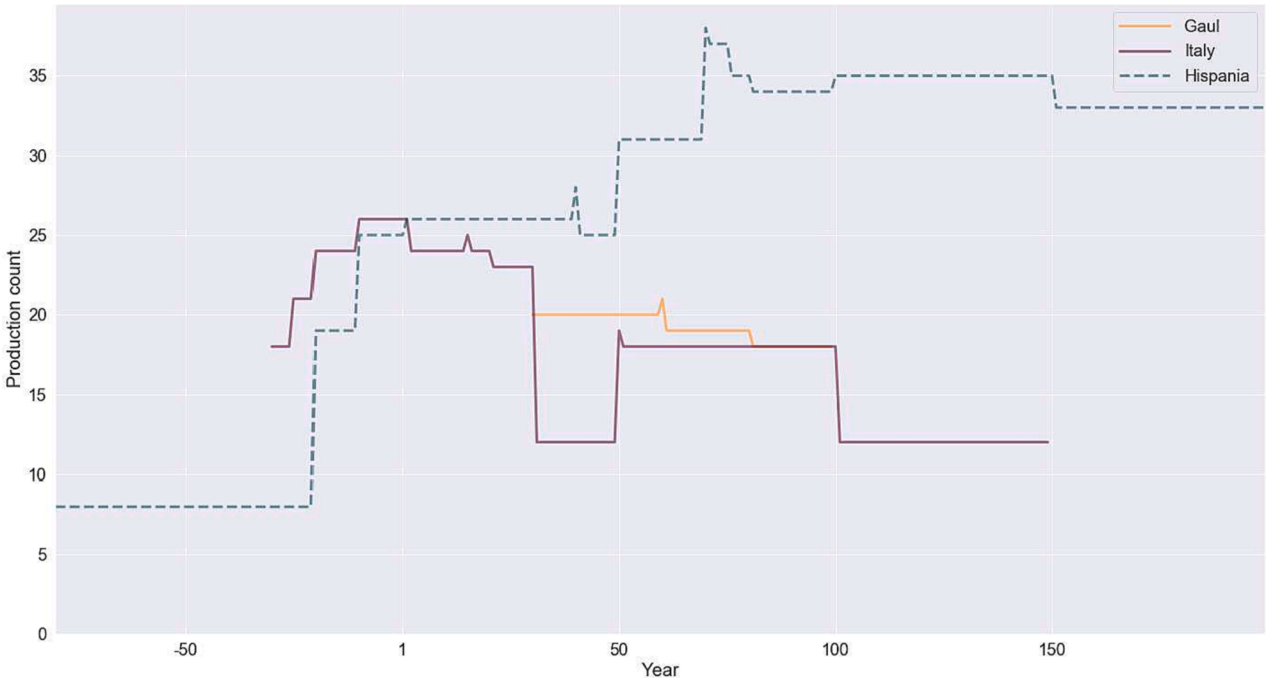

Fig. 8. Count of unique forms per origin [n Italy = 72 sherds; 54 MNI; n Gaul = 60 sherds; 26 MNI; n Hispania = 1355 sherds; 245 MNI].

