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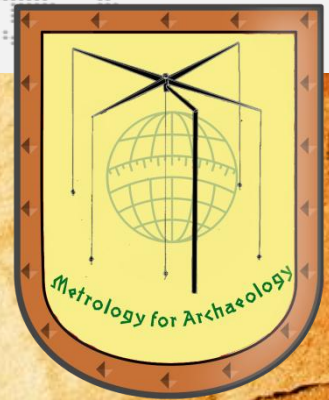
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Measure the sacred at Arpi: the share of food and drink in two votive deposits

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Abstract – In this year dedicated to food, we will seize the opportunity of this conference to discuss how the new measurement tools offered by different sciences applied to archeology allow us to specify the uses of food and drinks in archaeological contexts. Our study concentrates on the use of food and drink in two votive deposits belonging to the phase preceding the construction of a Hellenistic *domus* in the Daunian center of Arpi (Foggia).

I. INTRODUCTION

Discovered in 1992 and partially excavated during four campaigns conducted by Marina Mazzei between 1992 and 1997 for the account of the archaeological Superintendence of Puglia, the Hellenistic *domus* of Arpi (Foggia) is known by the iconography of its mosaic representing "lions and panthers" [1]. Since 2014, a new project by the Superintendence of Puglia in collaboration with the Centre Jean Bérard of Naples and the University of Salerno aims at the analysis of the whole area of the ONC 28. The study concerns the reexamination of the excavated data, mainly the campaigns' documentation as well as a thorough analysis of the unearthed material culture. It has already allowed a better understanding of the stratigraphic palimpsest and a sharpening of the chronological sequence, in order to clarify the phases of utilization of the area [2].

Among the rediscoveries, there are two votive sets (DV630 / Q. 44 and DV263 / Q. 33) of great interest due to the state of conservation of the documentation and to the presence of vessels associated with the consumption of wine and meat. The study of the contexts of discovery together with the pottery allowed the association of these sets to the transformation of the area in the last quarter of the Fourth century BC. Built in open spaces, near both a circulation axis and walls bordering the area, they apparently mark, before the construction of the *domus*, the use of some structures, accompanied with rites of deposition associated with a sacrificial kitchen [2].

In order to specify the content of those deposits and vases, some samples were taken, crossing

archaeozoology analysis and organic chemistry.

II. ANALYSIS OF ARCHAEOLOGICAL CONTEXTS

The first deposit was discovered in 1995 in a large open space, bordered by a road and by a series of wall structures related to rooms (Q. 44). The votive deposit re-functions a well connected to a canal system (US 637) located near the road. The original structure was composed by a cylindrical well (US 634) with small dimensions and plastered walls, embedded in a square structure built in clay and limestone (US 629). The cylindrical well was in direct contact with the canal system underneath and, therefore, functional to it both as a manhole of control and, more likely, as well for the collection of water.

In the last quarter of Fourth century, the well is exploited as a votive deposit (**Fig. 1**). In it, 36 containers (635 US) were found disposed in three levels. The structure was sealed with a large stone slab (US 628). Next to the latter, where the quadrangular structure in clay and limestone was touched, a second set of vessels was deposited (US 630), identical to those found inside the structure.

The two sets of vessels that compose the votive deposit DV635 are characterized by the same vase shapes but in different quantities. The receptacles are all small (below 9 cm in height).

The vessels within the circular well (US 635) are numerically superior, with its 36 vases distributed as follows: 12 *krateriskoi* decorated with bands or achromatic, 20 miniature fire-ware wheel-pottery *ollae*, 3 small jugs decorated with bands or achromatic and one one-handled cup with decorative bands.

Their arrangement inside the well seems to be accurate (**fig. 2**): all vases were arranged standing, one inside the other. Probably the first-layer vases provided a bearing surface for the second series of vessels, and so also the latter to the third layer.

