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The Contributions of Hellenistic Pottery to Economies Large and Small

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Hellenistic Pottery from Lipari (Sicily) Imitating Metal Vases

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Abstract

From the Lipari Island, located about 30 km from the coast of Sicily and about 80 from those of Calabria, come some silvered vases (tin-foiled) and one silvered vase decorated with gold leaf. Shapes are the pyxis, krateriskos, thymiaterion, louterion, cup, patera, simpulum, dish, strainer, skyphos, and situla. The ritual specificity of these shapes seems to prevail over their intrinsic value. The high number of pyxides is linked to the offerings to the female sphere. The vases, reproducing precious pottery (in silver or gold) used in the consumption of wine, come from votive pits of the necropolis. As known, the diffusion of pottery imitating metal vases or other luxury objects seems to be contemporary in Etruria and Apulia. In this study shapes, iconography, production, clay origin and technique (silver plated and gilding) are analyzed in order to understand if these vases are a local or imported production; for this last topic, archaeometric analyses are in progress. The most interesting result of this study is to have identified the original prototypes of the scenes depicted on two pyxides (one in silvered pottery decorated with gold leaf and one in silvered pottery): they derive from Greek bronze box mirrors. The scene takes place in a cave near a fountain outside the enclosure of the temple of Athena Alea in Tegea and shows Auge reaching out to a retreating drunken Herakles. The same scene, perhaps taken from similar moulds, appears on the famous silver gilded phiale from the Rogozen Treasure.

The Hellenistic pottery imitating metal ware found in Lipari[1] belongs to the class of silvered (or tin foiled pottery) and gilded (silvered pottery decorated with gold leaf) pottery. Lipari is one of the Aeolian islands, located about 37 km from the northern coast of Sicily. Here a colony of Cnidos and Rhodes was founded between 580–576 B. C.

The name "silvered pottery" indicates tin foiled pottery and its use in archeology has become common to indicate ceramics that imitate prototypes in precious metal (silver or bronze)[2].

Although the name "tin foiled pottery" would be more precise, it seems more appropriate to keep the name of "silvered pottery" as the vases decorated in this way were intended to imitate vases made of silver. This pottery from Lipari raises methodological problems: is all the pottery so far interpreted as silvered really silvered? Are the residues of whitish substance[3] present on the surface (sometimes gray) a preparation for receiving tin or are they a simple white decoration?

Some of these vases, regarded as silvered pottery are, in our opinion, white slip or black gloss ware or plain ware[4]. To understand the production process of these pottery, we have submitted them to non-destructive archaeometric analyses; for the results see the Appendix.

This pottery comes from "sacral pits" found in the Diana necropolis, in the area of Demeter and Kore's sanctuary and near the city walls[5]. The burial types used in the necropolis,

1 Bernabò-Brea – Cavalier 1994, 92. 123–124 pl. LXXXII; Bernabò-Brea – Cavalier 2000, 46 pl. XXIII; Bernabò-Brea et al. 2001, 2. 625–628. 630 figs. 99–104; Martinelli – Mastelloni 2015, 64; Cavalier et al. 2019. See now Ambrosini 2020.

2 For the link between metal and clay vases: Richter 1941; Kent Hill 1947; Züchner 1950/1951; Richter 1953; Rotroff 1982; Vickers 1985; Gill 1986; Vickers – Gill 1990; Barr-Sharrar 1990; Vickers – Gill 1994; Arias 1995; Vickers – Gill 1995; Zimmermann 1998. For the Macedonian prototypes: Pfrommer 1983; Barr-Sharrar 1984.

3 See the Canosa pyxides in New York, with colors added above (Bastet 1982).

4 See, for example, the dish inv. no. 15697 and the patera inv. no. 15698 (Bernabò-Brea et al. 2001, 2. 626–628. 633 fig. 104, b–c), and the bowl inv. no. 13168 (Bernabò-Brea et al. 2001, 2. 626 fig. 103, b).

5 Campagna 2012; not in tombs: Cavalier et al. 2019, 63. According to Vanaria and Sardella (Cavalier et al. 2019, 66) these vases (object-offerings to the deceased) were thrown into the pits.

with tombs often superimposed in limited spaces, combined with the excavation technique used, do not always guarantee with certainty the context of the discovery of this pottery. M. G. Vanaria and A. Sardella are studying other unpublished silvered pottery fragments from the votive pits of the Diana necropolis and the sanctuary[6]. In a recent article, in addition to the known shapes of vases, they mention also the bowl imitating the shape Athenian Agora 464, the bowl with shell shaped feet (Morel 2132), the kalathos, the situla (fig. 6,16) and the unguentarium. This pottery has been dated 350–250 B. C.[7].

Due to the brevity imposed in this text, I cannot expose the problems related to the topographical location of these findings[8]. Schwarzmaier suggests that these pits contain the remains, in a secondary deposition, of objects burned elsewhere, such as residues of food, ceramics used for the consumption of food, figurative terracottas and masks. The different composition of these deposits with respect to the burials thus indicates that the pits contain the remains of specific collective rites, such as communal meals performed on a limited number of occasions within a very narrow chronological horizon. Three of these pits[9] present traces of fire, coal and ash[10]. Inside the votive pits, pottery, pieces of wood, many seeds and burnt fruits (pomegranates, acorns and almonds), statuettes and masks dated to the first half of the 3rd century B. C. were found. The pits could be sacred contexts, such as votive pits, or a funerary context, such as remains of pyres or dismantled tombs[11]. The diggers had interpreted these pits as dumps of the remains of sacrifices or of ustrins. In some cases, however, is not certain, in my opinion, that the silver pottery belongs to votive pits, since it could also be grave goods. According to Schwarzmaier, all the other pits found among the tombs are not votive pits and not remains of pyres or of older tombs, but simple pits for waste discharge, in a secondary arrangement. Nonetheless, the relevancy of silvered pottery to votive pits is not certain since they could come from grave goods[12]. The presence of alterations due to exposure to fire on these vases[13] could suggest several hypotheses: they were in a discharge of a votive pit with the remains of sacrifices; that they were burned on the funeral pyre; that they were relevant to cremation tombs[14]. Excavators explained the strongly blackened surface on some of these vases as a result of the fire to which they were exposed, but instead Taliano Grasso traced it to the different oxidation state of the tin alloy constituting the metallic coating[15].