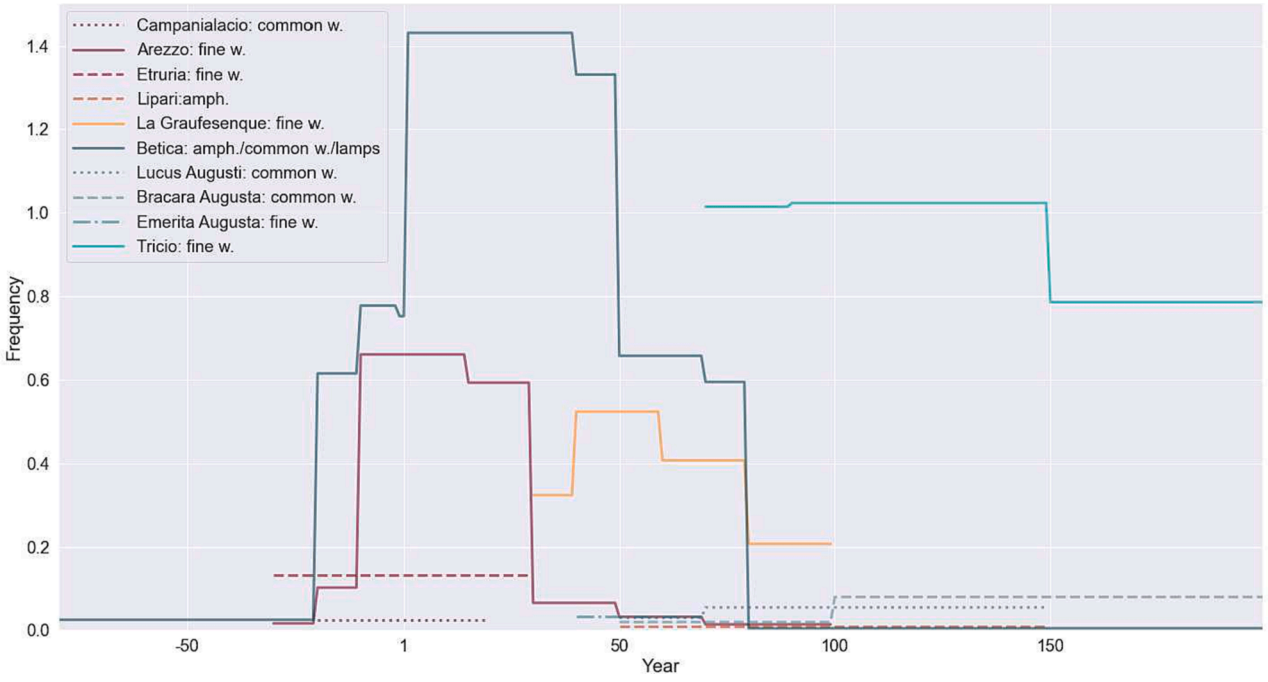

Fig. 9. Frequency per origin_h2 [n CampaniaLacio = 1 sherd; 1 MNI; n Arezzo = 44 sherds; 29 MNI; n Etruria = 8 sherds; 8 MNI; n Lipari = 1 sherd; 1 MNI; n La Graufesenque = 60 sherds; 26 MNI; n Betica = 1082 sherds; 106 MNI; n Lucus = 16 sherd; 5 MNI; n Bracara = 13 sherds; 9 MNI; n Emerita = 1 sherds; 1 MNI; n Tricio = 240 sherds; 121 MNI].

(1) A contextual quantitative analysis of both local and imported ceramic data can enhance the dating of the sites, and our understanding of the Iron Age to Roman transition.
(2) Gradual changes in local common wares and amphorae from Iron Age traditions to Roman-inspired forms reflect changing food consumption and manufacture behaviours.
(3) Ceramic evidence for the exposure to Roman material culture at inland settlements reflect very gradual but increasing integration with the Roman world and correlates with known events from textual sources: Caesar's campaign, the Augustan Cantabrian wars, and the Flavian reforms.

4.1. *Quantified ceramics reveal complex site occupation and dating*

Our results based on a quantified contextual study of all ceramics allow us to revise and refine the traditional dating of these sites and propose new dates derived mainly from consumption dates of non-local

