Classical Food and Diet under the Microscope. Feeding Children in pre-Roman Apulia (Southern Italy): the Contribution of the Analyses of Organic Residues from Pottery

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Introduction

From the Prehistoric until Roman period, in settlements of the Mediterranean Basin small pots are found, with slender tubular spout and single handle which facilitate their use for dispensing small quantities of liquid substances.[1] In archaeological reports, these vases are called by different names with reference to shape or function.[2] Their field of utilization is debated: as a drinking vessel for children and invalids or to pour oil in the lamps, and as a pourer of liquids during the burial rites.[3] In addition, some vases with tubular spout from Gallo-Roman funerary contexts are qualified as baby bottles or breast pumps.[4] The shape has been found mainly as an object of grave furniture from Greece (Athens, Corinth, Olynthus)[5] and from southern Italy, both in Greek (Tarent and Metaponto)[6] and indigenous pre-Roman necropoleis, from 5th to 2nd century BC. Examples occur usually in child burials, but also in adult burials.[7] However, many varieties of this pot could be related to different functions or to different fields of use.

In the present study, chemical analyses were performed by Fourier Transform Infrared (FTIR) spectroscopy and Gas-Chromatography-Mass Spectroscopy (GC-MS) to investigate the presence and nature of the contents in some pots from children's tombs discovered in Manduria (fig. 1), in Messapia (southern Apulia). The analyses were aimed at understanding the use of certain vessel forms and their role in reconstructing children diet in pre-Roman southern Apulia. Messapian, grave assemblages for children food (fig. 2) and are characterized by the presence of small vases, as well as of figured and animal rattle terracottas (*tintinnabula*). Here two types of feeder, made of black-glazed pottery, from children burials dating to 3rd century BC are noted. One is a small closed vessel with base-ring, vertical handle and tubular spout. Examples from Messapian centers[8] and Greek colonies come from the published necropoleis.[9] The other type is an *askos* with base-ring, head cattle mouth, strap handle and tubular spout. From Manduria's children's grave goods, dating to 4th century BC, only small jugs made of Messapian pottery occur. Therefore, also samples taken from small jugs were analysed in order to verify the presence of organic residues.

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Fig. 1: Map of Messapia (Southern Apulia).

Archaeological Samples

The vases under investigation are shown in fig. 3 and described in table 1.

Analytical Methods

The internal surfaces of the containers were scraped with a scalpel to collect the material for the analysis.

The gathered material was finely ground, mixed with KBr, and compacted into a pellet. The KBr pellets were analysed in transmission mode, immediately after the preparation. A FT-IR ThermoNicolet Nexus spectrometer was used. The spectra were acquired in the range of 4.000–400 cm^{-1}, with a resolution of 4 cm^{-1} and 200 scans per measurement; the background spectrum was collected on KBr only. A doublet, due to the CO_2, appeared in the spectra at around 2.340 cm^{-1}, because the employed instrumentations were not purged with dry and CO_2-free air.

Fig. 2: Manduria (Ta): Tomb 1, via Fonte Pliniano: grave assemblages (3rd–2nd cent. BC).

Fig. 3: Manduria (Ta): Vases from children's grave goods (4th–3rd cent. BC).

Some samples were analyzed by GC-MS after lipid extraction with chloroform/methanol (in 2/1 ratio) to better characterize the detected residues. The applied procedures for these investigations were described in previous papers.[10]

Results

The strongest signals in the FT-IR spectra, at 1.090–1054 and 465–460 cm^{-1}, were due to silicates; a doublet at 792, and 777 cm^{-1} was indicative of quartz. These compounds mainly came from the pottery, but very weak signals above 3.600 cm^{-1} suggested the presence of small amounts of silicates from the environment.[11] In addition, bands in the range 1.413–1.420 cm^{-1} accounted for the presence of carbonates, which could be a component of the pottery, but could also originate from soil residues.

Organic compounds were found in most the analyzed vases. In particular, proteins and lipids have been found in traces into the small jug and in a greater extent in the *guttus.*

Signals at 2.962, 2.923, 2.854, and 1.737 cm^{-1} suggested the presence of organic compounds of lipid nature (fig. 4a). Bands at 1.685, 1.560–1.554 cm^{-1}, along with weak