In addition to symposium pottery[16] the vases are exclusively pyxides. The krateriskos (figs. 1,5; 2,5), also called kantharos of type I, a shape which arises at the beginning of the 4th but continues with variations until the middle of the 3rd century B. C., can be compared with the Apulian production[17]. In Corinth this type is present in the first half of the 3rd century

6 Cavalier et al. 2019, 63–65. 67 figs. 3–4. In this article the number of unpublished fragments is "about one hundred". M. G. Vanaria kindly informed me that they are 95. Vanaria and Sardella will publish these fragments in a book edited by C. Giuffré Scibona. I have not seen these vases as they are unpublished and under study.

7 Cavalier et al. 2019, 64. It should be carefully checked whether, instead of silvered vases, they are black gloss ware vases (maybe of bad quality?). For the situla they quote, without references, two metallic situlae as comparisons, one in New York and one in Florence; for the thymiaterion see one from Lilybaeum (Bechtold et al. 1999, 151 pl. LI.1; see Cavalier et al. 2019, 63–64).

8 See Schwarzmaier 2011, 138–155; Ismaelli 2014; Cavalier et al. 2019. The discovery contexts are: Votive Pit XXXVII (Bernabò-Brea et al. 2001, 2. 591), City Wall Test VII (Bernabò-Brea et al. 1998a, 215–219; Bernabò-Brea et al. 1998b, 73), Square 3H Excavation 71 (Bernabò-Brea et al. 1998a, 134–135. 151–152), Votive Pit XXX (Bernabò-Brea – Cavalier 2000, 32–33), Votive Pit 2120 – M Zone (Bernabò-Brea – Cavalier 1991, 91–92), XXXVI F82 Zone (Bernabò-Brea – Cavalier 1991, 74), Sanctuary XXIII 1955–56 Layer I–II (Bernabò-Brea – Cavalier 1965, 158–159), Votive Pit XVII (Bernabò-Brea – Cavalier 1965, 90–91. 237), Votive Pit XXXI (Bernabò-Brea et al. 1998b, 517); see Ingoglia 2007.

9 Many votive pits dated to the first half of the 3rd century B. C. (Bernabò-Brea et al. 1998a, 136).

10 The pits XXX, XXXVI and XXXVII.

11 Bernabò-Brea 1981, VI.

12 Silvered pottery in Etruria and Magna Graecia has been commonly found in tombs.

13 For example on vases nos. inv. 15112 and 15113 (XXXVI – Zone M – Pit 2120), 13000 and 13011 (Pit XXXVII), 9948 (Pit XXX).

14 Bernabò-Brea – Cavalier 1965, 237.

15 Taliano Grasso 2019, 44.

16 Krateriskos, olpe, simpulum, strainer, phiale mesomphalos, cup, and skyphos in votive pits XXX and XXXVII.

17 Inv. no. 25004 (Bernabò-Brea et al. 2001, 2. 625. 627 fig. 100,2. 629 fig. 101b; Cavalier et al. 2019, 64. 67 fig. 2). The one from Lipari can be compared

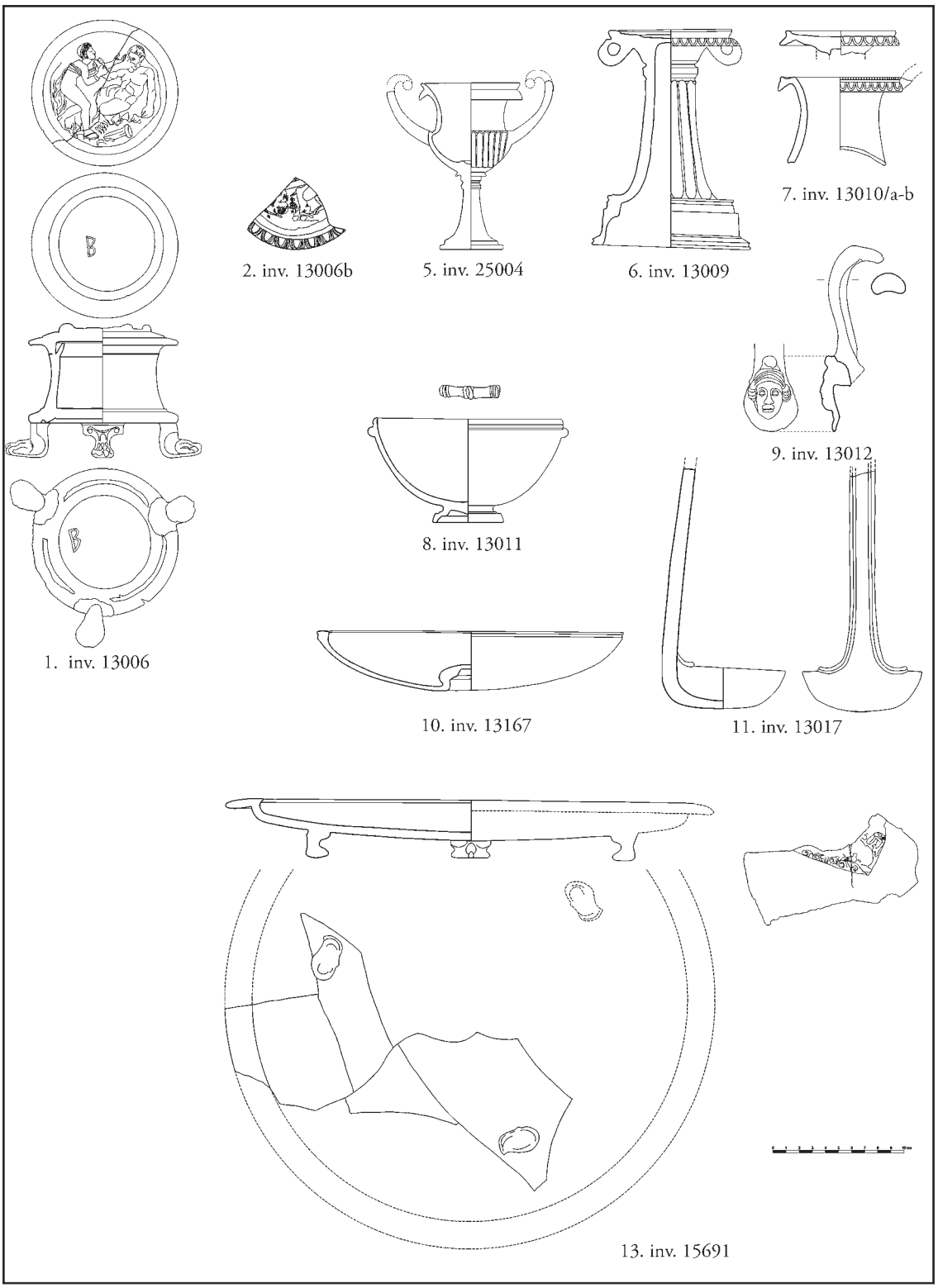

Fig. 1: Silvered pottery from Lipari – Votive Pit XXXVII (drawings M. D'Alessio).