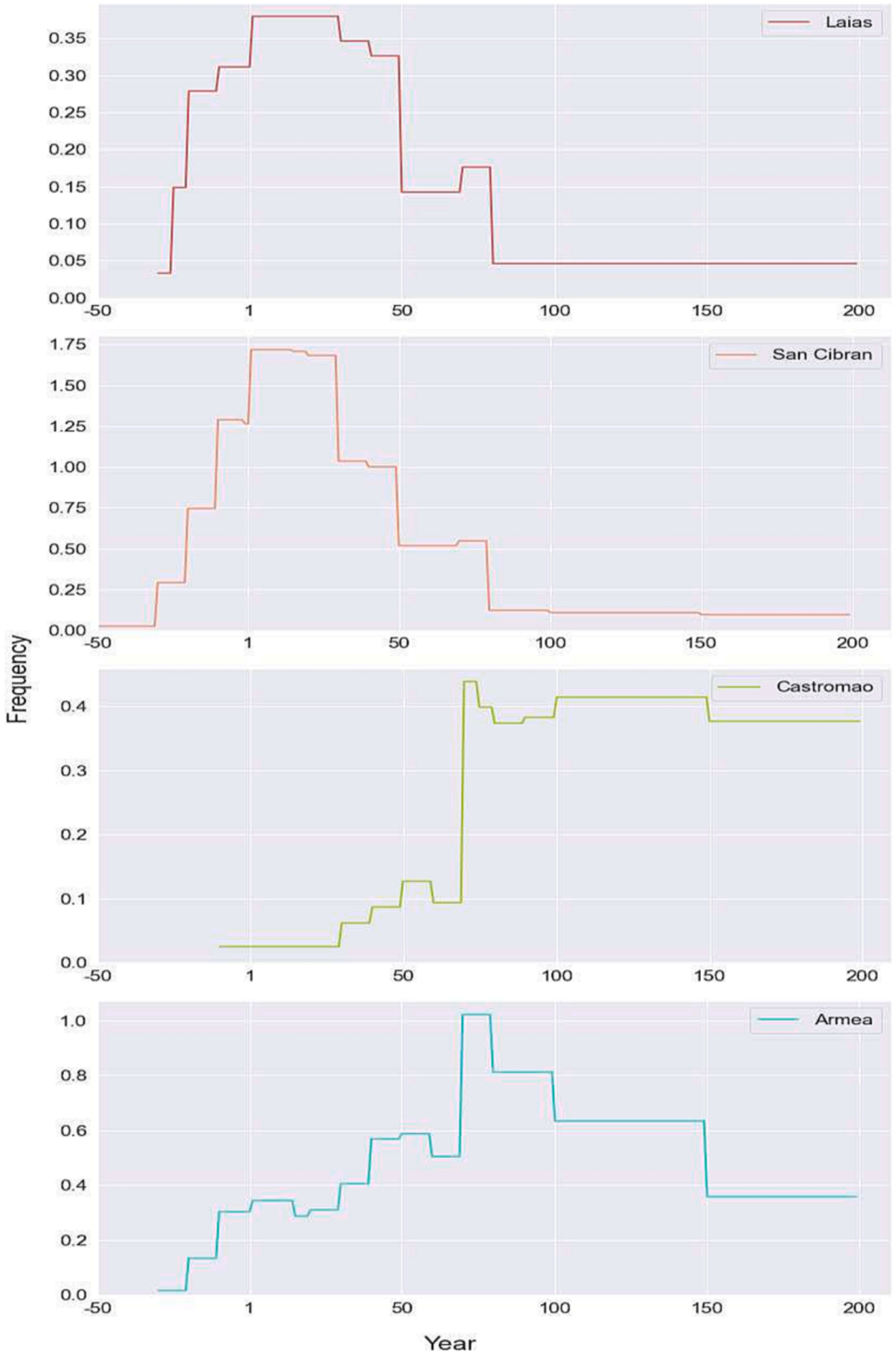

Fig. 10. Frequency of imported goods per year in a) O Castelo de Laias [n = 103 sherds; 35 MNI], b) San Cibrán de Las [n = 1062 sherds; 142 MNI], c) Castromao [n = 106 sherds; 57 MNI] and d) Armea [n = 322 sherds; 143 MNI].

pottery (informed by reference books as mention above), as well as more recent C14 dating. Laias and Las were occupied between the middle 1st century BCE and the middle to late 1st century CE; Castromao and Armea in contrast remained occupied from the end of the 1st century BCE to the 3rd century CE (Fig. 10). Crucially, counting the frequency of Roman-inspired *local* produced forms in addition to imported forms reveals clear temporal patterning, in particular the active manufacture and consumption of Roman-inspired forms in the *ex-novo* Roman foundation of Armea from the mid-1st century CE (Fig. 15). This work demonstrates that a contextual and quantitative approach to ceramics can make key contributions (complementary to C14) to the dating of inland sites that are crucial for understanding the Iron Age to Roman transition.

All four sites were traditionally dated between 50 BC and 50 AD, as they were considered comparable to most of the big hillforts of the NW (the Roman foundation Armea being originally incorrectly identified as an Iron Age hillfort). An elaborate radiocarbon dating program has recently proposed new broad dates for some of these sites (Prieto

