

Dressel 21-22 Italic amphorae for fish: the archaeozoological confirmation from the garum shop at Pompeii

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Abstract: Between 2008 and 2012, a joint project called 'Fishing and Fish-processing at Pompeii and Herculaneum' explored the exploitation of marine resources in the region around mount Vesuvius in the Roman period. All available evidence for the marine species fished and consumed in the area (from iconography to archaeozoological remains), the fishing tackle, the areas used for processing and preparing fish, and the local/regional ceramic vessels (mainly *amphorae* and *urcei*) used for trading with fish marine foodstuffs were collected and analyzed. Field work was conducted in the so-called Garum Shop or *Bottega del Garum* (1, 12, 8), the only place clearly being used at the time of the Plinian eruption in AD 79 for the preparation and sale of fish preserves.

An exceptional deposit of around one hundred complete amphorae, stored in the second courtyard of the Garum shop (room 13), known as the 'pila d'anfore', was analyzed; most of these containers belonged to the Dr. 21-22 family. The deposit was dug, analyzed in detail and partially published. The importance of this deposit is that for the first time we were able to demonstrate Botte's hypothesis, that these italic amphorae were used for the bottling of fish products and not dried fruit. Most of the Dr. 21-22 contained archaeozoological remains, as they had been emptied just before the eruption (scales, vertebrae and other fish bones attached to their walls). The archaeozoological study carried out determined the existence of different fish-families (Clupeidae, Engraulidae, Carangidae, Scombridae and Sparidae); especially interesting is the connection of these archaeozoological remains with the *tituli picti* that refer to the palaeocontent (mainly MAL, SP and COP but also AB, CE, COP AB and VR are known) of the amphorae. Based on this evidence, we can argue that these are not abbreviations of fish names as previously assumed, but products manufactured with the said species, as in many cases the same fish species are associated with amphorae bearing different inscriptions. In this paper, the ichthyological palaeocontent of 8 amphorae from the 'Pila d'Anfore' is presented in detail, which confirms the use primarily of two taxa as the main ingredients (picarel — *Spicara smaris* and anchovy — *Engraulis encrasicolus*). These data verify the relationship of these well-known Italic amphorae types with Italian fish-processing plants from the 1st century BC to the 2nd century AD.

Key words: Italic Amphorae; fish; *garum*; Pompeii; *Garum Shop*; *tituli picti*; archaeozoology.

1. Introduction

Until recently, Italian Dr. 21/22 amphorae were generally believed to have been used for the storage and transport of fruit preserves: this idea was put forward by H. Dressel based on the *tituli picti* that some of them displayed, for instance *Mal(a) Cum(ana)* — apples from Cumae — or *CE(rasa)* — cherries — (Dressel 1879: 167-172). This hypothesis was accepted by most researchers, from Callender and Zevi to the main reference works about Roman amphorae (Peacock and Williams 1986: 96-97; Sciallano and Sibella 1991).

This widespread belief was challenged by E. Botte's analysis of the Dr. 21/22 amphorae from Pompeii and

other areas of Thyrrhenian Italy and Sicily, following his detailed examination of the chronological and typological evolution of the family and, especially, a rereading of the painted inscriptions (Botte 2007; 2009a; and especially 2009b: 120-161).

In 2008, in order to investigate the halieutic cycle in Pompeii, works resumed in the *Bottega del Garum* (1, 12, 8), and the question was re-opened owing to the large number of Dr. 21/22 found in this *oficina salsamentaria*, which specialised in producing and selling *garum* at the time of burial by Vesuvius' eruption in AD 79 (a synthesis of the project can be found in Bernal-Casasola



FIGURE 1. DR. 21/22 AMPHORAE FROM THE *BOTTEGA DEL GARUM*, POMPEII, WITH INSCRIPTIONS THAT ALLUDE TO THE CONTENTS, CE (A) AND MAL (B); ICHTHYOLOGIC REMAINS ADHERED TO THE INNER WALLS, MIXED WITH RESIN (C); FISH REMAINS RESTING ON THE PAVING, DISCOVERED WHEN ONE OF THE AMPHORAE IN THE BOTTOM LAYER WAS REMOVED (D).

and Cottica 2013). This deposit is exceptional on three counts: the number of whole amphorae belonging to the same type found together (over a hundred); the presence of inscriptions in nearly all of them (Figure 1 A, B) (and, when they are missing, it is because of preservation issues); and, the abundant presence of fish residues inside the amphorae (Figure 1 C) or on the floor when the amphorae were lying on the ground (Figure 1 D). That is, the context presented a rare opportunity to analyse the content of Italian Dr. 21/22 amphorae, because the presence of *tituli picti*, macroscopic fish remains and well-preserved amphorae from which precise typological inferences can be made in the same archaeological context is truly exceptional. Some of our results have already been presented, for instance concerning area 13

of the *Bottega del Garum*, which was presented in the *Fautores Conference* at Catania, to which the reader is directed for contextual and functional issues (Bernal-Casasola *et al.* 2014); and also about the inscriptions and the interpretation of the deposit, which were presented at the conference *Fecisti Cretaria* (García-Vargas *et al.* 2020; Bernal-Casasola *et al.* 2020). These results confirmed for the first time Botte's insightful hypothesis, by linking these amphorae with fish contents. Now it is widely accepted that Italian Dr. 21/22 were used for the storage and transport of fish products (Bertoldi 2012: 104; Bernal-Casasola and Cottica 2019; Menchelli in this volume).

The aim of this paper is to present the first detailed analytical data, so that precise links can be drawn between

typological variants and contents and to encourage the discussion among specialists. As such, in what follows we present the study of the fish palaeocontents of eight amphorae found in the 2009 excavation season; future works will present the results of the analyses carried out on all the amphorae identified in the *Bottega del Garum*, which are currently being undertaken by Universidad de Cádiz and Università Ca' Foscari Venezia.

2. Characteristics of the sample and methodology

The amphorae under study were those found to contain visible remains of palaeocontents during the initial stages of the excavation of the *Bottega del Garum*. The sample comprises eight specimens of Dr. 21/22 amphorae from the 'pila d'anfore', found *in situ* (A5, A8, A9, A11, A14, A36), and two more that were stored in the 'Granai del Foro' since they were dug out by Maiuri in the 1960s (no.43108 and 43129). As illustrated by figures 2 and 3, all of them belong to type Botte 2, from the so called Calabrian-Peloritan region, except for no.43129 which is a Botte 1 Sicilian amphora.¹

To date, the study of the paleocontents of these eight amphorae² remained unpublished (Rodríguez Santana and Marlasca, 2011), and had only been referred to in very general terms, in publications dealing with the excavation of the *Bottega del Garum* (Bernal-Casasola *et al.* 2014).

The characterisation of the samples began with the description of the macroscopic remains and the verification of the excavators' preliminary observations (Figure 4): A05 (Sample 1 = S1): to the naked eye, the residue collected from this amphora did not contain anything of note, and its detailed examination through a binocular lens confirmed the presence of no ichthyofauna (Figure 5 A); A08: the examination of the residue found inside the area of the belly revealed the presence of a large number of fish scales (Figure 5 B-D); A09: the residue found in the inner walls of the rim and neck contained a small quantity of scales and small bones; this amphora was illustrated elsewhere, as it is one of the very few in the *Bottega del Garum* which, in addition to paleocontents, presents a *titulus* — SP — and a stamp which alludes to the workshop in which it was manufactured (Bernal-Casasola *et al.* 2014: 226, fig. 5); the sediment was treated with water, which allowed for the identification of some of the bones (Figure 5 E-F); A11: the residues were found to contain only a few fish scales (Figure 5 G); A14: the inside of these amphorae was found to contain an abundance

of bones and vertebrae (Figure 5 H, I); A36: was found to contain only a small number of scales in the interior of the rim and neck; the residue was not sieved owing to the small amount of faunal remains identified (Figure 5 J, K); 43108: the interior of this amphora yielded an earthy residue which, after being sieved through a 0.5mm mesh was found to contain only a few unidentifiable remains (Figure 5 L, M, N); 43129: this Sicilian amphora yielded multiple tiny bones within an earthy sediment matrix (Figure 5 O, P); only 2mm and 1mm sieves were used, owing to the small amount of sediment present, which made the use of the 0.5mm mesh redundant.