The lower level included 16 vases (US 635, nn. 23-38) distributed as follows: 12 miniature *ollae*, 3 *krateriskoi* and a one-handled cup; the second level consisted of 12

vessels (US 635, nn. 11-22); 4 miniature *ollae*, 7 *krateriskoi* and a small jug; the last layer included 10 vessels (US 635, nn. 1-10); 4 miniature *ollae*, 2 *krateriskoi* and 2 small jugs. At the bottom, under the pots, there was “*uno strato potente di terreno cineroso e ossa bruciate*” (“an earthen stratum with ash and burnt bones”, M. Mazzei, Archivio Sop. Arch. Puglia, Centro Operativo per l’Archeologia della Daunia).



Fig. 1 – Votive deposit DV635, vessels of the external set, US 360 (Photo M. Marchesino, Archivio Soprintendenza Archeologia della Puglia - Centro Operativo per l’Archeologia della Daunia).

The vessels outside the well (US 630), probably deposited after it was covered by the stone slab, were placed next to the slab to the south and west sides. The composition of this external set is not much different from the previous one: 10 *krateriskoi* with decoration bands, 7 miniature fire-ware wheel-pottery *ollae* and 3 small jugs achromatic or decorated with bands. It is important to note that some vessels were put one inside the other. At least six vases were voluntarily deposited in pairs: in two cases there was a pair *krateriskos-olla*, wherein the *olla* was put inside the *krateriskos* (630.5-6 and 630.12-13), whereas in another case, inside the *krateriskos* there was a small jug (630.14-15).

Some of the vessels still conserved their original filling composed by strongly carbonaceous and ashy earth with traces, perhaps, of the rites performed at the time of the deposit’s sealing.



Fig. 2 – Votive deposit DV635, internal layers (Photo M. Marchesino, Archivio Soprintendenza Archeologia della Puglia - Centro Operativo per l’Archeologia della Daunia).

At the present state of research, nothing prevents us to think that the second set of vessels (US 630) could be the result of a ritual repeated over time and then deposited at a later time compared to the US 635.

During the interventions of 1994, at about 20 meters away from the store DV635, in an open space characterized by the presence of a pebble mosaic (US 120), a second context was unearthed, which is also interpreted as a votive deposit (DV263). The structure is far simpler than the previous one (fig. 3). It is an earthy rectangular pit that cut the dirt road situated on the side of the above-mentioned carpet in pebbles. In this case, the containers were also arranged vertically, sometimes, one inside the other as has been already observed for the first deposit. The pit was devoid of cover and showed only a layer of earth in protection of the vessels. The examination of the strongly fragmented material allowed the recognition of 11 *krateriskoi* decorated with bands and 10 miniature fire-ware wheel-pottery *ollae* very similar to those found in the deposit DV635. In this case, the vessels were found with the sediment filling which, in addition to being strongly ashy, presented numerous fragments of bones.

During the excavations, the samplings were carried out on both deposits, but the study concerned the fillings of only deposit DV263.



Fig. 3 – Votive deposit DV263 (Photo M. Marchesino, Archivio Soprintendenza Archeologia della Puglia - Centro Operativo per l'Archeologia della Daunia).

III. ARCHAEOZOOLOGY ANALYSIS

The systematic sampling of sediment during excavation of the votive deposit DV263, has allowed recognition, in some vessels, of traces of meat food offerings. This set is particularly interesting because it helps to identify the precise nature of meat preparations: the species, appearance (size), age, meat parts, cutting portions.

The deposit contained 14 indeterminate bone fragments (NFRgID) and 19 determined bone fragments (NFRgD). They were contained inside 3 *krateriskoi* and 3 miniature *ollae*, the two forms of vessels present in the votive deposit (Table 1).

	Context	UnR	Species	Skeletal elements	NIR	Stage	NBM	Obs.
<i>krateriskoi</i>	263.5	2	Ovis/Capra	Humerus	1	/+	1 (1/4)	
				Radius	1	unid.	2 (1/4)	
				Femur	2	-/	1	No burned
				Calcaneus	1	-		
				Metatarsal	1	unid.		
	263.13	2	Ovis/Capra	Talus	1	Ad		Burned
	263.14	1	Ovis/Capra	Rib	1	+	1 (1/4)	No burned
				Metatarsal	1	unid.		
Total <i>krateriskoi</i>		5			9			
<i>ollae</i>	263.4	1	Ovis/Capra	Metatarsal	2	/+		Burned
	263.8	6	Ovis/Capra	Vertebrae caudal	1	-	1	No burned
				Ribs	5	unid.		
	263.9	2	Ovis/Capra	Humérus	1	unid.		Burned
				Radius	1	/-	1 (1/4)	
Total <i>ollae</i>		9			10			
Total général NFRg		14			19			