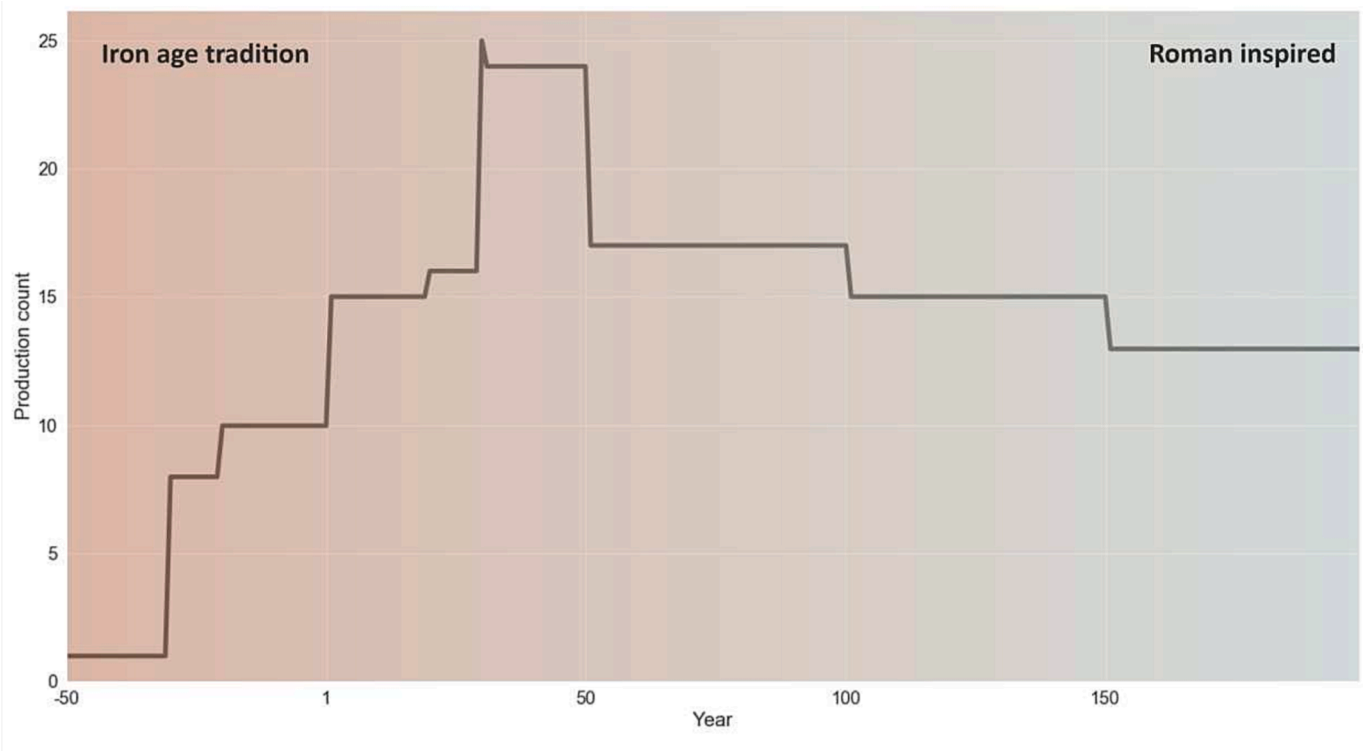

Fig. 11. Count of unique forms for the local/regional wares per year [n = 148,646 sherds; 8,717 MNI].

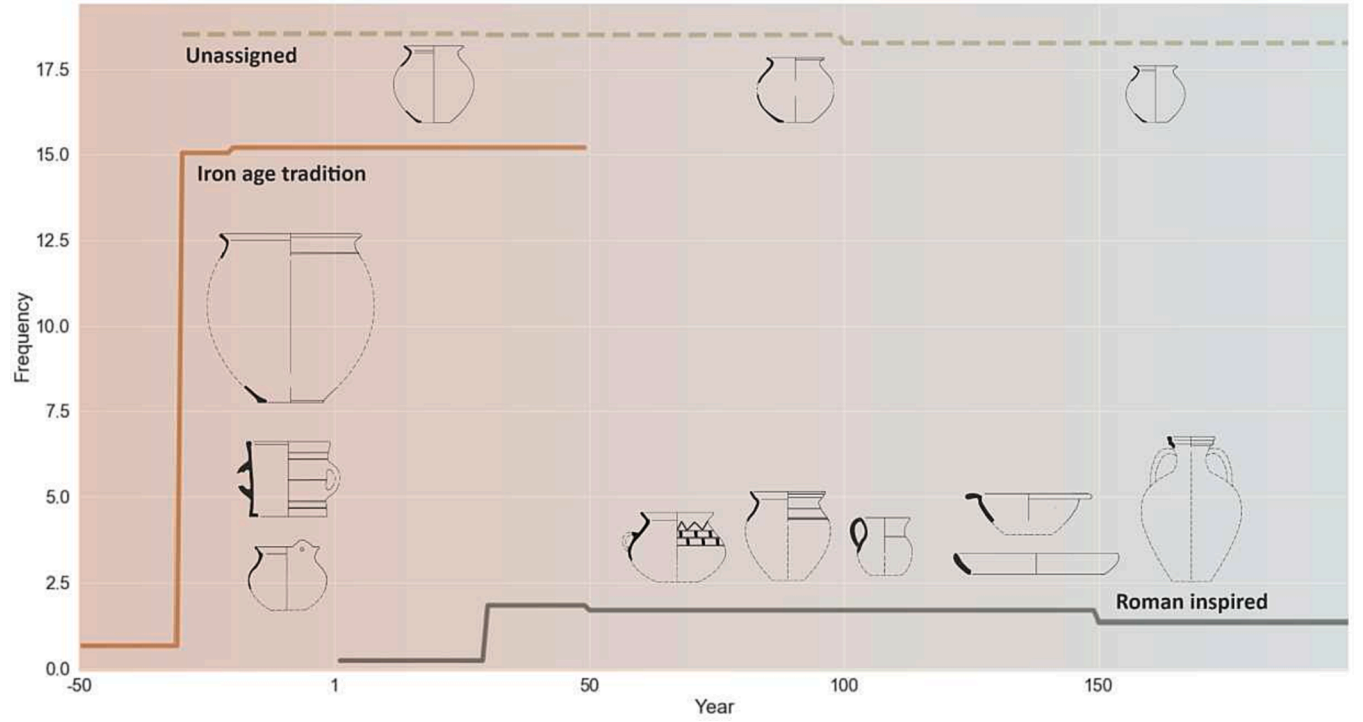

Fig. 12. Frequency per year per form per tradition [n = 148,646 sherds; 8,717 MNI]: iron age types (brown), Roman inspired forms (dark green) and unsassigned forms (dashed grey line)). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Martínez et al., 2017; Tereso et al., 2013). Several phases from the first (8th to 4th centuries BC) or the second (4th to 2nd centuries BC) Iron Age to Roman times were distinguished. Yet these phases were based exclusively on C14 dates and were not compared with archaeological contextual information.