Following this, the remains found were examined in the laboratory with the assistance of reference collections. The state of preservation of the material found in the amphorae was generally good, and in some cases the amount of residue present was sufficient for sieving and selection. In some instances, only very fragmentary anatomic elements could be identified (e.g. *acantotrichia*, *lepidotrichia*, *costae* or *scutae*). The different mesh sizes used for sieving heavily conditioned the type of sediment and bone remains found (Figure 4):

- Sieve 1 (2mm): fragments of *neurocranium*, shoulder and abdominal girdle, some *hyomadibulare*, and vertebrae. In addition to this, this mesh size yielded plant remains, insects, stones and other elements.
- Sieve 2 (1mm): *neurocranium* and *viscerocranium*, as well as shoulder and abdominal girdle and axial skeleton; large number of vertebrae; little sediment.
- Sieve 3 (0.5mm): large number of vertebrae, small fragments of *viscerocranium* (but well preserved, especially concerning the most robust joints), abundant fragments of *neurocranium* and axial skeleton; little sediment.
- Sieve 4 (0.25mm): very fragmentary bone remains, and some tiny bones found whole; multiple remains almost reduced to dust.
- Residue: ash, sediment and bone dust.

3. Anatomical characterisation and quantification of ichthyofaunal remains

The archaeozoological remains were compared with specimens in reference collections. Since the samples comprise small species, the specific determination focused on diagnostic vertebral and cranial remains. In order to determine a Minimum Number of Individuals (MNI), the laterality of paired bones (*sinistrum* and *dextrum*) was examined whenever the state of preservation of the bones allowed. Since the bones were found in sealed contexts (amphorae) MNI was calculated separately for each amphora. The total number of remains examined in the 2009 season was 2356, leading to the specific characterisation of 1763 (Rodríguez and Marlasca 2011). Excluded from these figures are serial elements, such as *vertebrae* (both *centra* and *processus spinosi*); *skeleton pinnarum* (fins); *acantotrichia*; *lepidotrichia*; *pterygoforia*;

¹Two more amphorae with fish remains from the *Bottega del Garum* and stored in the *Granai del Foro* were analysed, but are not presented here because they belonged to different types. One is a late Punic Serie 7/ Maña C2b — Sample 7, no.43102 — and the other an Italian Dr. 2/4 — Sample 10, no.43133. Numbers A(amphora) + no. were assigned during excavation, and the other two ones just with numbers correspond to those in the *Soprintendenza* (currently *Parco Archeologico*) catalogue.

²Undertaken within the framework of a cooperation agreement between Universidad de Cádiz and Cabildo de Gran Canaria - Museo y Parque Arqueológico Cueva Pintada (Gáldar, Gran Canaria).

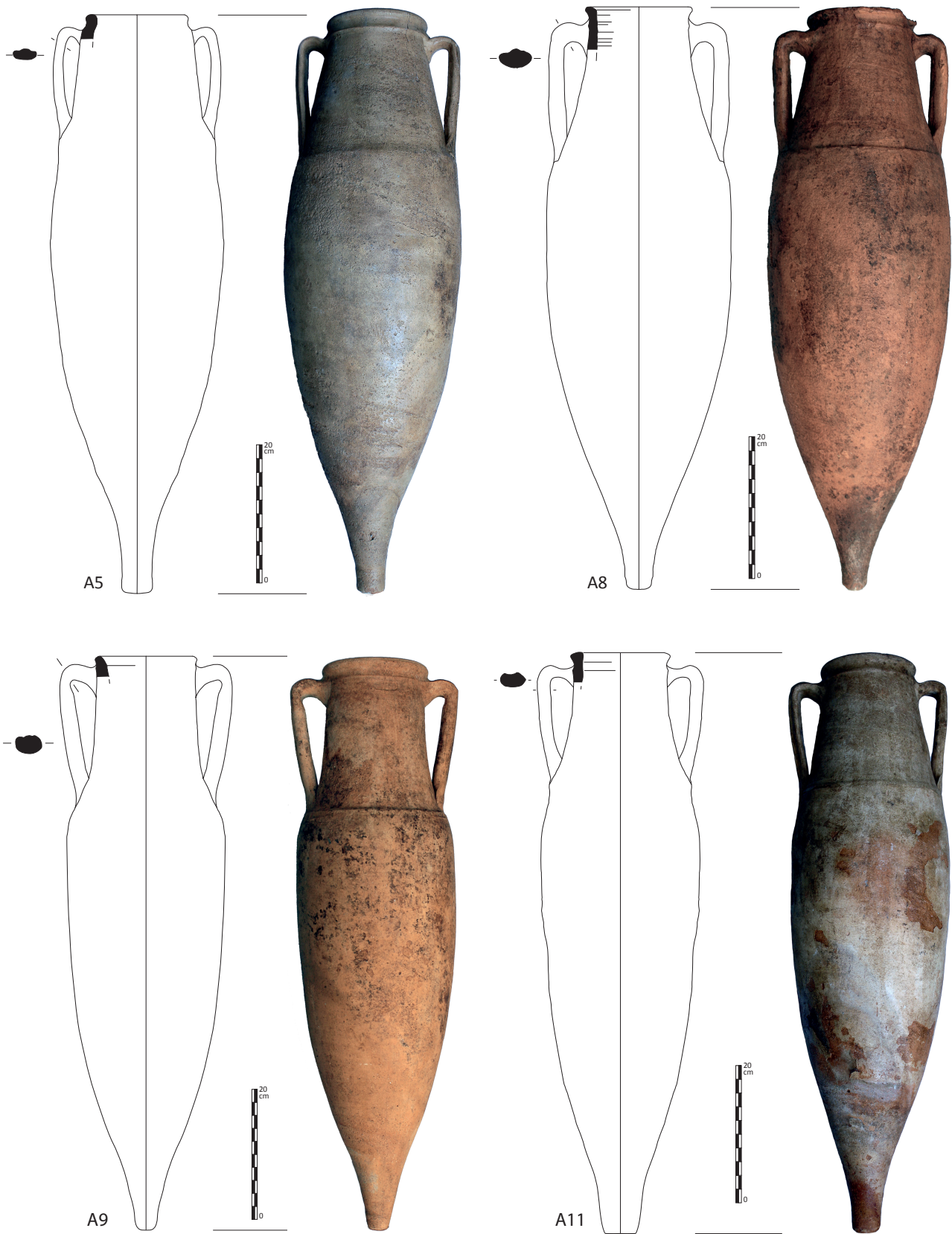


FIGURE 2. DRAWING AND PHOTOGRAPH OF DR. 21/22 AMPHORAE FROM THE *BOTTEGA DEL GARUM* BEING STUDIED (A5, A8, A9, A11).



FIGURE 3. DRAWING AND PHOTOGRAPH OF DR. 21/22 AMPHORAE FROM THE *BOTTEGA DEL GARUM* BEING STUDIED (A14, A36, NO.43108, NO.43129).