with another in Chicago said to have been found in Taranto, referred to Apulian production (perhaps Canosa) and dated 310–280 B. C. The foot of the Lipari krateriskos has been restored as the foot of the kantharoi of St. Petersburg (Shefton 1971, pl. XXI fig. 7; Gill 1986, 23 fig. 25) and Essen (Zimmermann 1998, pl. 12,1), but maybe the foot was short as in the Chicago krateriskos. The type, created at the beginning of the 4th century B. C., continues with variants until the middle of the 3rd century B. C. (Prommer 1987, pl. 40; Zimmermann 1998, 15). For the Apulian silvered pottery see also Ambrosini 2010.

B. C.[18]. Our kantharos can be compared with one in Chicago attributed to Apulian production, perhaps made in Canosa, said found in Taranto, and dated 310–280 B. C.[19]. The mesomphalos phiale[20] (figs. 1,10; 2,10) in silvered pottery is a shape found in Oria tomb 7 (shortly before the middle of the 4th century B. C.), is very common in Canosa and derives from silver prototypes of Taranto production[21]. The skyphos[22] (figs. 3,7; 4,7) can be compared to a specimen from the southern Thuriade. This shape seems to be specific to the Calabrian Ionian coast and has a close relationship with the shape of precious metal models made in the Taranto area[23]. The cup[24] (figs. 1,8; 2,8) is similar to the Corinthian cup dated to the beginning of the 3rd century B. C.[25]. Also the olpai[26] (figs. 1,7; 9,2; 7,9) are inspired by metal prototypes. The *louterion*[27] (figs. 1,6; 2,6) seems similar to the Iozzo type C found, for example, in Crotone and Locri[28], but is actually a *thymiaterion* (see now also fig. 6,17)[29]. Pyxides could be interpreted as symbolic and funerary objects. In the sanctuary, the offering of pyxides can be linked to the *mundus muliebris* since they are containers of jewelry, cosmetics, incense and medicines (to Asclepius)[30]. The shape of the pyxides does not find comparison with the Greek specimens, but with silver ones, although more slender. The silver pyxides of the Morgantina Treasure[31] (attributed to Alexandrine production), of the Rothschild Treasure from Taranto and of New York, according to Guzzo, were intended to contain incense and have a ritual function[32]. There is also a clay shell of the *Pecten jacobaeus* type[33] (figs. 1,12; 2,12; 7,3), that imitates a metallic pyxis (*concha*) used as a cosmetic container and linked to female beauty and to the cult of the goddess Aphrodite[34]. It intends to reproduce both the shell itself and the shell-shaped pyxis, common in Macedonia, southern Italy and Myrina[35]. Gold and silver shell-shaped pyxides are very rare[36] (fig. 7,4). Those of Canosa and Paternò

18 Edwards 1975, 73–74 nos. 376–377 pl. 14, 376–377.

19 Art Institute of Chicago, no. 1889.26 (see <https://www.artic.edu/artworks/183/kantharos-drinking-cup> (27.07.2021). On the neck is the gilded inscription APHRODITHS, 20.6 × 19.6 × 13 cm, Taranto, 1878 (Old Register at the Art Institute of Chicago). Augusto Mele, Naples, Italy; sold to the Art Institute of Chicago through J. C. Fletcher as agent, 1889; price reimbursed by Charles Hutchinson and Philip D. Armour, 1889. Gift of Philip D. Armour and Charles L. Hutchinson: Barr-Sharrar 2016, 88 fig. 4.

20 Inv. no. 13167 (Bernabò-Brea et al. 2001, 2. 626. 630 fig. 102 no.7. 632 fig. 103, c).

21 For the phialai from Oria see Lo Porto 1990, 112 nos. 16–23 pl. 44. According to Taliano Grasso, the mesomphalos phiale in silvered pottery, made in central Apulia, is a complex and less widespread shape of vase, used for libation ritual that derives from silver prototypes of Taranto production (Taliano Grasso 2019, 32. 43).

22 Inv. no. 15113 (Bernabò-Brea – Cavalier 1994, 124 pl. LXXXII.2).

23 Frassinetto-Scala Coeli (Cosenza); the vase has been found in a male tomb dated back to the end of the 4th century B. C.: Taliano Grasso 2019, 30. 37 no. 23 figs. 9,7. 40; 12,7. 44. It seems that the shape imitates the silver skyphos from the chamber tomb of Salto-Cariati believed to be of probable Tarantine production (Guzzo – Luppino 1980, 857).

24 Inv. no. 13011 (Bernabò-Brea et al. 2001, 2. 625. 630 fig. 102,1. 632 fig. 103, a). The imitation of the spool handles of Diana's culture does not seem accidental. In fact, even on pottery lids of the Gnathia style found in Lipari, the decoration of the middle band recalls that of bottles of the Middle Bronze Aeolian Age (Milazzese): Bernabò-Brea – Cavalier 1965, 233.

25 Edwards 1975, 46 pl. 7.188.

26 Inv. nos. 13010/a–b and 13012 (Bernabò-Brea et al. 2001, 2. 625–627 fig. 100,3 a–b. 630 fig. 102,3. An olpe from tomb 230 of Lipari has the same plaque with the head of an Amazon on the upper attachment of the handle (Bernabò-Brea – Cavalier 1965, 223 pl. XC, 2–3 b).

27 Inv. no. 13009 (Bernabò-Brea et al. 2001, 2. 625. 627 fig. 100,1. 629 fig. 101, d).

28 Iozzo 1981, 178–179, 191. Similar is a stand in silvered pottery made in Falerii Veteres (Biella 2011, 109–110 no. II.a.7.3. 288 fig. 12, II.a.7.3. 345 pl. XLIII. II, a.7.3).