Our study reveals a more complex reality of the occupation of these settlements through time. Laias and San Cibrán de Las present a comparable story (cf. Pattern 1, Fig. 5). It is possible that there was infrequent inhabitation of the area before the 1st century BCE, which could explain the early C14 dates. But we cannot be certain when the sites

were founded, as local and imported pottery are only indicating their development since the mid-1st century BCE. In the absence of material culture evidence, it would be very difficult to propose dates before the 1st century BCE for these inland hillforts. Both sites were certainly occupied between the end of the 1st century BCE and the beginning of the 1st century CE, and could have been important centres in their local areas (with Laias perhaps having a productive role related to mining or the storage of crops) since the few imported materials that reached the middle Minho river basin were found at these sites. Dating the abandonment of the sites is most difficult. The number of imported objects decreases from the beginning of the 1st century CE and the local pottery did not copy the Roman types in an extensive way. If these locally important sites were fully functioning in the middle or late 1st century CE, then we would expect to observe a higher quantity of South Gaulish or Hispanic *terra sigillata*, or of Lucus or Bracara common wares, as is the case for Castromao or Armea. So we propose that both sites were progressively abandoned by the second half of the 1st century CE. The pottery evidence definitely does not offer proof of inhabitants at these settlements during the early phases of the Iron Age or beyond the end of the 1st century CE.

Castromao and Armea show a later occupation pattern (cf. Pattern 2, Fig. 5). Castromao had an occupation phase at the end of the 1st century BCE, but constructions (without associated material) found under this phase suggest an earlier occupation. Although this pre-Roman site revealed some local pottery sherds from the Early and Middle Iron Age (Rey Castiñeira, 2014), its main phase of occupation should be dated between the end of the 1st century and the 2nd century CE, with a significant development under the Flavian dynasty demonstrated by a huge amount of imported objects (South Gaulish and Hispanic *terra sigillata*). In contrast to Las and Laias, Castromao remained occupied during Roman imperial times. It is probable that the site was abandoned in the 3rd century CE because no transitional or late Hispanic *terra sigillata* or other materials from this period have been identified.

Excavated materials suggest that Armea is an ex-novo Roman foundation settlement (Fernández Fernández and Rodríguez Nóvoa, 2016; Rodríguez Nóvoa et al., 2019). We cannot discard an Iron Age settlement in the area, but no evidence has been found to support this. The first phase of Armea is dated by Italic fine wares between the end of the 1st century BCE and 1st century CE. During the mid-late 1st century CE, *domus* are built and dated through South Gaulish *terra sigillata*. The importance of the site is reflected in the number of imported fine ware and glass products. The site has evidence of common Hispanic *terra sigillata* types such as Drag. 15/17, drag. 27, or Drag. 29/37, but also some rare forms like Hisp. 51 or Hisp. 92 (Rodríguez Nóvoa and Valle Abad, 2017). The site remains occupied until the late 2nd early 3rd centuries AD for the same reasons stated for Castromao. These two sites present a lot of similarities. Boosted by the Flavian urban reforms, they acquired an important role as main cities to control the territories of the *coelerni populus*, mentioned in the *tabula hospiti* signed in the year 132 CE between these people and a Roman *praefectus* (Ferro Couselo and Lorenzo Fernández, 1971).

Our results highlight the importance of not only identifying imports to date site phases, but also to correctly identify product origins and classes/forms, to quantify all of this, and to allow their context to determine plausible consumption dates. For example, finding a Hispanic *terra sigillata* sherd does not necessarily mean that the site was inhabited until its production ceased in the end of the 2nd century CE or the beginning of the 3rd century CE: using contextual ceramic consumption dates will lead to different results as we demonstrated here (Fig. 13). The frequency of the appearance of Roman inspired local produced forms is equally crucials to help date the sites (Fig. 14).

4.2. Gradual changes in local ceramics reflect changing food consumption practices

Our results demonstrate gradual long-term changes in local ceramic production and consumption patterns for everyday use, with the availability of new Roman-inspired forms reflecting a change in food preparation and consumption behaviour in this inland region (Figs. 11-12). Locally produced forms that were identified and dated based on contextual information between 50 BC and AD 150/200, show an increase in the diversity of the catalogue of locally produced forms and new forms copied from Roman common ware sets (Fig. 11).

The catalogue of open forms includes mortars to crush and mix elements (Rodríguez Nóvoa, 2020, pp. 593–594), inspired maybe on Baetican or Italian Roman shapes, as well as dishes for individual food consumption (Rodríguez Nóvoa, 2020, pp. 584–594), very similar to