Sample	Amphora	Residue	Weight (g)	>2	>1	>0.5	>0.25	Faunal remains	<i>Tituli picti</i>
S1	A05	Body	0.05	-	-	-	-	-	MAL
S2	A08	Body	7	2.7	1.3	0.9	0.6	Scales and other remains	-
S3	A09	Rim/Neck	0.5	-	-	-	-	Different remains water sieved	SP
S4	A11	Neck	0.3	-	-	-	-	Small scales	CE
S5	A14	Neck	0.4	-	-	-	-	Different remains	-
S6	A36	Rim/Neck	0.2	-	-	-	-	Scales	-
S8	no.43108	Inner sediment	36.5	6.3	3	-	-	Different remains	-
S9	no.43129	Inner sediment	5.2	1.2	1	-	-	Minimal remains	-

FIGURE 4. FISH SAMPLES FROM THE *BOTTEGA DEL GARUM* IN POMPEII, WITH INDICATIONS OF THE LOCATION OF REMAINS AND THEIR COMPOSITION (TOTAL WEIGHT AND WEIGHT AFTER SIEVING - S2 ALSO INCLUDES ABUNDANT RESIDUES), AND *TITULI PICTI* REFERRING TO CONTENT.

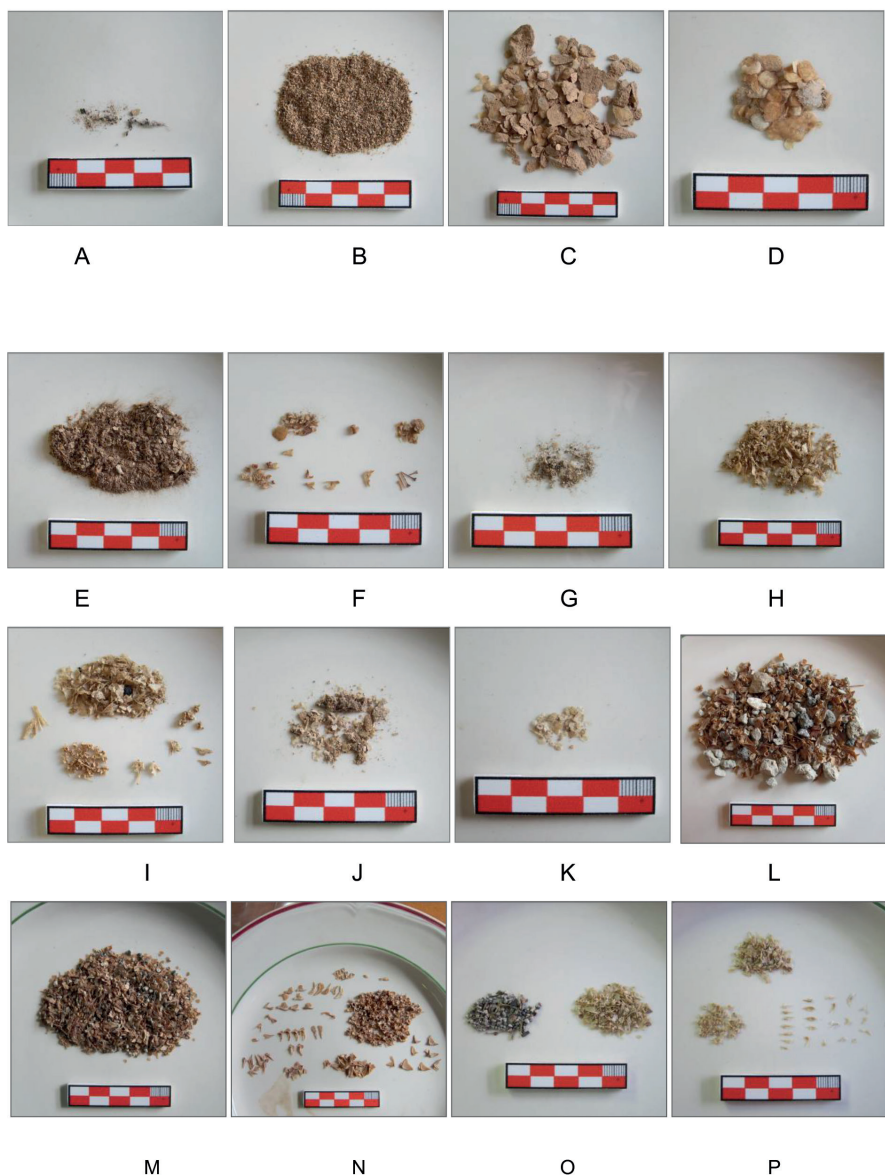


FIGURE 5. SEDIMENT IN THE AMPHORAEE: MINIMAL REMAINS INSIDE A05 (A – S1); SEDIMENT (B), INDETERMINATE FISH REMAINS (C), INCLUDING SCALES (D) IN A08 (S2); SEDIMENT AFTER WATER-SIEVING (E) AND INDETERMINATE ELEMENTS (F) IN A09 (S3); SMALL QUANTITY OF SEDIMENT FROM A11 (G), INCLUDING A FEW SCALES (S4); SEDIMENT FOLLOWING SIEVING AND IDENTIFIABLE FISH REMAINS (H, I; S5, A14); SMALL QUANTITY OF SEDIMENT (J) AND INDETERMINATE ELEMENTS (K) IN A36 (S6); SEDIMENT FROM AMPHORA 43108 (L, M), WITH DETAIL OF THE PROCESS OF BONE SELECTION (N) AND ANATOMIC AND SPECIFIC IDENTIFICATION (S8); SEDIMENT FROM AMPHORA 43129 (O), AND SELECTION OF REMAINS (P) FROM SAMPLE S9.

Amphora 09 (S3) <i>Spicara smaris</i> (Linnaeus, 1758)		
Cranium (NR)	7	
<i>Viscerocranium</i>		
Even elements	s	d
<i>Maxillare</i>	1	
<i>Praemaxillare</i>		1
<i>Dentale</i>		2
<i>Articulare</i>	1	1
<i>Praeoperculare</i>	1	
Columna vertebralis (NR)	14	
Odd elements		
<i>Urostylus</i>	1	
Serial elements		
<i>Vertebrae</i>	13	
TOTAL	21	

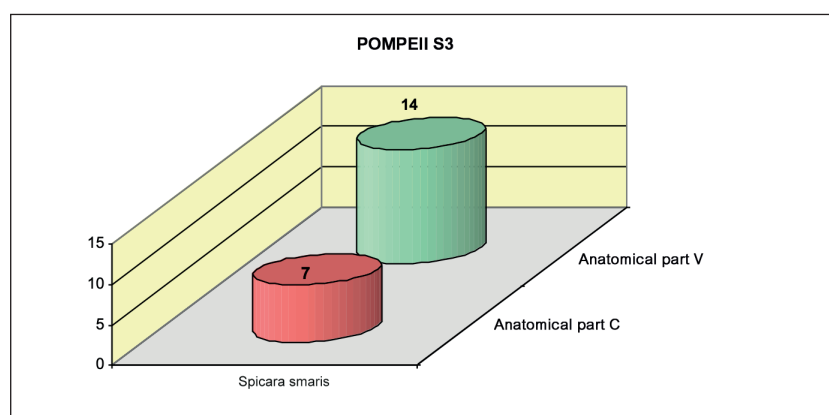


FIGURE 6. RELATIVE FREQUENCY OF THE ANATOMICAL PARTS PRESERVED IN SAMPLE S3 FROM AMPHORA A09 (THE NUMBER COLUMNS REFER TO NUMBER OF REMAINS OR NR).

radialia; *basalia*; *costae*; *branchiostegalia*; teeth (molariform, canines and incisors); *scutae* (scales); and parts of the *archus branchialis*.³ This category also includes small flakes of bones from the *viscerocranium* and the *neurocranium* which, owing to their extreme state of fragmentation, risked double-counting and altering the final taxonomic characterisation.