29 For the incense bowl see the Etruscan Curunas type of bronze incense burner in Ambrosini 2002, 373–417.

30 Bonivento Pupino 1995, 151; Colivicchi 1995, 281. The pyxis, according to Guzzo, used to hold incense, has a ritual function (Guzzo 2003). Pyxides have erotic implications in the initiation rite in which Aphrodite appropriates the equipment of the bride, often confused with the bride herself. For the funerary involvement, the pyxis could be linked to the cosmetic ritual of purification for the immortal apotheosis.

31 See now Maniscalco 2015.

32 Guzzo 2003, 59 fig. 35. 60 fig. 37. 82–83 figs. 68–69. 85–86; Cavalier et al. 2019, 64.

33 Inv. no. 13000 (Bernabò-Brea et al. 2001, 2. 626. 530 fig. 102,2; Cavalier et al. 2019, 65).

34 For the gift of *conchae* for cosmetics as an offering for Aphrodite see Bonivento Pupino 1995, 132. 139.

35 Nankov 2011, 9.

36 Three specimens are known, one from a female tomb of Kerch, one from the 'Tomba degli Ori' of Canosa and one from the Tumulus of Golyama Kosmatka, of Seuthes III in Thrace; a similar specimen comes from the Paternò Treasure in Sicily: Nankov 2011, 7.

Fig. 2: Silvered pottery from Lipari – Votive Pit XXXVII (photos L. Ambrosini).

and Lilybaeum were produced in a Taranto atelier in the early 3rd century B. C.[37]. Clay specimens from the end of the 5th century B. C. come from Potidea[38]. The silver pyxides in the shape of *Pecten jacobaeus,* endemic to the Mediterranean, widespread in Macedonia and Magna Graecia, were regarded as a symbol of the vulva, a symbol of female fertility associated both with Aphrodite and Demeter and resurrection after death[39]. Other pyxides[40] show to derive from bronze

37 Nankov 2011, 7; see also Cavalier et al. 2019, 65.

38 Nankov 2011, 10 no. 1.

39 Nankov 2011, 5. 14–15.

40 See also the fragments inv. no. 13010/e, 13010/d (Bernabò-Brea et al. 2001, 2. 625. 627 figs. 100, 4–5).

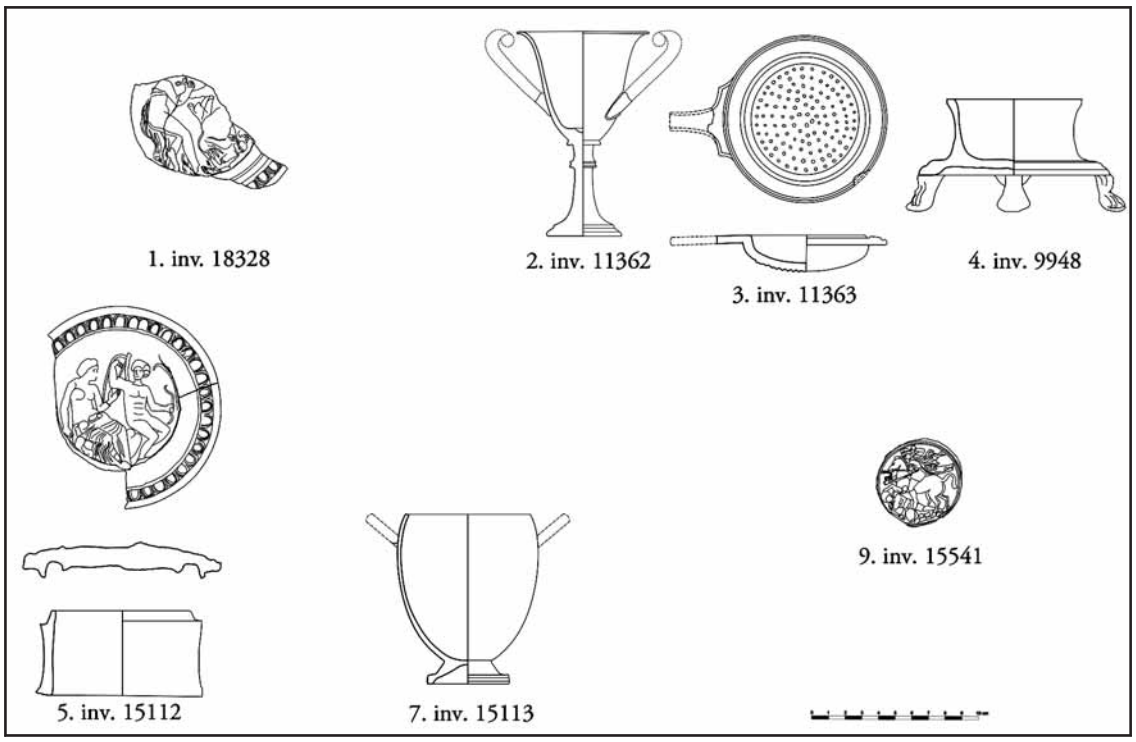

Fig. 3: Gilded and silvered pottery from Lipari 1: City Wall Test VII; 2–4: 1970, Votive Pit XXX; 5. 7: Votive Pit 2120 – M Zone; 9: XXXVI – F82 Zone (drawings M. D'Alessio).