UnR Unidentifiable Remains, NIR Number of Identifiable Remains, NBM Number of butchery marks

Table 1 – Archaeozoological remains in the vessels of the votive deposit DV263 (M. Leguilloux).

All analyzed remains come from parts of small ruminants, sheep or goats, namely 6 individuals (NMI); the various stages of epiphyzation of remains (Table 1) indicate the presence of three adults and three young individuals:

263.4: An adult over 24 months (metatarsal distal epiphysis / +).

263.5: a young adult of over 6 months (distal humeral epiphysis / +) and under 3 years (not proximal epiphysis femur, - / and a non epiphysis calcaneum).

263.8: a young adult under 3 years (non epiphysis caudal vertebra, -).

263.9: a young adult under 3 years (not epiphysis distal

radius / -).

263.13: an indetermined adult (+ slope).

263.14: an adult over 36 months (joint costal epiphysis, +).

The selection of young animals and the lack of culled animals (no age-related pathology) indicate a slaughter aimed at a high quality meat diet based on medium-sized animals (61 cm at the withers).

Despite the fragmentation of the remains, anatomical segments could be identified. They come from many parts. This set does not show any special selection, which indicates that all consumables pieces could be prepared and cooked on the occasion of these ritual (Fig. 4).

The examination of the fragments shows the methods of food preparation for meat dishes: 7 cut marks (NTD) were identified. The location and number of these traces provide a ratio of 1/4 (RT): each bone segment was sectioned at least into four pieces. These cutting practices generated small portions of meat.

Three of these sets (263.4, 263.9, 263.13) contain burnt skeletal remains and their black coloration was caused by intense heat. The furniture shows signs of charring, including the vessels, indicating that it was not a particular way of preparing meat but a practice linked to the offering ritual.

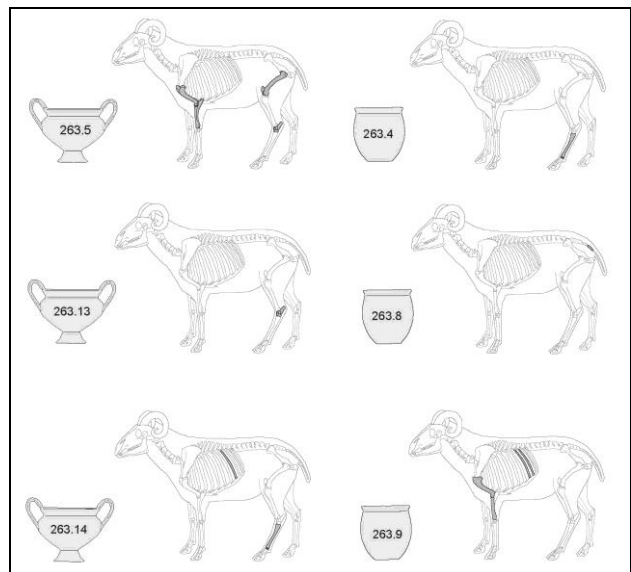


Fig. 4 – Archaeozoological remains present inside the vessels of the votive deposit DV263 (M. Leguilloux).

Analyses of fauna of central and southern Italy dated to the Fourth and Third centuries BC show that meat from small ruminants was the most commonly consumed by ancient populations of these periods. Indeed, recent diachronic studies show the predominance of their remains in the deposits of Mediterranean coastal towns, in Pompeii in the Fourth and Third centuries [3], at Cumae in the Fifth century [4] and in rural areas. [5]

IV. ORGANIC CHEMISTRY

The conference constitutes an opportunity to present for the first time the sampling methods, the two-step extraction methodology, and the results from the collected and studied pottery, as well as to present the identified molecular markers and their interpretation. We shall also assess the contribution of these data to clarify the function of the vessels and their association in the sacrificial kitchen.