The following figures refer to taxonomic groups (Families and Gender) and not species because the identification of the remains to the species level often proved impossible. For each taxon, the anatomical elements identified are listed (in the case of paired bones, *dextrum* and *sinistrum* bones are also specified), and total numbers given. The figures also present total numbers for two anatomical groups: *cranium* (*neurocranium*, *viscerocranium* and *zonoskeleton anterius* or shoulder girdle), which include the head bones; and *columna vertebralis*, which includes the rest of the body of the fish. Photographs of relevant bone specimens are also included.⁴

³ The number of these serial elements were counted in some samples in order to estimate their representativeness, but with these estimates were not taken into consideration in terms of the interpretation of the sample.

⁴ The images were taken with a binocular magnifying lens and processed by Jacob Morales Mateos, Universidad de Las Palmas de Gran Canaria, whom we want to thank for his work.

4. Anatomical and specific determination of fish remains.

In what follows, we summarise the results pertaining to the four amphorae that have yielded significant archaeozoological remains, and in the following section we shall analyse the implications of these results.

Amphora 09 (S3)

A small quantity of ichthyological remains was found in the sediment adhered to the interior wall of the neck and rim (Figure 6). Despite the paucity of these remains, it could be established that the amphora contained a single species, the picarel (*Spicara smaris*). Unsurprisingly, vertebrae (which are more robust) clearly predominate over the rest of the bones. Comparison with reference specimens (the size and weight of which are known) suggests the use of very small specimens, one year old, around 60-70mm in length; a weight of 2-2.5g also suggests fishes of around one living year.

Amphora 14 (S5)

A small quantity of residue was collected from the interior wall of the neck. Despite the paucity of these remains, it was attested that the amphora contained a single species (Figure 7), the sprat (*Engraulis encrasicolus*) with around 60-70mm of whole length. Elements from

Amphora A14 (S5) <i>Engraulis encrasicolus</i> (Linnaeus, 1758)	
Cranium (NR)	9
Neurocranium	
Undetermined	5
Viscerocranium	
Even elements	s d
Articulare	2
Hyomandibulare	2
Columna vertebralis (NR)	43
Vertebrae	43
TOTAL	52

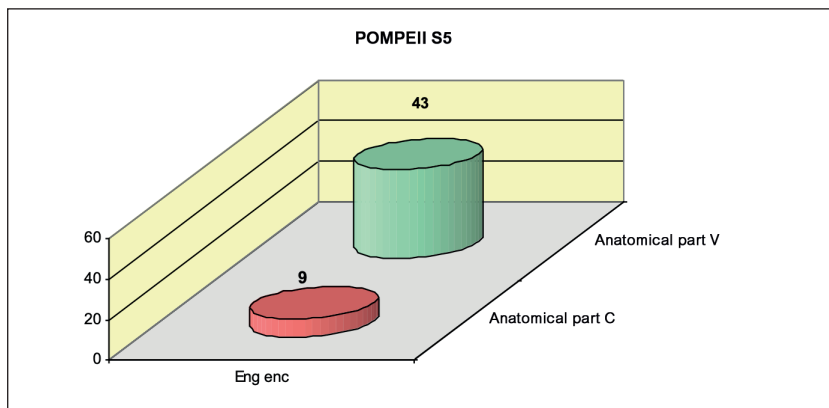


FIGURE 7. QUANTIFICATION AND GRAPHIC REPRESENTATION OF THE RELATIVE FREQUENCY OF ANATOMICAL PARTS IDENTIFIED IN SAMPLE S5 IN AMPHORA A14 (THE NUMBER COLUMNS REFER TO NUMBER OF REMAINS OR NR).

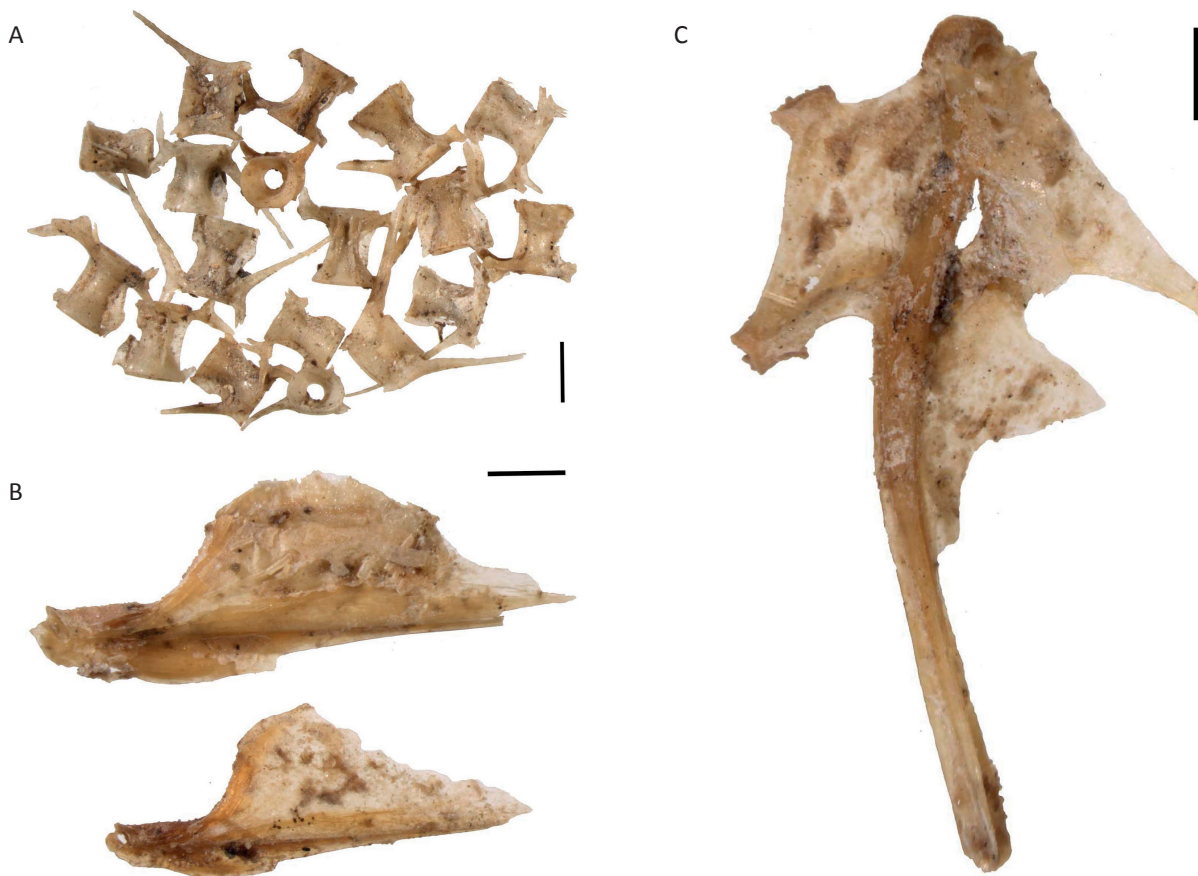


FIGURE 8. VERTEBRAE (A), ARTICULARI DEXTRA — NORMA LATERALIS — (B) Y HYOMANDIBULARE — NORMA MEDIALIS — (C) OF ANCHOVIES (*ENGRAULIS ENCRASICOLUS*) IN AMPHORA A14 (S5).