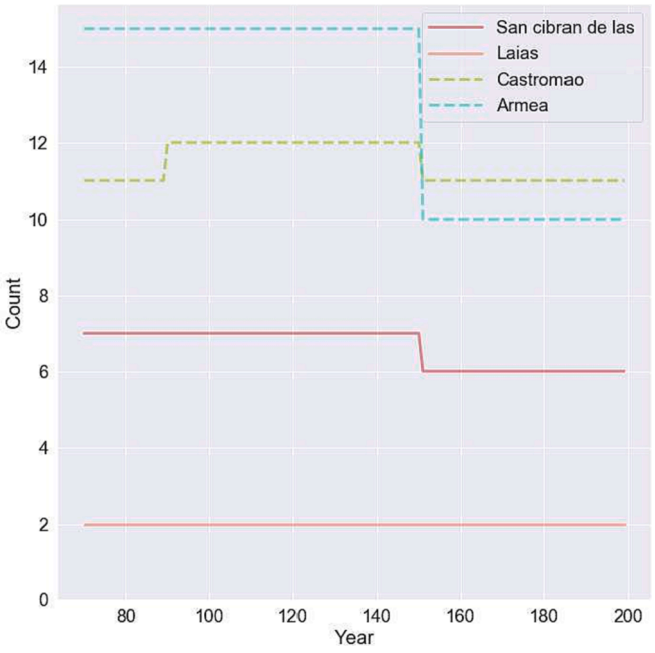

Fig. 13. Frequency of Hispanic *terra sigillata* individuals per site [n = 240 sherds; 121 MNI].

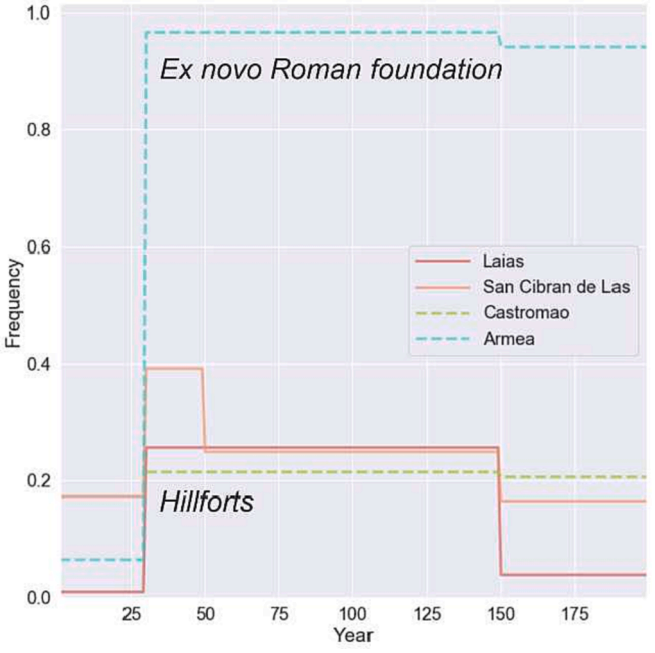

Fig. 14. Frequency per form: Roman inspired local forms per site [n = 423 sherds; 280 MNI].