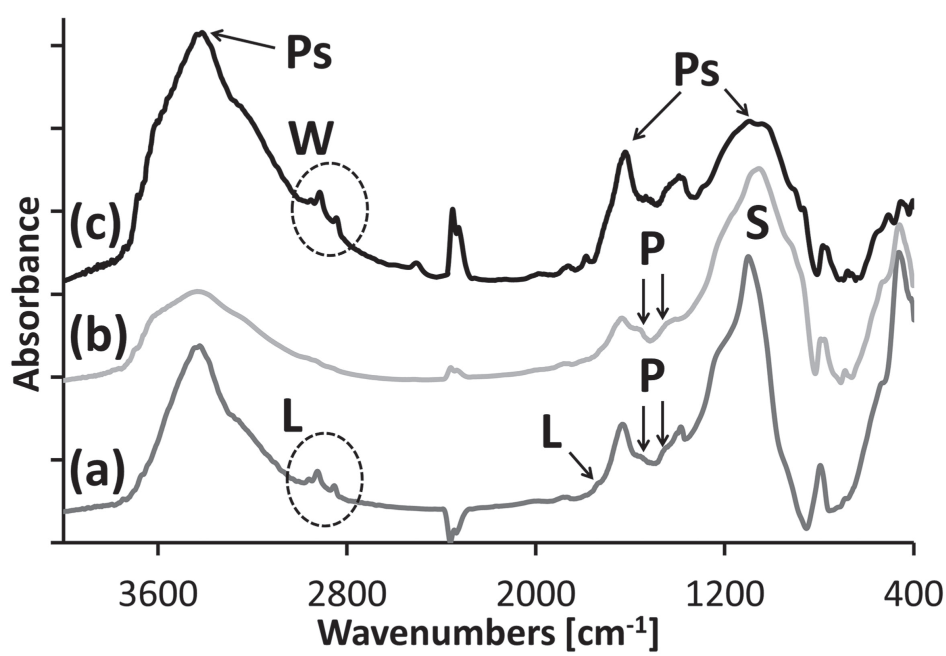

Fig. 4: FT-IR spectra of residues from (a) a feeder (sample 3), (b) a small jug (sample 5), and (c) the *askos* (sample 14). L = lipids, P = proteins, S = silicates, W = waxes, Ps = polysaccharides.

shoulder at 1.452–1.446 cm^{-1} (fig. 4a–b) are referred to as amides and form the typical pattern of proteinaceous materials.[12] Proteins easily suffer denaturation and rarely survive to decay. However, some studies report about proteinaceous compounds detected in archaeological pottery as collagen from boiled meat,[13] in containers with meal leftovers,[14] or in materials for make-up purposes.[15] The simultaneous presence of lipids and proteins let us suppose that the original content was a milk-based compound. It is to note that the absence of a clear peak at 1.745 cm^{-1} in the FT-IR spectra has been related to sheep milk.[16]

The GC-MS analysis of samples from these containers detected animal fats, with the obtained profiles suggesting a likely origin from milk. Other studies also report similar results.[17] The GC-MS technique is usually able to discriminate between milk, dairy, and other animal fats on the basis of the triacylglycerol content, the characteristic biomarkers of animal fats. Although the triacylglycerol distribution of fresh milk is very characteristic, the lipid materials after degradation become sometimes difficult to distinguish from each other.[18] For the same reason (i.e., degradation), the GC-MS results did not allow the unambiguous attribution to a particular animal species.

Different organic substances were found in the *askos.* In the FT-IR spectrum (fig. 4c), strong peaks appeared at 1.052, 1.618, and 3.321 cm^{-1}, a typical pattern of polysaccharides (i.e., sugars). Weaker but sharp peaks ascribable to waxes were observed at 2.960, 2.920, and 2.850 cm^{-1}. The presence of wax was confirmed by GC-MS, which also found *Pinaceae* resin in this sample.

Wax and polysaccharides in the same residue are highly indicative of a honey constituent.[19] On the other hand, the signal at 1.052 cm^{-1} can be attributed to fructose,[20] the most abundant sugar in honey.[21]

Conclusions

The chemical analyses of the residues have been very useful in identifying the content of the investigated pottery. In the pots from Manduria, proteins and fats have been detected in traces into the small jug and, to greater extent, into the feeders. The presence of such compounds confirms that these containers were used to give liquid or semi-solid foods based on milk, probably of sheep. The two vascular forms characterize children's assemblages referring to 4th (small jug) and 3rd (feeder) centuries BC. Therefore, their use during breastfeeding and/or weaning can be supposed. However, their use to nourish the infirm cannot be excluded. The result obtained for the *askos* is particularly interesting, since traces of wax and sugars, both typical of honey, have been found. This natural food, known for its nutritional and curative properties, in the ancient world had also a strong ritual and cultural value.

The results of this research contribute to reconstruct the dietary choices for children and implement the data related to Classical food and diet in the Mediterranean basin.

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Notes

[1] Pomadère 2007; Dubois 2012.

[2] Guttus, feeder, side-spouted, thelastron, feeding bottle, vase-biberon, biberon, poppatoio, saugflasche, etc.: Pomadère 2007, 270–271; Dubois 2012, 336.

[3] Sparkes et al. 1970, 161; Carter 1998, 189. 229; Dubois 2013.

[4] Rouquet 2004.

[5] From Athens (Sparkes et al. 1970, 161–162), Corinth (Blegen et al. 1964, 139. 283, no.457.5 pl. 75) and Olynthus (Robinson 1933, 258, pl. 193).

[6] Lippolis 1994, 288–299 figg. 218–221. 327 fig. 265; Carter 1998, 229. 285–288 T.T. 203–199–111, 422 T.194, 406 T. 207.

[7] In Salento, at *Brundisium,* cfr. Cocchiaro et al. 1988, 80–81. 91–93. 119–120.

[8] From Vaste (Delli Ponti 1996, 203–205) and Soleto (Giannotta et al. 2015, 123–124).

[9] Cfr. Carter 1998, 645–655 feeder group iii F14, F5 and F9; Lippolis 1994, 265–290 fig. 199.

[10] Arthur et al. 2016, 97–118; Notarstefano et al. 2011, 465–471.

[11] Lettieri 2005, 48–54.

[12] Derrick et al. 1999, 108.

[13] Arthur et al. 2016, 97–118; Evershed et al. 1996, 429–436.

[14] Notarstefano et al. 2011, 465–471.

[15] Lettieri et al. 2017; Mai et al. 2016.

[16] Pappas et al. 2008, 1.271–1.277.

[17] Coulon 2004.

[18] Mirabaud et al. 2007, 6.182–6.192.

[19] Bliujiene et al. 2018, 144–165.

[20] Tewari et al. 2004, 3.237–3.243.

[21] Kędzierska-Matysek et al. 2018.

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