Amphora 43108 (S8) <i>Spicara smaris</i> (Linnaeus, 1758)		
Cranium (NR)	70	
Neurocranium		
Even elements	s	d
Posttemporale	5	
Otolitus	5	
Viscerocranium		
Odd elements		
Urohyale	1	
Even elements	s	d
Palatinum	5	
Maxillare	3	3
Praemaxillare	2	2
Dentale	2	4
Dentale	1	
Articulare	5	7
Operculare	2	6
Hyomandibulare	6	2
Epi-keratohyale	4	
Shoulder girdle		
Even elements		
Scapula	4	
Supracleithrale	1	
Columna vertebralis (NR)	226	
Odd elements		
Urostylus	17	
Serial elements		
Vertebrae	44	
Vertebrae praecaudalis	51	
Vertebrae caudalis	114	
TOTAL	296	

Amphora 43108 (S8) <i>Spicara spp.</i>		
Cranium (NR)	12	
Viscerocranium		
Even elements	s	d
Quadratum	5	7
TOTAL	12	

Amphora 43108 (S8) Undetermined		
Cranium (NR)	26	
Neurocranium		
Undetermined	2	
Even elements	s	d
Frontale	4	4
Posttemporale	1	
Viscerocranium		
Odd elements		
Urohyale	1	
Even elements	s	d
Palatinum	1	
Maxillare	1	
Dentale	1	
Operculare	1	
Shoulder girdle		
Even elements		
Cleithrum	6	
Scapula	6	
Columna vertebralis (NR)	2	
Serial elements		
Vertebrae praecaudalis	1	
Vertebrae caudalis	1	
TOTAL	28	

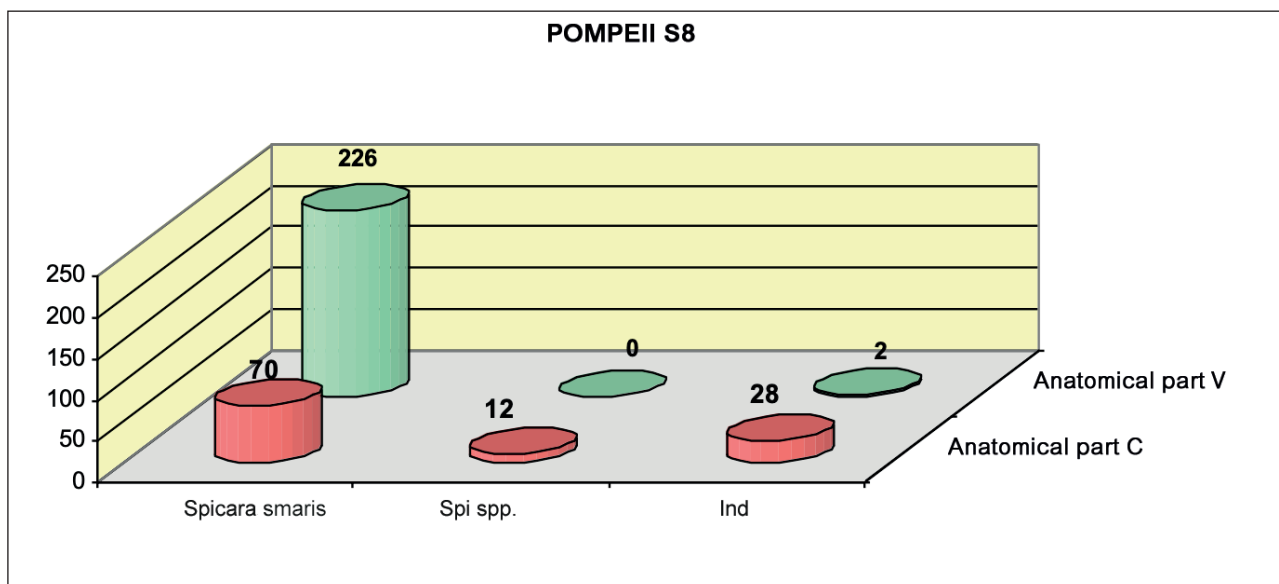


FIGURE 9. ANATOMICAL PARTS OF FISH REMAINS IN AMPHORA 43108 (S8), WITH NR (COLUMN NUMBERS).

the cranium and the rachis were identified, which is unsurprising, considering that these small fish were introduced whole in the container (Figure 8). In addition to this, multiple serial bones (*acantotrichia*, *lepidotrichia*, *costae*, *processus spinosus*...) were also identified, but not quantified, because this information is irrelevant in terms of body parts and specific determination. At any

rate, these remains appear to match the diagnostic elements.

The state of preservation of these remains was excellent (Figure 8). As usual, vertebrae clearly predominate over cranial remains, owing to the comparatively robust nature of vertebrae in anchovies (*Engraulis encrasicolus*).

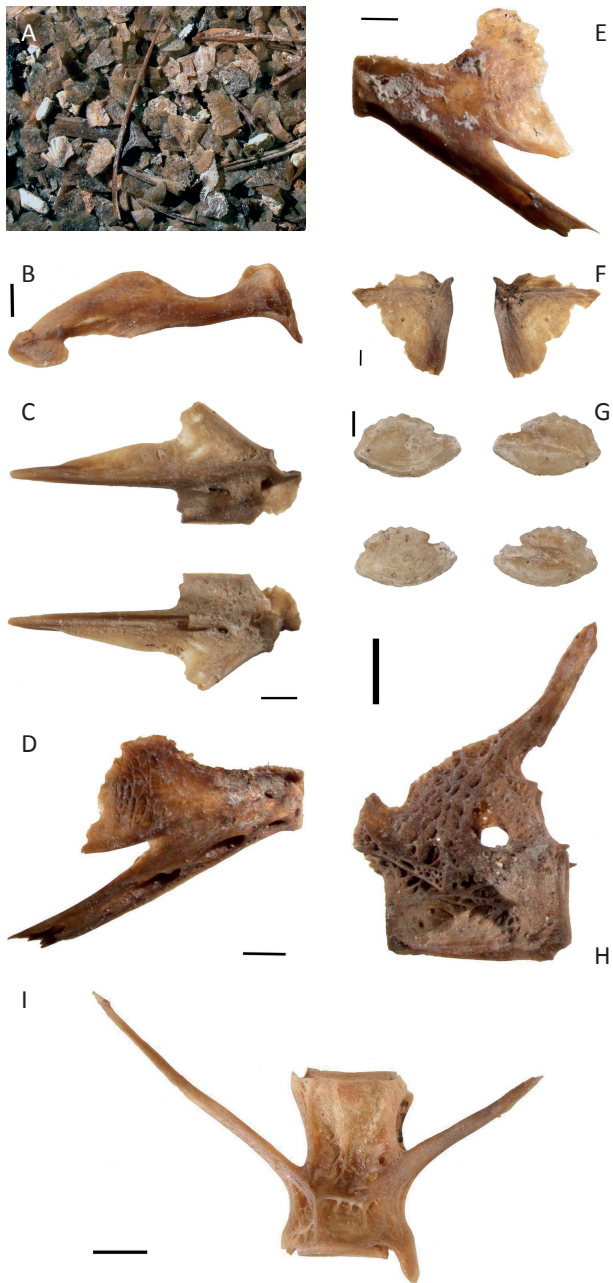


FIGURE 10. ILLUSTRATION OF FISH REMAINS FOUND IN AMPHORA 43108 (S8): DETAIL OF REMAINS FOUND IN THE SIEVE (A); MAXILLARE SINISTRUM — NORMA MEDIALIS — (B); ARTICULARE SINISTRUM — NORMA LATERALIS Y MEDIALIS — (C); DENTALIA DEXTRUM (D) AND SINISTRUM (E) — NORMA LATERALIS —; OPERCULUM DEXTRUM — NORMA LATERALIS Y MEDIALIS — (F); OTOLITI — NORMA MEDIALIS AND LATERALIS — (G); VERTEBRA PRAECAUDALIS — NORMA LATERALIS — (H); AND VERTEBRA CAUDALIS — NORMA LATERALIS — (I). EXCEPT FOR A, ALL REMAINS CORRESPOND TO *SPICARA SMARIS*.