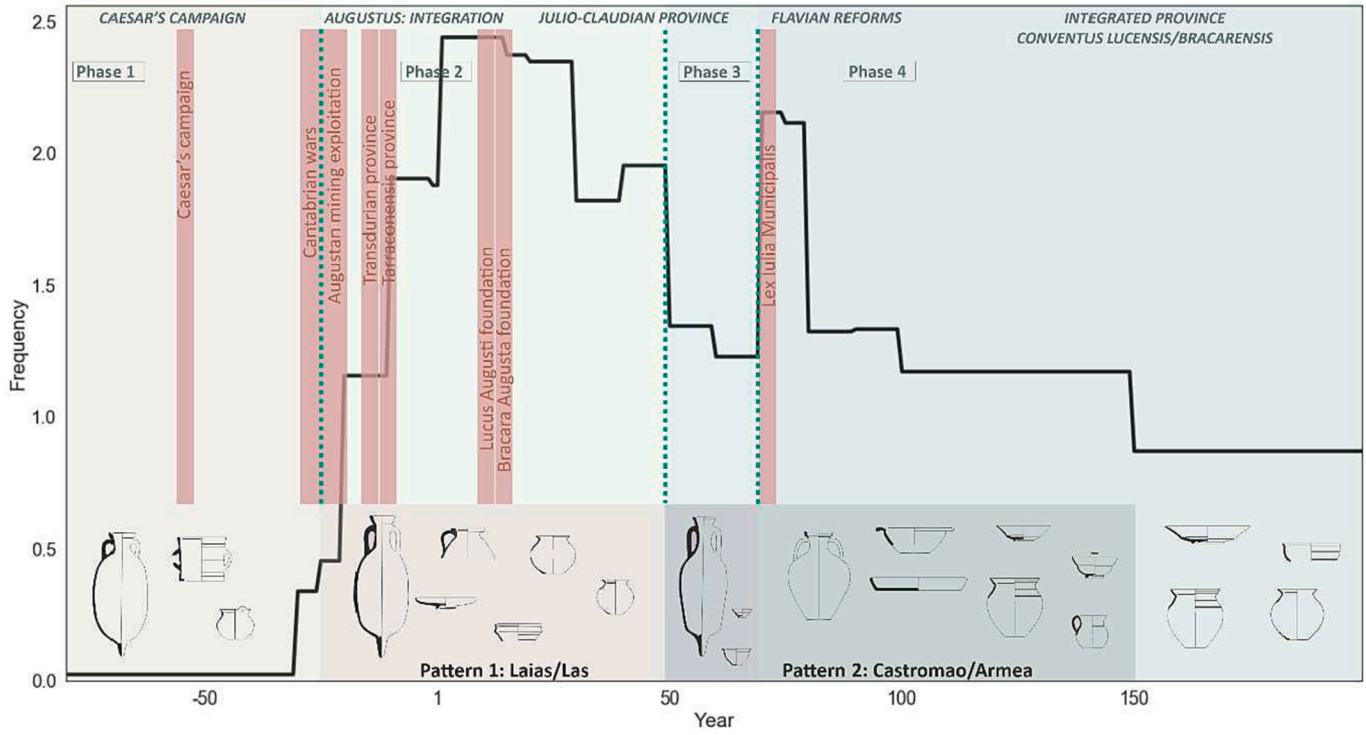

Fig. 15. Evolution of imported goods reception in the middle Minho basin [n = 1593 sherds; 384 MNI].

those produced in the workshops of the conventus capitals of Lucus and Bracara (Alcorta Irastorza, 2001; Delgado et al., 2009). On the other hand, the catalogue of forms for the storage and consumption of liquids expanded through Roman influence. In the Iron Age tradition there were just a few drinking forms, such as the Toralla type jars that could have been used mainly for collective consumption at festivities (Amado Rodríguez et al., 2015), according to descriptions of their use (Strabo, III, 3, 7). But a range of new Roman-inspired smaller jars would have been most useful for individual drinking (Rodríguez Nóvoa, 2020, pp. 595–600). Changes in foodstuffs transported in amphorae are also reflected. Amphora types that reached the northwestern coasts would contain mainly fish sauces and wine, but the decrease of imported amphorae coincides with the construction of local fish-salting plants (Castro Carrera et al., 2019) and the increase of the local/regional flat-bottomed amphorae reflects terrestrial transportation for local/regional wine (Morais et al., 2015; Valle Abad et al., 2020, p. 222). This suggests that local industry of fish sauces and wine were further developed under Roman rule, and that there was less need for non-local products. There is also evidence of typological continuity with minor changes, such as pots maintaining their traditional s-shape but accompanied by an increase of less globular and more pear-shaped walls in the 1st century CE. Some indigenous features slowly disappeared such as faceted rims, but others survived such as some kinds of decorative patterns and motives (Rodríguez Nóvoa, 2020, pp. 612–632) (Fig. 12). The whole process of ceramic change is more or less completed around AD 50, at which time we find contexts with the new Roman inspired forms in which indigenous Iron Age forms are no longer present (or less represented).

4.3. A first insight into the development of Roman trade in an inland Atlantic territory

Our quantified material culture results reveal four historical phases of Roman trade in the region (Fig. 15): (1) the first inland appearance of imported goods coinciding with Caesar's trip to the region; (2) significant increase in imports coinciding with the Cantabrian wars and Augustan mining exploitation; (3) decrease in Baetican imports coinciding with the transition from the Julio-Claudian to the Flavian dynasty; (4) increase in local production coinciding with Flavian urban reforms and the firm integration of the region in the Roman province.

Phase 1 (early 1st-century BCE): the earliest inland evidence of imported materials (Ovoide 4), in low quantities and only in San Cibrán de Las. This change of non-local products consumed in non-coastal hillforts could respond to a new need in the Northwest related to Caesar's trip in 60 BC to obtain raw materials (especially metals) to support his Iberian military campaigns (Casiuss Dio, 37, 52–53). Inland areas are very rich in metals and interesting zones for mining (Sánchez-Palencia et al., 1996; Zubiaurre Ibañez, 2018) and gaditan *mercatores* and *navigatores* knew the route to reach the NW by sea (Carreras Monfort and Morais, 2012; Fernández Fernández and Barciela, 2016; Morillo et al., 2016; Strabo, III, 5, 11). In Laias, several objects interpreted as mining tools were recovered (Chamoso Lamas, 1956). San Cibrán de Las controls the riversides of the Minho and Barbantes rivers, identified as mining areas (Álvarez González, 2019). Our study suggests an interesting theory: that Caesar's trip increased pressure on Iron Age communities to obtain metals to trade/exchange. Our study has identified that a century-long process of Roman influence on material culture starts around the time of Caesar's trip in the region when the first exposure to Roman ceramics material is evidenced. We posit the theory that this first exposure reinforced connections between inland and coastal communities, which gradually increased exposure to and copying of Roman material culture practices. Indeed, it would be possible to obtain the metals Caesar needed in the inland rivers and mountains, so the communication route between the coastal ports (where the Roman ships would arrive) and the interior hillforts, such as the ones studied here, would be reactivated/increased. Our theory states that metals would travel to the coast, and other goods moved inland, such as the first Roman amphorae and fine tableware.