The residue analyses on archaeological samples were possible through funding from the French National Research Agency (ANR) of the MAGI program ("Eating, drinking, and offering for eternity in Gaul and pre-Roman Italy" (directed by D. Frère), in collaboration with the research groups UMR 8546 (AOROC), UMR 5140 (Archaeology of Mediterranean societies) and the Laboratory Nicolas Garnier.

Selected vases come from the two deposits and illustrate three of the four forms found: *krateriskoi*, small jugs and miniature *ollae*. For the main deposit, samples include vases located outside (DV630: 1 *krateriskos*, 1 miniature *olla*) and inside the well (DV635: 2 *krateriskoi*, 2 miniature jugs, 2 miniature *ollae*). For the second deposit (DV263), samples include four miniature *ollae* and one *krateriskos* located inside the well. In order to identify the original content of the vases, the inner sides of the ceramics were sampled with a drill or a scalpel. The outer sides of some ceramics were also sampled in order to determine the chemical fingerprint of the environment, as reference background signal.

As the ceramics did not present any visible traces on their inner sides, the organic analyses carried out by Nicolas Garnier focused on the identification of chemical markers adsorbed in the collected porous ceramic powder. The characterization of such organic materials, preserved as tiny traces, and consisting in degraded and often mixed materials, needs the implementation of an adapted protocol for the extraction of soluble and insoluble markers, their purification, and their analysis by separative and structural methods, i.e. by gas chromatography-mass spectrometry (GC-MS). In this way, each preserved biomarker is clearly identified by its mass spectrum. Then the interpretation of chemical data consists on several successive steps:

- The identified biomarkers are classified into different associations;
- Each association, according to the identity of biomarkers (qualitative aspect) and to their relative concentration in a same chemical family (semi-quantitative aspect), allows to identify one or more natural products. Some complementary data can be obtained and permits to document the state of preservation-conservation of the materials, determining whether it has been heated, cooked, mixed..., details that inform about the *chaîne opératoire* the material(s) and the object have followed;

- In the case of identification of plants, the identified organic material is confronted to archaeobotanical knowledge, permitting to validate or to precise the chemical interpretation;

- Chemical interpretations are confronted to other analyses conducted on the site, and all the data are re-contextualized, permitting to propose answers to the original problematic.

The analytical methodology implemented in this study was recently developed and validated with reference to modern materials and with archaeological ones [6]. Briefly, the ceramic powder is extracted according two complementary methods: the first one, using a mixture of dichloromethane/methanol under sonication, allows the extraction of soluble markers such as fatty acids, sterols, terpenoids, aromatics, hydrocarbons, sugars... The second one was developed for extracting insoluble and/or bound matter from the clay, giving access to polar compounds and aldaric acids permitting the identification of fruit derivatives. Both extracts are analyzed separately by GC-MS. The improved method allows the detection of grape and wine traces in very tiny amounts, reaching an extreme sensibility of 10 ng of tartaric acid / g sherd, corresponding to 2 nL of impregnated wine ($2 \cdot 10^{-9}$ L) / g sherd. In addition, the method allows the identification of a wide range of phenolic and aldaric acids: if tartaric acid allows the identification of grape, the presence of syringic issued from the degradation of malvidine (a typical purple-coloured anthocyanin present in the dark and teinturier grapes) permits to discriminate white grape extracts from dark grape products. At last, a series of short chain acids (succinic, maleic, fumaric, pyruvic, lactic acids) allows distinguishing the must from the fermented juice, e.g. wine.

The corpus of studied pottery showed that organic matter was present in each ceramic even if no residue was visible to the naked eye. Even if chemical pollutions have been detected in some samples in high proportions, the efficient separation by chromatography allows characterization of all the other organic markers:

- Fatty acids and cholesterol allows the identification of animal fats. Ruminant sources are recognized when even and odd-numbered chain, branched and linear, fatty acids are detected, in association with phytanic acid;

- Medium-chain fatty acids ($C_{16} - C_{18}$) associated to phytosterols (mainly sitosterol indicate plant oil or a fatty material derived from plants;

- Odd ket-16/18-ones ($C_{29} - C_{35}$) formed from the thermal decay of triacylglycerols indicate an important heating of the fats (at a temperature $> 250 - 280$ °C).