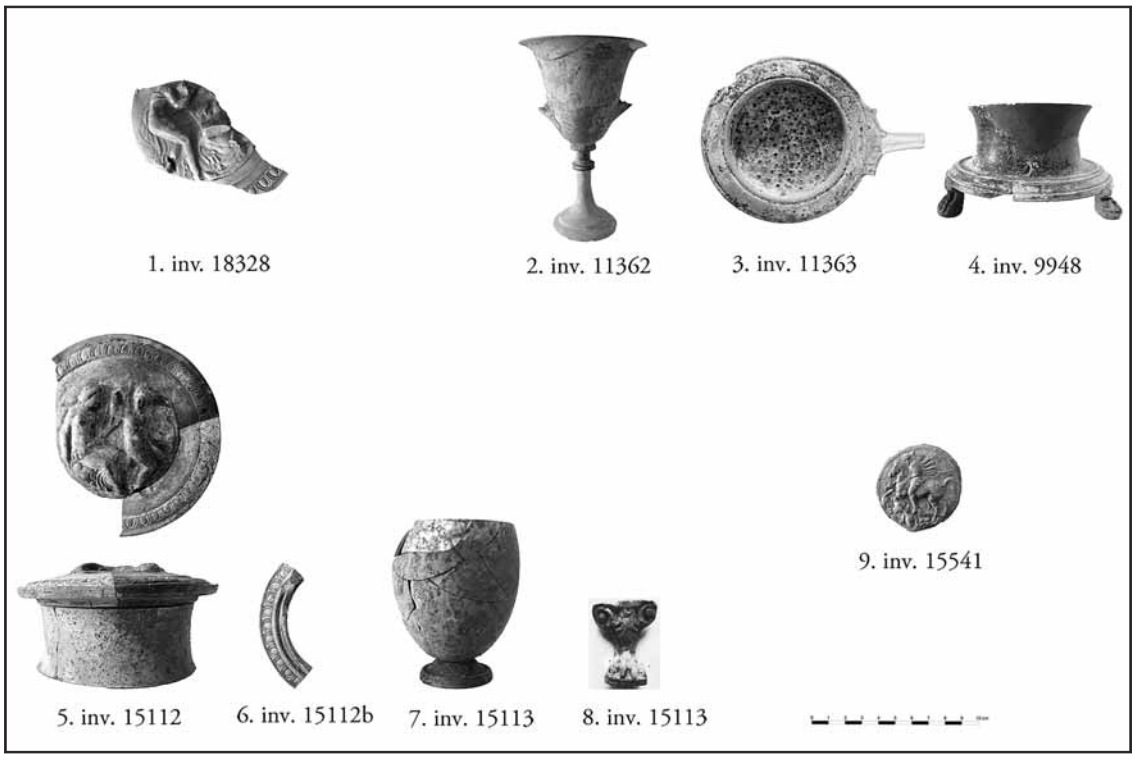

Fig. 4: Gilded and silvered pottery from Lipari; 1: City Wall Test VII – 1970; 2–4: Votive Pit XXX; 5–8: Votive Pit 2120 – M Zone; 9: XXXVI – F82 Zone (photos L. Ambrosini).

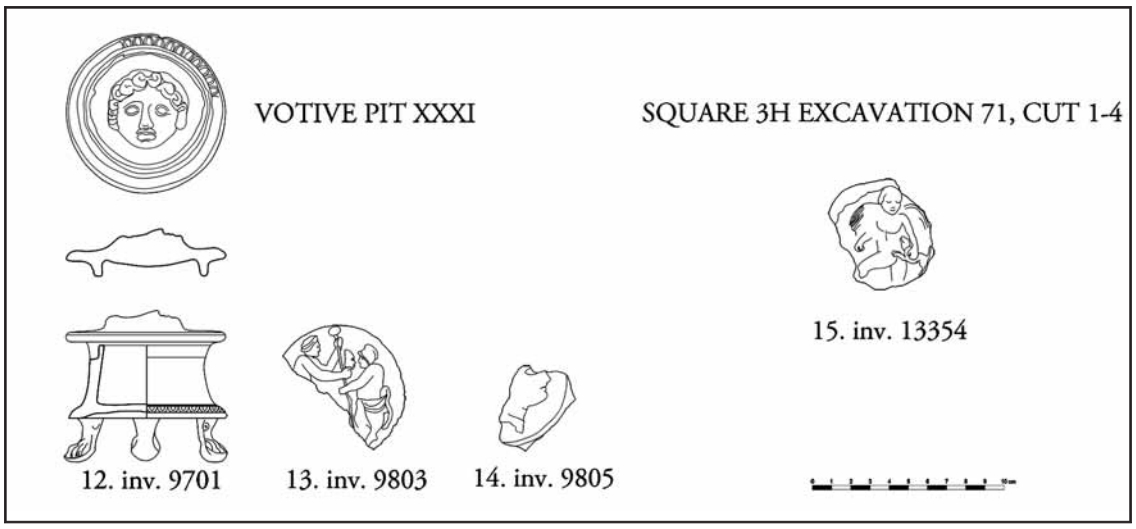

Fig. 5: Silvered pottery from Lipari – Votive Pit XXXI, Square 3H Excavation 71, Cut 1–4, (drawings M. D'Alessio).

box mirrors, for example the one with Aphrodite and Eros[41] (figs. 3,5; 4,5; 7,1–2). They bear a Gorgoneion[42] (figs. 5,12; 6,12), a fawn (figs. 1,2; 2,2)[43], Eros with a ball and a dog[44] (figs. 5,15; 6,15), and Dionysus who offers a theatrical mask to an actor (dressed as satyr)[45] (figs. 5,13; 6,13). This fact is not surprising if we think that a box mirror in silvered pottery comes from Messene[46] (fig. 7,12).

The dish with the plaque with the dolphin (figs. 1,13; 2,13; 7,5) can be compared with the depiction of Eros with a dolphin on box mirrors[47] (fig. 7,6). A female head in profile (figs. 5,14; 6,14; 7,7), probably a representation of Aphrodite[48], personification of beauty and body care, is attested on more than thirty box mirrors (fig. 7,8), made in the Chalcidic or Corinthian area, according to Zuchner[49]. A fragment (figs. 3,9; 4,9) regarded as the emblem of a silvered

41 Inv. no. 15112 (Bernabò-Brea – Cavalier 1994, 123 pl. LXXXII, 3–4). It finds the best comparisons with some bronze box mirrors: see Stewart 1980, pl. 8. A box mirror from Tanagra, with one of the Collection Somzée, one from Corinth (Züchner 1942, 16–17 figs. 3–4, KS 18–19. 96 fig. 48, KS 14), and one in New York (Schwarzmaier 1997, Kat. 187 pl. 21,2).

42 Inv. no. 9701. Züchner 1942, 159 fig. 75. Cfr. pyxides with Gorgoneia (for example, Jentel 1976, 165, no. AP I, 12A pl. XXIX figs. 102. 104 or Macedonian Kotitsa 1996, pl. 40, MIII).

43 Inv. no. 13006/b (Bernabò-Brea et al. 2001, 2. 625. 627 fig. 100,6).

44 Inv. no. 13354. See Eros with a dog on terracottas from Myrina kept in Budapest, Istanbul and Paris: LIMC III (1986), 876, nos. 297–299, s. v. Eros (A. Hermary – H. Cassimatis – R. Vollkomer).