Amphora no.43108 (S8)

The earthy residue was partially extracted and examined, leading to the recovery of a large number of bones. The bones overwhelmingly belong to picarels; in fact, the remaining Sparidae bones could also belong to this species, but their state of fragmentation makes this

uncertain (Figure 9). Bones that could not be identified include at least one additional fish species, perhaps a small member of the Sparidae family, larger than the picarel. Picarel remains include 8 *quadrata* (6 *dextra* and 2 *sinistrum*); based on this and on the size of these remains, the MNI in the sample is 8 (Figure 10). These fished with have a whole length around 60-70mm, and their weight around 2-2.5g suggests again around one living year.

Amphorae no.43129 (S9)

The extraction of a sample of earthy residue yielded a large number of tiny bones. The sample is overwhelmingly dominated by picarels — *Spicara smarís* — (Figure 11). Although the sample collected is not large, it is clear that small specimens were used, like in amphora A09 (S3) — 60-70mm of length; 2-2. g of weight, around one year old. A *praemaxillare dextrum* found within the sample belongs to another species that could not be established. It may be an accidental intrusion, because it seems clear that the producers' intention was to make a picarel-only product (Figure 12).

Results from the four amphorae in which the specific identification of fish bones was possible have allowed for a general characterisation of contents. It must be taken into account, however, that in many of our amphorae specific identification was not possible, at least in the small samples collected (from the neck and rim areas). At any rate, the fact that they include fish remains (serial elements such as scales) is not open to doubt,⁵ and this is in itself highly significant, as this seems to confirm the use to which these amphorae were put.

The first thing worth mentioning is the overwhelming presence of two species in the record: anchovy (*Engraulis encrasicolus*. Linnaeus, 1758) and picarel (*Spicara smarís*. Linnaeus, 1758), but always separately. There could be several reasons behind this separation, such as different catches at sea or culinary recipes. The fact is that anchovies and picarels are never mixed in the same container.

Second, the presence of other species (small Sparidae and other species that could not be defined) is likely accidental. The idea that other species could be introduced in small quantities to alter the flavour is suggestive, but the amounts in which they appear seems to rule it out. It is more plausible to think about the accidental presence of a member of another species in a catch predominantly made up of sprats or picarels.

In fact, a recent study carried out on the coasts of the island of Eivissa, shows how fishing carried out with traditional gear, aimed at fishing for picarel, would catch 90% picarels (so called 'gerret' on the island), and the remaining 10% would be distributed among different species of diverse

⁵ In those cases in which only scales have been attested (A08, A11, A36) a precise identification will need to rely on biomolecular techniques.

Amphora 43129 (S9) <i>Spicara smaris</i> (Linnaeus, 1758)		
Cranium (NR)	28	
Neurocranium		
Undetermined	1	
Even elements	s	d
Frontale	3	
Posttemporale	2	
Viscerocranium		
Odd elements	1	
Urohyale		
Even elements	s	d
Quadratum	1	
Dentale	1	
Articulare	4	5
Operculare	2	2
Operculare	2	
Suboperculare	1	
Epi-keratohyale	2	
Shoulder girdle		
Even elements		
Scapula	1	
Columna vertebralis (NR)	58	
Serial elements		
Vertebrae	58	
TOTAL	86	

Amphora 43129 (S9) Undetermined		
Cranium (NR)	2	
Neurocranium		
Undetermined	1	
Viscerocranium		
Even elements	s	d
Praemaxillare	1	
TOTAL	2	

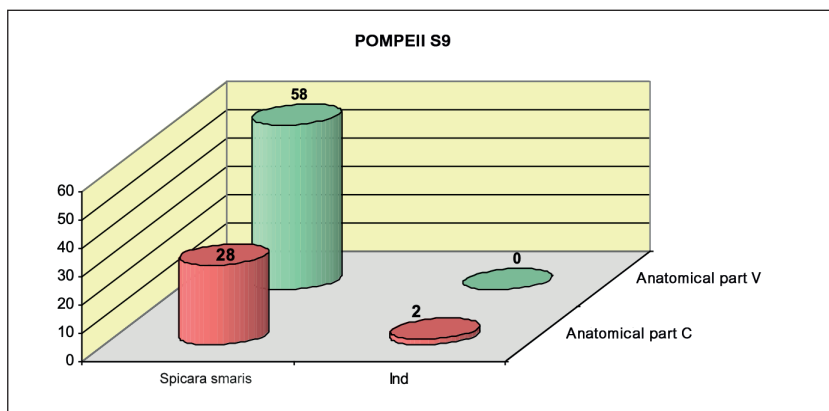


FIGURE 11. ANATOMICAL FISH REMAINS IDENTIFIED IN AMPHORA 43129 (S9), WITH NR.

families, among which there would be, for example, sparids, carangids or wrasses (Montero *et al.* 2018), which seems to be perfectly reflected in the samples studied.

The dimensions of the identified specimens allow them to be defined as juvenile, just over one year old, so most, if not all, would be female, since, following a study carried out on the Croatian coast (Dulcic *et al.* 2003), male individuals would

appear in ranges of 8-9cm in length, being the majority or exclusive in ranges of 17 to 20cm. Therefore, we believe that they would have been captured in the spring.

Third, the type of container seems to be irrelevant for the species contained within them (Figure 13). At any rate, picarels seem to be the most abundant species, regardless of the type of amphora under consideration.

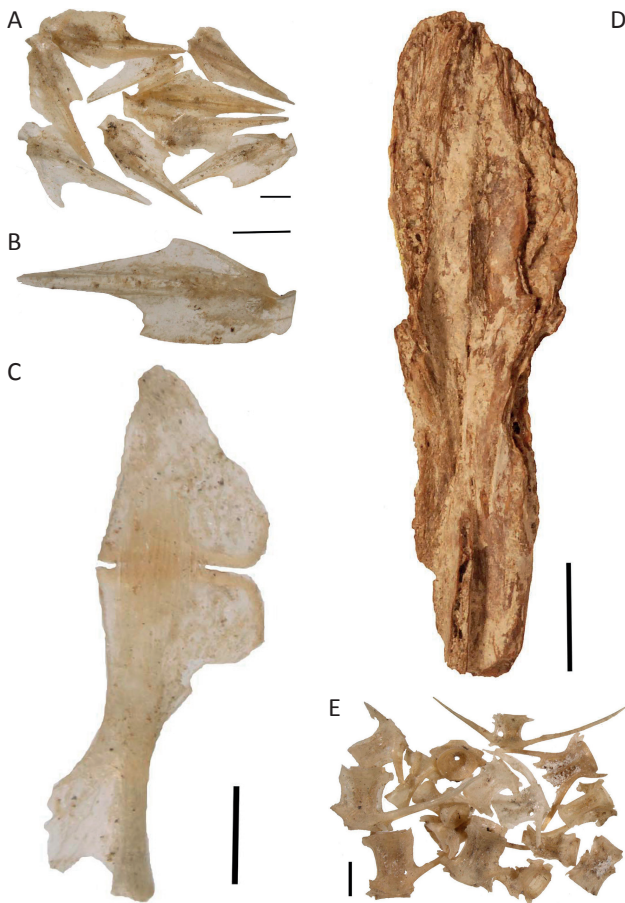


FIGURE 12. ILLUSTRATION OF REMAINS OF *SPICARA SMARIS* FOUND IN AMPHORA 43129 (S9): ARTICULARIA (A); ARTICULARE DEXTRUM — NORMA MEDIALIS — (B); KERATOHYALE AND EPIHYALE ANATOMICALLY CONNECTED — NORMA LATERALIS — (C); OPERCULARE — NORMA LATERALIS — (D); AND VERTEBRAE (E).