Among diterpenic acids, dehydroabiatic acid reveals resinous materials from *Pinaceae*. The absence of methylated dehydroabiatic acid and polyaromatic hydrocarbons lets to discard pitch.

Sugars, mainly disaccharids dominated by mycose, are systematically detected and sometimes present as major

markers. If these markers were sometimes interpreted as honey traces, recent researches in environmental chemistry highlighted their presence in bacteria from soil. Therefore, we consider these markers as pollution markers from soil.

The second analytical protocol allowed the extraction of high-concentrated polar compounds:

Tartaric and malic acids are present in all samples, associated to syringic acid, indicating the large use of dark grape derivatives. Succinic acid allows to precise that in six vases, the beverage was fermented (e.g. red wine),

- In one case (*krateriskos* 635.16), aldaric acids have been detected but the absence or relative low amount of tartaric acid rules out grape derivative in the benefit of other fruits that cannot be identified at this time because of the lack of research on the chemistry archaeological fruits and fermented beverages.

As the analyses were conducted in a series of ceramics issuing from the same context, the comparison of qualitative and quantitative data can be cautiously considered. For example, tartaric acid is present in very various proportions. The *olla* 263.10 reveals a very high concentration in tartaric acid, and the *olla* 263.11 and the *krateriskos* 263.14 show a unique and intensive peak of tartaric acid, although other vases show the presence of tartaric acid and others aldaric acids in regular amounts, closed to those of fatty acids. We can deduce that grape produce a very concentrated deposit in the three artifacts, probably corresponding to vases deposited in the votive deposite filled with wine.

V. CONCLUSION

The function of the two votive deposits is still not very clear. What emerges from the examination of the contexts is, in fact, not comparable to any known other ones neither in Daunia nor in the rest of Apulia. A further complication of the work of archaeologists is the total absence of literary sources that could help in the reading of the contexts and the lack of a clear separation between the spheres of the sacred and the funeral.

The composition of the two sets of vessels is surprising as they are composed exclusively by vases of indigenous tradition (with decoration bands, achromatic or fire-ware), whereas are completely absent black-glaze, Gnathia and red-figure vases that in other contexts are the attested votive classes (Lavello, Ascoli Satriano, Serra di Vaglio, Viggiano, Masseria Nigro and Marsicovetere, loc. Mattinella).

The two basic vessels of the two deposits are the miniature *olla* and the *krateriskos*. If the miniature *olla* is, among the kitchen furnishings, a form intended to food preparation, the *krateriskos*, however, is a vase used to draw and to pour. The presence of wine confirmed by chemical analysis is a known association with this

ceramic form; its presence even in the miniature *ollae* could indicate the traces of libations that accompanied the deposition of offerings.

Analyses of organic material carried on the miniature *olla* 263.9 and on the *krateriskos* 263.14 reveal the presence of non-ruminant animal fat, which might suggest the presence of additional meat in the form of animal fat (lard) or parts of pork without bones.

The small size of the *ollae* may support the hypothesis that the important aspect in this ceremony was not the quantity of the product given, but the action itself, the gesture. Indeed, the miniature vases are related to the sacred sphere and may be associated with a symbolic offering.

If, in the light of the analysis results, we can affirm that the rite in question was intended for the deposition of a solid offering composed of meat and a liquid one containing wine, less clear is the reason that led the community that occupied the area to construct these two structures in the late Fourth century BC. It is not unreasonable to suggest that the two deposits marked the transformation of the area, from a housing and/or sacred function to a burial space; or, more plausibly, the abandonment and closure of a housing and/or sacred area.