45 Inv. no. 9803. Scenes in which actors offer masks are present on Apulian vases (Turner 2004, pl. 15,1. 3); see, for example, the famous Pronomos krater (Giacobello 2015). In the Tarporley Painter's krater in Sydney and in the Apulian krater in Moscow are the only two depictions of actors wearing the satirical costume and both date back to the first quarter of the 4th century B. C. (Turner 2004, 101). The return from drunkenness, the taking off the mask is a return to life that takes place only through Dionysus and the initiation into its mysteries. The masks have nothing to do with the theater but with the world of Dionysus. Dionysus has a role in the cult of the dead as a hope for life beyond the afterlife (Muller 2014, 60). On Apulian pottery the presence of the thyrsus and the mask refers to the initiation into the mysteries of Dionysus, god of theater, and wine and death (Turner 2004, 102). He has a role in the cult of the dead as a hope for life beyond the afterlife and the actors, the phlyakes, appear to be part of the cortege of the god, like the satyrs (Turner 2004, 102; Muller 2014, 60).

46 I thank Zoi Kotitsa for this kind information: Themelis 1997, 104 pl. 59, b; Kotitsa 2016, 716–717. A plaster cast from Egypt similar to Greek bronze box mirror (Richter 1958, 372 pl. 92 fig. 19–20). See also the modern plaster impression with Herakles and Omphale (?) made from the ancient mold from Chersonnese (Richter 1958, 375 pl. 93 fig. 27) taken from a Greek mirror or from a lid of a box.

47 Inv. no. 15691 (Bernabò-Brea et al. 2001, 2. 626. 633 fig. 104, a). Box mirrors: Stewart 1980, pl. 10, 4; Schwarzmaier 1997, Kat. 68 pl. 15,1. One in Boston dated around 300 B. C.

48 Onassoglou 1988, 451. 458.

49 Züchner 1942; Onassoglou 1988, 452.

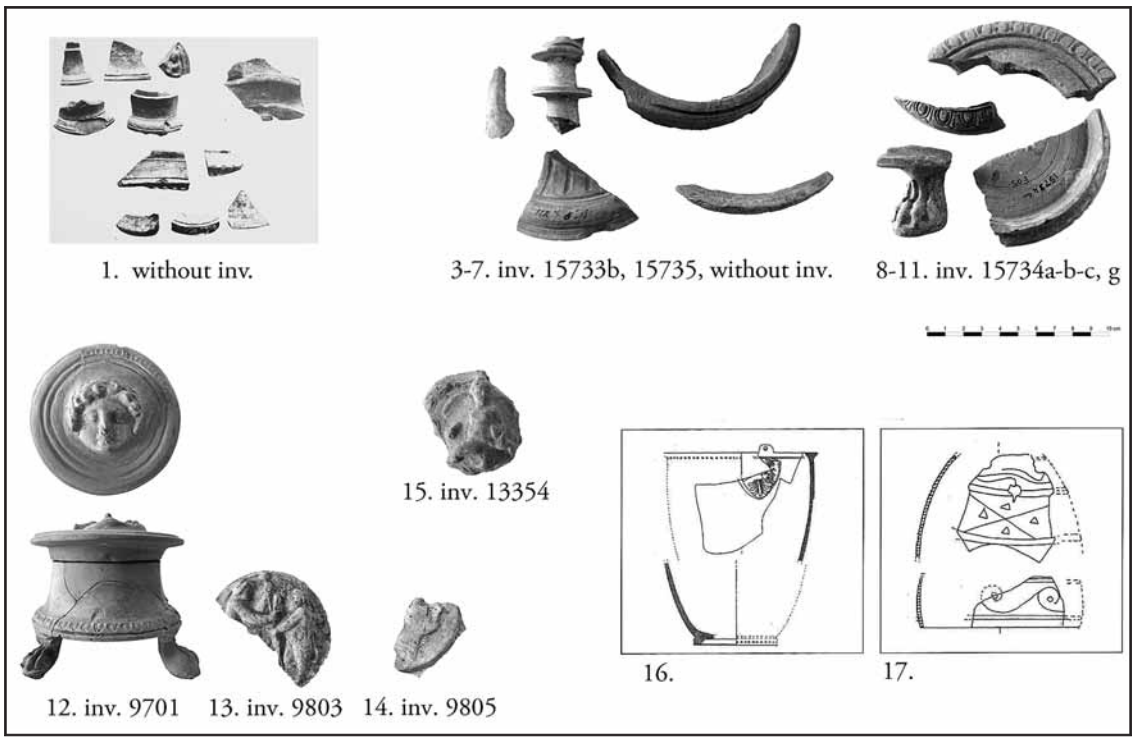

Fig. 6: Silvered pottery from Lipari, 1: Sanctuary XXIII 1955-56 Layer I-II; 3–11: Votive Pit XVII; 12–15: Votive Pit XXXI, Square 3H Excavation 71, Cut 1–4 (photos L. Ambrosini); 16–17: From Pit/s in the Diana necropolis (not specified) (after Cavalier et al. 2019; *drawings R. Giardina).*

pottery pyxis[50] is, instead, the emblem of black-gloss Calenian guttus (fig. 7,10) with an Amazon on horseback trying to strike with her spear a naked warrior on the ground. Identical specimens are in museum collections[51]. The mould of the emblem of these gutti was found in 1952 in Paestum (fig. 7,11), in a well (niche IV) containing votive discharges of the Hellenistic age, near the Heraion and dated 400–370 B. C.[52]. Richter claims that the mould of this emblem was taken from the central medallion of a Greek cup or from the cover of a pyxis[53].

Iconography: In Sicily the pyxides are all of cylindrical type deriving from the Attic type D[54]. The profiles of the pyxides from Lipari are very different from those produced in Greece[55] because the latter have a lid with a vertical wall very developed in height, grafted in the body of the pyxis, that covers it almost entirely. Among the Lipari pyxides, two have the same decoration, one is in gilded pottery (silvered pottery decorated with gold leaf) (figs. 3,1; 4,1)[56] and one in

50 Inv. no. 15541 (Bernabò-Brea – Cavalier 1994, 123 pl. LXXXII, 5).

51 Paris (Pagenstecher 1909, 101–102, no. 201 a–l pl. 22,210g; Richter 1959, pl. 51,3–4 and CVA Paris Louvre (15), pls. 17, no. 10. 23, no. 7. 30, no. 2; LIMC I (1986), 616 no. 463, s. v. Amazones (P. Devambez – A. Kauffmann – Samaras) Capua (LIMC I (1986), 616 no. 462, s. v. Amazones (P. Devambez – A. Kauffmann – Samaras) Munich, in the Arndt Collection, in Bari and in Cuma (Jentel 1976, pl. IV).