As such, it can be concluded that amphorae Dr. 21-22 were predominantly used to store a product based on picarels, although they were also used to contain anchovy-based products. It is worth stressing that anchovies are widely represented in the *Bottega del Garum*, notably in the content of the *dolia* found in room 9 (Bernal-Casasola and Cottica 2013: 47–49; Rodríguez-Alcántara *et al.* 2020). It must also be highlighted that both Calabrian and Sicilian amphorae were used to store the same products.

5. Conclusions and perspectives. Dr. 21/22 and fish. But, what products?

First, it is worth emphasising that these eight Dr. 21/22 amphorae from the *Bottega del Garum* in Pompeii are the first to have their fish palaeocontents published in detail. Earlier publications included data concerning fish families and species in 28 of the Dr. 21/22 amphorae found in this context, but only in very general terms (Bernal-Casasola *et al.* 2014: 229, fig. 7) and without addressing the potential relationship between fish content and type of amphora; only the contents of the two amphorae preserved in the *Granai del Foro* (no.43108 and no.43129) had been published in some detail (Bernal-Casasola and Cottica 2019: 127, fig. 5).

D Our first conclusion is that most samples analysed for this paper yielded fish remains (seven out of eight), which confirms that the Dr. 21/22 amphorae in the ‘Pila d’Anfore’ in the *Bottega del Garum* were used to store fish products.

Concerning the species represented, a large proportion corresponds to members of the Sparidae family, overwhelmingly picarel (*Spicara smaris*), perhaps with the addition of blotched picarels (*Spicara maena*) and some members of the Sparidae family.

We want to highlight, as has also been done recently (Carannante 2019: 380), that when the analyses presented here were carried out in Pompeii in 2012, the results were recorded in a preliminary study (Bernal-Casasola *et al.* 2014), and at that point the picarel (*Spicara smaris*) and blotched picarels (*Spicara maena*) species were integrated into the Centracanthidae family; but a study published that same year 2014 (Santini, Carnevale and Sorenson 2014) integrated these species within the Sparidae family, as done for this study.

The picarel (*Spicara smaris*) clearly dominates three of the contexts under analysis (A09, 43108, 43129). On two occasions they appear mixed with other species, which appear in very small proportions and were likely included in the batch accidentally, a situation that has numerous parallels (Bernal-Casasola *et al.* 2016). This species had already been associated with Dr. 21-22 amphorae, when it was found inside one of the containers from the *Bottega del Garum* currently on display in the *Antiquarium* of Boscoreale (Stefani *et al.* 2015: 87, no.99; Bernal-Casasola and Cottica 2019: 124–128, fig. 6). Recently, the contents of an amphora found in the *Bottega del Garum* during Maiuri’s excavations have been analysed, although unfortunately the container is lacking in context information and its typology is uncertain: the results of the analysis, however, determined that the amphora contained picarels, mostly female and approximately one year old (they were between 10-13cm in length) (Carannante 2019); this confirms the importance of this species for trade in Pompeii.

The picarel was not highly commended in the classical sources, but must have been frequently used to make *garum* and other fish products in the Mediterranean, judging by its common presence in archaeological contexts. For instance, a Dr. 6 amphora, the first in which the species contained could be identified (Lepiksaar 1986), was found to include up to 24 different small fish species, mostly sardine but also picarel. This species was also identified in an amphora, probably produced in Africa, found in Olbia, although in this case the specimens used were larger, approaching 20 cm in length (Brusci and Wilkens 1996; Delusu and Wilkens 2000: 57). The species has also been identified in production contexts, for instance in the salting vats of the *cetariae* of *Neapolis* (Nabeul, Tunisia), where it was found in small quantities in





Sample	Reference	Type	Predominant species	
1	Amphora 5	Dr. 21/22, Calabrian fabric	-	
2	Amphora 8	Dr. 21/22, Calabrian fabric	-	
3	Amphora 9	Dr. 21/22, Calabrian fabric	<i>Spicara smaris</i>	
4	Amphora 11	Dr. 21/22, Calabrian fabric	-	
5	Amphora 14	Dr. 21/22, Calabrian fabric	<i>Engraulis encrasicolus</i>	
6	Amphora 36	Dr. 21/22, Calabrian fabric	-	
8	Amphora 43108	Dr. 21/22, Calabrian fabric	<i>Spicara smaris</i> *	
9	Amphora 43129	Dr. 21/22, Sicilian	<i>Spicara smaris</i> *	

FIGURE 13. FISH SPECIES IDENTIFIED IN THE AMPHORAE (THE ASTERISKS DENOTE INTRUSIONS, OR SPECIES OTHER THAN THE PREDOMINANT; FISH DRAWINGS BY A.M. ARIAS IN *ICTIONIMIA ANDALUZA*, 2019, MADRID).

products dominated by anchovies (*Engraulis encrasicolus*), round sardinellas (*Sardinella aurita*) and sardines (*Sardina pilchardus*) (Sternberg 2000), as well as in a number of Spanish production contexts such as Santa Pola and Cerro del Mar (García-Vargas *et al.* 2018: no.20, 43). For this reason, it can be argued that the picarel was a key ingredient in the preparation of fish sauces in Pompeii and its region, as the presence of remains of both *Spicara maena* and *Spicara sp.* in the well-known sewer under Cardo V, in nearby Herculaneum, seems to confirm (Rowan 2014: 67).

Also significant is the identification of anchovies (*Engraulis encrasicolus*), unmixed with other species, in another of the amphorae (A14). The amphora was found whole and *in situ* in so-called Level 2, so nothing suggests that it might have been reused.⁶ This species has been found in other containers in the ‘Pila d’Anfore’, either on its own (A17, A49, A59, A76, A78, A83, A84) or mixed with other species (A17, A47, A48, A53, A55, A68, A74, A79, A80, A81), and the taxon is clearly associated with this shape (Bernal-Casasola *et al.* 2014: 229, fig. 7). The zooarchaeological studies undertaken in the *Bottega del Garum* clearly indicate that *garum* was being fermented (‘brewed’) in the *dolia* found in room 9 when the eruption hit, and that this *garum* was based on anchovies (Curtis 1979; Rodríguez Alcántara *et al.* 2020), so it is a possibility that these had just come out of the Dr. 21-22 in the ‘Pila d’Anfore’. It is not easy, however, to draw a direct link, such as the one outlined above, between all the elements found in this archaeological context, as picarels are not found in the *dolia*, as would have been the case if the amphorae were emptied into the *dolia*. In any case, the evidence available suggests that the Dr. 21/22 in the ‘Pila’ had just been emptied and stored for sale/reuse/recycling; no obvious sign of reuse exists, such as double *tituli picti*. At any rate, all the amphorae stored in room 13 were fish amphorae, while other types, such as African oil

amphorae and Dr. 2/4 wine amphorae, were stored in a different area of the second courtyard of the Bottega, and were in all cases free from fish remains (Bernal-Casasola *et al.* 2020: 213, fig. 1).⁷

The product contained in the Dr. 21/22 amphorae is not easy to elucidate. The contents (small fish species) and the small size of the samples suggest *garum*-like sauces made with fermented fish, poorly filtered, which would explain the presence of some bones. However, two things make us think that the amphorae were full of a semi-solid paste with solid remains: first, the amphorae in the pile were nearly empty and upside down, so the animal remains found in the sample are likely non-representative of the original content; second, we also know the contents of the bottom half of the Dr. 21/22 from the ‘Pila d’anfore’ on display in Boscoreale, in which at least one fourth or one fifth of the total capacity of the amphora was filled with remains of Sparidae (*Spicara sp.*) and other species (Rodríguez-Santana and Marlasca 2011; Bernal-Casasola and Cottica 2019: 128, fig. 6); prior to breaking and its contents dehydrating, this amphora would have been nearly full of fish bones. Since these did not belong to species of blue fish rich in fats, the most highly appreciated for the production of salted products (*salsamenta*), the logical conclusion is that they contained some sort of *allec*, the semi-solid residue that results from the filtering of *garum/liquamen*.