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Inv.	Object	Dimensions			Observations	Archaeozoological analysis	Chemical analysis	
		Ø brim	Ø foot	H			Organic markers	Identified substances
630.6	Krateriskos	8,3	4,4	8,1			fatty acids (14:0-18:0) and cholesterol	Animal fats (non-ruminant animals)
							dehydroabietic acid	resinous materials from Pinaceae
							tartaric, succinic, malic and syringic acids	fermented beverages (red wine)
630.15	Olletta	6,7	3,2	7,1	traces of fire both inside and outside		fatty acids (14:0-18:0) and cholesterol	Animal fats (non-ruminant animals)
							dehydroabietic acid	resinous materials from Pinaceae
							tartaric, succinic, malic and syringic acids	fermented beverages (red wine)
635.8	Brocchetta	4,1	2,3	6,6			fatty acids (14:0-18:0) and cholesterol	Animal fats (non-ruminant animals)
							tartaric, malic and succinic + syringic acids	fermented beverages (red wine)
635.16	Krateriskos	7,8	4	7,2			fatty acids (14:0-18:0) and cholesterol	Animal fats (non-ruminant animals)
							tartaric acids (no malic and syringic acid)	fermented beverages (no red wine)
635.18	Brocchetta	4,1	2,1	5,1			tartaric, malic, succinic and syringic acids	fermented beverages (red wine)
635.25	Olletta	6	3,3	6,8	traces of fire both inside and outside		fatty acids (14:0-18:0) and ac. phytanic and cholesterol	Animal fats (ruminant animals)
							tartaric and syringic acids	juice of black grape
635.31	Krateriskos	9	3,3	7,8			fatty acids (16:0-18:0) and cholesterol	Animal fats (non-ruminant animals)
							tartaric, malic and syringic acids	juice of black grape
635.37	Olletta	6	3	6	traces of fire both inside and outside		fatty acids (14:0-18:0) and ac. phytanic and cholesterol	Animal fats (ruminant animals)
							tartaric, malic and succinic + syringic acids	fermented beverages (red wine)
263.4	Olletta					A ruminant, ovine or caprino. Adult more of 24 months. Burnt bones.		
263.5	Krateriskos					A ruminant, ovine or caprino. A young adult more of 6 months and less than 3 years.		
263.6	Olletta						fatty acids (14:0-18:0), cholesterol and squalene	Animal fats
							among diterpenic acids and dehydroabietic acid	resinous materials from Pinaceae
							tartaric, syringic and malic acids	juice of black grape
263.8	Olletta					A ruminant, ovine or caprino. A young adult less of 3 years.		
263.9	Olletta					A ruminant, ovine or caprino. A young adult less of 3 years. Burnt bones.	fatty acids (14:0-18:0), phytanic acid, cholesterol and squalene	Animal fats
							among diterpenic acids and dehydroabietic acid	resinous materials from Pinaceae
							odd ket-16/18-ones (C29 – C35) formed from the thermal decay of triacylglycerols	heating of the fats (at a temperature > 250 – 280 °C)
							medium-chain fatty acids (C16 – C18) associated to phytostérols	plant oil or a fatty material derived from plants
							tartaric, syringic and malic acids (intensive peak of tartaric acid)	juice of black grape
263.10	Olletta						fatty acids (14:0-18:0) cholesterol and squalene	Animal fats (non-ruminant animals)
							tartaric, syringic, malic and succinic acids	fermented beverages (red wine)
263.11	Olletta						fatty acids (14:0-18:0) cholesterol and squalene	Animal fats (non-ruminant animals)
							among diterpenic acids and dehydroabietic acid	resinous materials from Pinaceae
263.13	Krateriskos					A ruminant, ovine or caprino. A indefinite adult. Burnt bones.		
263.14	Krateriskos					A ruminant, ovine or caprino. A adulte more of 36 months.	fatty acids (14:0-18:0) and cholesterol	Animal fats (non-ruminant animals)
							tartaric and malic acids	fermented beverages (red wine)
							medium-chain fatty acids (C16 – C18) associated to phytostérols	plant oil or a fatty material derived from plants
							tartaric (intensive peak of tartaric acid)	juice of black grape

Table 2 – The two votive sets (DV630 / Q. 44 and DV263 / Q. 33) with the archaeological and chemical analyses.