Phase 2 (30/20 BC to AD 50): the number of imported materials increased slowly in all four sites, receiving Baetican and other imported products (amphorae Haltern 70; common wares; Italic fine wares) and foodstuffs (reflected through Italic and Baetican amphorae) through Baetican ships (Morais et al., 2013). It is the time of the Cantabrian Wars

(29–19 BC) when Augustus put his eyes (and his army) on the northwest. Augustus opened the big mining exploitations (e.g. Medulas), so it is possible that the Romans increasingly used the Atlantic route to obtain the northwestern metals. The amphorae suggest the main supply route passed through the Baetican food producing region, and the same ships also carried Italic lamps or fine wares and common wares.

Phase 3 (AD 50–70): Between AD 50–70, the Roman Empire knew a political transition period from the Julio-Claudian dynasty to the Flavians. A transition is also visible in the pottery evidence: trade was diversified and internationalised, the Italian fine wares decreased in favour of the south Gaulish *terra sigillata* (but these do not appear in the middle basin of the Minho river in high quantities), and the ceramic workshops in the local *conventus* capitals (Lucus, Emerita or Bracara) started making common and fine wares. Baetican products started to decrease, with the last Haltern 70 amphorae. However, sealed or clear contexts dated to the mid-1st-century CE are rare, and they should be characterised by a huge presence of South Gaulish *terra sigillata*. Instead, we always find in the studied contexts Gaulish products associated with Hispanic *terra sigillata*, indicating dates close to the late rather than the middle 1st-century CE.

Phase 4 (AD 70 onwards): From AD 70, the Flavian urban reforms allowed the establishment and development of craft and foodstuff manufacture of the larger urban centres, such as Lucus Augusti and Bracara Augusta, not only of fine wares (Hispanic *terra sigillata*), such as the Tricio workshops but also of common ceramics (especially from Lucus Augusti). Good contexts dated to the 1st and 2nd centuries reveal that the proportion of imported ceramics over local goods increases. Hispanic *terra sigillata* is received in high quantities in the inland territories of the NW, exclusively from La Rioja workshops. We can also still find *lucensis* or *bracarensis* pottery. Transportation of goods between inland settlements might have been facilitated in this period thanks to the construction of new roads. This period also coincides with the local production in the northwest of salted fish and canned sauces (Fernández Fernández, 2017), and possibly wine (Brión and Castiñeira, 2021). This means that it was no longer necessary to import these foodstuffs from Baetica and, therefore, the number of imported amphorae decreased. A small number of amphorae were found overall, likely because they were not appropriate containers for terrestrial transportation. Wines, sauces, or oil could be transferred to other containers for roads (barrels, flat bottomed amphorae, or others). So, in this phase, we can see a change in the supply pattern in the northwest, that switch from the see/rivers to inland roads/rivers, from the west to the east.

5. Conclusion

We have revealed in a replicable quantitative manner for the first time the long-term effects of exposure to imported Roman goods on local ceramic manufacture practices, changing pottery shapes for everyday use that reflect changes in food consumption and preparation behaviour of inhabitants at inland sites. It was suggested that fish sauce and wine production, trade, and consumption changed, with new locally produced flat-bottomed amphorae for their overland transport in this inland region. We also suggested that the common ware shapes from the Iron Age tradition reflect collective consumption, which gradually changed towards Roman-inspired jars and plates more suitable for individual consumption. We demonstrated that this change in ceramic and consumption practices was a very slow and gradual process, with local Iron Age traditions continuing into the middle of the 1st century CE. We have argued that historically documented political and administrative events could be related to the changes in material culture in inland sites in NW Iberia: the campaign of Caesar to obtain metals might have provided first early exposure to Roman material culture, the completion of the conquest of the Iberian peninsula under Augustus significantly increased and diversified this exposure, and the Flavian reforms could have triggered changes in craft production processes and in the supply pattern and be an explanatory factor for the change away from Iron Age ceramic traditions towards more Roman inspired shapes in the second part of the 1st century CE.

Material culture evidence provides crucial context for these events that are well-known from textual sources. We see their effects, what people were confronted with or had access to on a daily basis, and how craft production and food consumption practices slowly changed over centuries from Iron Age to Roman traditions. We argue future studies in other areas along the Atlantic facade should adopt this method to address the research bias towards coastal sites, pursue formal comparisons of coastal data patterns with the inland data patterns identified here, and to better understand the long-term transition process inland sites underwent. Our quantified data and analytical results imply significant changes to the traditional picture of the exposure of inland areas to the Roman world: small volumes of imported Italic materials already made their way inland during Caesar's campaign in 60 BC, possibly in the context of obtaining mined metals (Silva-Sánchez, 2015). Roman influence in this region did not start with Augustus but much earlier and identifiably enacted its influence over centuries.

Supplementary material: Data and code to reproduce the analysis on this paper can be found through this link: https://github.com/albaarodrigueznovoa/Atlantica.

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CRediT authorship contribution statement

Alba Antía Rodríguez Nóvoa: Conceptualization, Formal analysis, Investigation, Writing – original draft. **Tom Brughmans:** Conceptualization, Methodology, Writing – review & editing, Supervision. **Adolfo Fernández Fernández:** Conceptualization, Investigation, Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data and code are available through this link: https://github.com/albaarodrigueznovoa/Atlantica.

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