52 Inv. no. 3087, diam. 5.3 cm: Sestieri 1954, 11–12; Richter 1959, 242 pl. 51,1–2; LIMC I (1986), 615 no. 453 with references, s. v. Amazones (P. Devambez – A. Kauffmann – Samaras).

53 Wuilleumier 1939, pls. XX–XXI; Hackin 1954, no. 213 fig. 289. A similar scene is depicted on a Greek bronze box mirror in Gotha (Züchner 1942, 61 fig. 30; Schwarzmaier 1997, Kat. 102 pl. 45,2). The scene is similar to the Thracian knight, protector of house and family, present on votive pinakes from Lipari (Sardella 2000).

54 Stone 2014, 98, from tomb 117 of Lipari attested from the second half of the 5th to the end of the 4th century B. C.

55 Attica, Macedonia, Thessaly, Epirus: see Kotitsa 1996, Beil. 1–5.

56 Inv. no. 18328 (Bernabò-Brea et al. 2001, 2. 625. 626 fig. 99,1).

Fig. 7, 1. 3. 5. 7. 9: Silvered pottery from Lipari (photos L. Ambrosini); 2: bronze box mirror (after Stewart 1980); *4: Silver-gilt pyxis in the form of Pecten jacobaeus from the tomb of Seuthes III (photo © D. Diffendale); 6: bronze box mirror (after* Stewart 1980); *8: bronze box mirror (© photo © RMN – Hervé Lewandowski); 10: Calenian black-gloss guttus (photo © Medusa Ancient Art); 11 (terracotta mould from Calenian black-gloss guttus after* Richter 1959); *12: box mirror in silvered pottery (after* Themelis 1997).

silvered pottery (figs. 1,1; 2,1)[57]. The scene has so far been interpreted as Herakles and a woman in the Garden of the Hesperides[58]; recently the woman has been identified with Auge[59]. But now, the careful observation of the scene and the comparison with a bronze Greek mirror box allows us to establish that the scene on the two Lipari pyxides (fig. 8,1–2) takes place instead in a cave[60] near a fountain outside the enclosure of the temple of Athena Alea in Tegea and north of it, as claimed by various written sources[61]. The central medallion depicts drunken Herakles[62] retreating from Auge, daughter of Aleos king of Tegea and priestess of Atena Alea, who reaches out to him[63]. This scheme, with few variations, appears on objects datable between the beginning of the 4th and the 3rd century B. C. and seems goes back to an archetype from the early 4th century

57 Inv. no. 13006 (Bernabò-Brea et al. 2001, 2. 625 figs. 99,2; 100, la. 5; 101, c; Cavalier et al. 2019, 67 fig. 1; Schwarzmaier 2011, 141). On the two pyxides see now Ambrosini 2020.

58 Bernabò-Brea et al. 2001, 2. 625.

59 Cavalier et al. 2019, 64. 67 fig. 1.

60 See Heinemann 2019.

61 Oikonomos 1946–1948, 135; Brulé 1996, 43.

62 From the tomb 2355 at Lipari comes a black gloss ware kantharos Morel 3133a (275–250 B. C.) with over painted inscription HERAKLEOS (Bernabò-Brea et al. 2003, 511–512 pl. CCVIII, 2–3).

63 Zamperini 2017, 225–226. LIMC IV (1988), 822, s. v. Herakles (J. Boardman). From this union Telephus, the mythical founder of the Attalid dynasty, will be born.

Fig. 8: Herakles and Auge: 1–2: Silvered and gilded pottery pyxides from Lipari (photos L. Ambrosini); 3–4: the Rogozen phiale (after Mazarov 1996); *5: silver disk – Krakow (after* Schwarzmaier 1997); *6: bronze box mirror (Ex priv. coll. Derek Content after Christie's London Auction 12-7-1977); 7: bronze box mirror from Elis – Athens (photo © George E. Koronaios); 8: bronze box mirror from Thessaly (New York, Christos G. Bastis after* Oliver 1987); *9: mirror, Magna Graecia production (?) (Munich, Coll. Loeb 45 after* Sieveking 1930).

B. C.[64]. The same scene, perhaps taken from similar moulds, appear on the famous silver gilded phiale from the Rogozen Treasure[65] (fig. 8,3) and on the silver emblem in Krakow. In the Rogozen phiale next to the two figures are the inscriptions Auge and "Delade" (that is "it is clear") (fig. 8,4) to indicate[66], obviously, Herakles. The silver emblem of a plate (or cup)? in Krakow (fig. 8,5) is attributed to Syrian production and dated to the last quarter of the 3rd century B. C. or to the 1st century B. C.[67]. The same scene is also on bronze box mirrors of Greek production[68]. Oikonomos attributes the box mirrors with Heracles and Auge to the Lysippean circle and to Corinthian production[69].

64 Matz 1956, 26; Massa 1992, 92.

65 Cook 1989, pl. XIV; Hind 1989; Shefton 1989; Tačeva 1990; Arias 1995, 20 fig. 3,21; Mazarov 1996; Stewart 1997 fig. 111; Treister 2016, 68–69; Treister in press.

66 Those who saw the scene immediately understood that he was Herakles (Mihailov 1987; Hind 1989, 38–39).

67 Inv. XI-442. Prince Ladislas Czartoryski Collection; found in 1865. Diam. 10.2 cm. de Witte 1880, 140–142 pl. 23b (who identifies the female figure with Methe); Matz 1956, 26; Moczulska 1970; Cook 1989, pl. XVa; Shefton 1989, 83 no. 3; Schwarzmaier 1997, 22. 105. 216, Kat. 297 pl. 31; LIMC III (1986), 47 no. 10, s. v. Auge (Ch. Bauchhenß-Thüriedl).

68 A. Greifenhagen highlighted how pyxides lids derive from bronze box mirrors (Greifenhagen 1939; Oikonomos 1946–1948, 138).

69 Corinth launched its products throughout the classical world because of its vast trade and is well known for its relations with Magna Graecia (Oikonomos 1946–1948, 138).