Unfortunately, the *tituli picti* do not clarify the issue. Of the three present in the amphorae here considered (Figure 14 — MAL in A05; CE in A11; and SP in A09 —), only one can be clearly associated with picarel (A09), while the meaning of the other two is uncertain. It is, however, tempting to read SP as *S(a)P(erda)* or *SP(arus)*, as has been proposed (Botte 2009b: 138–140), which would match our *Spicara smaris*. The association of picarels (or rather, Sparidae, as not all remains can be identified at the species level) with other

⁶ In that case, the anchovies would have been mixed with the original paleocontent.

⁷ Only one specimen of Italian Dr. 2/4 (no.43133), can be interpreted as having been reused in this fish establishment.

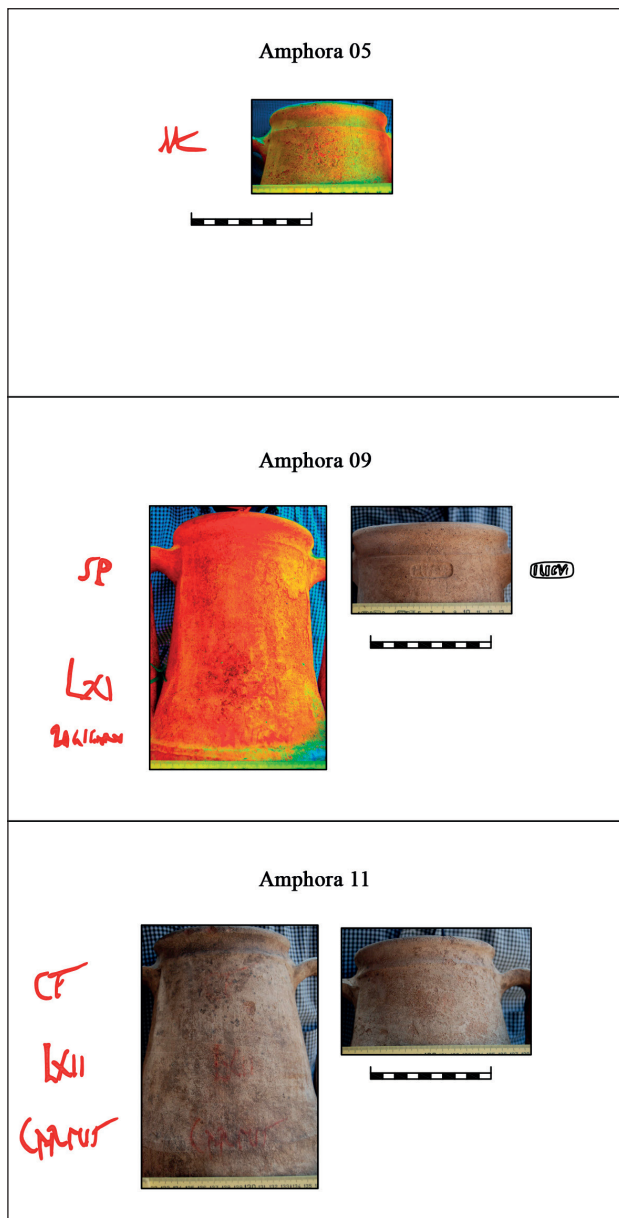


FIGURE 14.- READABLE *TITULI PICTI* ON THE AMPHORAE UNDER ANALYSIS: MAL (A05), CE (A11) AND SP (A09).

tituli (COP — A54, A79, A80 — or CE — A64 —, Bernal-Casasola *et al.* 2014: 229, fig. 7) indicates that these are not references to other fish species, as suggested by other authors, but to products created with similar ingredients. So, at present we can neither develop the seven abbreviations concerning products in the A record corresponding to this shape — COP, MAL, SP and to a lesser extent AB, CE, COP AB and VR — (Botte 2009b; Bernal-Casasola *et al.* 2014; García Vargas *et al.* 2020), nor determine production processes, which should be one of our priorities in future. What we do know is that many of these products were made with these sort of species and that they were similar to *allec*, with a semi-solid texture and many bone residues, hardly micronized. The results also suggest the preparation of mixed sauces, with several species but based on anchovies and picarel, the other species being added only in small quantities. It seems obvious, however, that when other species appear in such small percentages, as in our samples, this is merely accidental

and not deliberate: it is likely that these compositions were determined by the catches at sea and that quality was given priority over quantity.

Concerning species, it is important to stress the total absence of tuna remains in the Dr. 21/22 amphorae, or in any of the other archaeological contexts associated with the *Bottega del Garum* (Rodríguez Santana and Marlasca 2011). Recent finds in the Hellenistic and Roman *cetariae* of Portopalo di Capo Passero, in southeast Sicily, have for the first time linked tuna and Dr. 21/22 amphorae, both directly (bone remains have been found in some containers) and indirectly (through the large number of Dr. 21/22 amphorae, in some archaeological contexts directly in association with tuna remains, in a fish preserve factory that specialised in the fishing and processing of tuna); it is plausible to think, therefore, that, in addition to small fish species, these containers were also used for the commercialisation of red tuna (Bernal-Casasola *et al.* 2021). The confirmation of this point should be one of our future research priorities, and involves the characterisation of scales through biomolecular techniques (ancient DNA), since they often cannot be identified by anatomical comparison.

The other important question that remains to be answered is why this *cetaria* in Pompeii dealt with fish so far away from the Vesuvian area, as 85.2% of the Dr. 21/22 amphorae were from Calabria and 4.9% from Sicily, with only 8.5% corresponding to the type Botte 3, from the central Tyrrhenian area. Perhaps the content of these amphorae was so-called ‘raw *garum*’ used as a condiment in different recipes. This could potentially explain the prevalence of fermented fish from Calabria and Sicily.⁸

Finally, it is worth pointing out that we already have the first organic residue analysis results yielded by five Dr. 21/22 amphorae from project ‘Impianto Elettrico’ in Pompeii. Although these results are still preliminary, they reveal the presence of Pinaceae-based products, related to the resin/pitch used to seal the walls of the amphorae. The analyses have also detected several acids that could also point to vegetal resins and fatty acids present in fish, alongside residues related to post-depositional contamination, vegetal oils and succinic acid present in fermentation. These deposits do not relate to wine, as there are no traces of tartaric acid, so the Dr. 21/22 in Pompeii present fish rather than wine-related markers, although further confirmation is needed; the presence of traces of vegetal oils is interpreted as evidence for the reuse of these containers (Pecci and Giorgi 2019).

⁸ It is for this reason that we are not sure whether the interesting paleoenvironmental results coming from the study of the samples preserved in the so called ‘Laboratorio di Ricerche Applicate’ in Pompeii reflect the conditions of the picarels fished in Calabria and Sicily; or the ones of the local catches in the Bay of Naples, as has recently been suggested (Carannante 2019).

These results demonstrate that the Dr. 21/22 found in the *Bottega del Garum* were used to contain fish. The abundance of ichthyologic evidence found in this exceptional archaeological context illustrates the complexity of fish-processing palaeocontents associated with these amphorae. The evidence suggests that the samples analysed represent some sort of semi-solid product similar to *allec*, based on small fish species such as anchovy (*Engraulis encrasicolus*) and picarel (*Spicara smaris*).

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