The best comparison is with the mirror of the Helena Stathatos Collection (fig. 8,7) from Elis (or nearby Olympia)[70], attributed to the Corinthian production and dated around 340 B. C. With slight variations, the scene appears almost identically on other box mirrors: on the box mirror of the Christos Bastis Collection (fig. 8,8) from Thessaly (mid-4th century B. C.)[71], on the box mirror attributed to the Magna Graecia production of the Loeb Collection in Munich[72] (fig. 8,9) and, with the inverse scheme, on the silver gilt mirror fragment of the Derek Content Collection (fig. 8,6), attributed to the production of northern Greece and dated to the 4th century B. C. or to the 3rd–2nd century B. C.[73]. Due to the presence of the wavy line to indicate the cave, the scene on the two Lipari pyxides derives from the same model used in two box mirrors (Athens and Munich). The same theme, in pottery, appears on a red-figure Campanian krater from Capua in Berlin[74] and on a phlyax krater of the Manfria Group, from Lentini, dated 350–340 B. C. (according to Todisco) or 340–330 B. C. (according to De Cesare)[75]. There is also the variant of Herakles standing[76] on a Magna Graecia box mirror from Corinth dated 280 B. C.[77], on a box mirror in Cleveland[78] and on one from Vonitza, dated at the first half of the 4th century B. C.[79], on Megarian bowls from the Athenian Agora, Megara and Thessaloniki[80], on a skyphoid krater of Plakettenvasen from Isthmia[81] and Pergamon[82], on a bowl with white engobe in Bruxelles[83], on an amethyst signed by Teukros dated 40–10 B. C.[84]. and on a marble disk from the villa of Herodes Atticus at Lykou near Kynouria dated to the 2nd century A. D.[85].

The identification of the scene is guaranteed by the comparison with some Asia Minor coins (Ionic League, Pergamon, Elea) of the age of Antoninus Pius, Lucius Verus and Marcus Aure-

70 Athens, National Museum, inv. no. St. 312. Diam. 17,7 cm: Oikonomos 1946–1948, 133–140 pl. XV; Amandry 1953, 14 pl. IVa; Caskey 1960, 170 pls. 54–55; Foucher 1983, pl. XCIX.1; Boardman 1985, 150 fig. 152; Shefton 1989, 83, no. 2; Shefton 1990, 406; Charbonneaux et al. 2005, 226 fig. 184; LIMC III (1986), 47 no. 9 with references, s. v. Auge (Ch. Bauchhenß-Thüriedl); Mazarov 1996, fig. 184. – Compared to the Lysippos' Herakles Epitrapezios (Bartman 1986). According to Caskey (Caskey 1960, 171, but see also De Witte 1880), the woman is not Auge, but Methe, Dionysus's attendant, depicted in the contest that Dionysus had won once again, but adding the attractiveness of her femininity to that of wine; Schwarzmaier 1994, 146; Schwarzmaier 1997, 22. 252 with references, Kat. 43. 104 pl. 6,1; Stewart 1997, 172 fig. 110.

71 Christos Bastis no. 109. Diam. 15,2 cm; Oliver 1987, no. 109 (end of the 4th century B. C.) with full references; Schwarzmaier 1997, 22, Kat. 243. 106 pl. 6,2.

72 Loeb no. 45. Diam. 16 cm. Sieveking 1930, 5–6 pl. 6; Züchner 1942, 210; Shefton 1989, 84 no. 4, 87 (according to Shefton the mirror dates back to Roman times); LIMC III (1986), 47 no. 10, with references, s. v. Auge (Ch. Bauchhenß-Thüriedl) dated at the second half of the 4th century B. C.; Schwarzmaier 1997, 22 Kat. 175.

73 Once on the Amsterdam art market. Diam. 6.2 × 5.6 cm. Sold by Christie's in 1997: Christie's 1977, 43 no. 198 pl. 49; Jacques Schulman B. V., list 216 (October 1979), 25 no. 63; LIMC IV (1988), 823 no. 1545, s. v. Herakles (J. Boardman); Shefton 1989, 87. 90 note 39; Schwarzmaier 1997, 22.

74 Inv. no. 3169. Furtwängler 1891, 119 no. 19 fig. 19; Neugebauer 1932, 141 inv. no. 3169 pl. 71; Oikonomos 1946–1948, 136; Schauenburg 1960, 67 no. 4 with references; LIMC III (1986), 50 no. 30, s. v. Auge (Ch. Bauchhenß-Thüriedl); LIMC IV (1988), 823 no. 1549, s. v. Herakles (J. Boardman).

75 Schauenburg 1960, 68 no. 11 with references. 69; Trendall 1967, 596. 74 pl. 231; Metzger 1968, 138 note 2; Bauchhenss-Thüriedl 1971, 76 no. 6; Trendall 1989, 269; Todisco 1995, 144–145. 155 fig. 6; De Cesare 1997, 215 fig. 152. 261 no. 18; Oenbrink 1997, 99, 380 B 35.

76 Todisco 1995, 144–145. 155 fig. 6. See also Nicholls 1982.

77 Inv. no. 293 (92.7–19.4). Diam. 17,3 cm. Züchner 1942, KS 92, 65 pl. 27; Schwarzmaier 1997, 106. 216. 292–293 Kat. 141, dated about 280 B. C.; LIMC III Auge 11 with references, dated to the 3rd century B. C.; LIMC IV (1988), 823 no. 1545 with references, s. v. Herakles (J. Boardman); Vergara Cerqueira 2018, 171 fig. 10 dated 300–280 B. C.

78 Picard 1963, 1105–1106 note 3 fig. 441; Foucher 1983, pl. XCIX, 2.

79 Richter 1915, 263 fig. 760; Richter 1953, 96 pl. 77 f. inv. no. 06.1228; LIMC IV (1988), 823 no. 1554, s. v. Herakles (J. Boardman).

80 Schwabacher 1941, 193–195 pl. IIB, 5–6; LIMC III (1986), 47 nos. 8a–d, s. v. Auge (Ch. Bauchhenß-Thüriedl); LIMC IV (1988), 823 no. 1555, s. v. Herakles (J. Boardman); Massa 1992, 91–92 pls. 47, 278; 115, 6. See the mirror in Walters 1899, 253 G 103.

81 Caskey 1960, 170 pls. 54–55; Shefton 1989, 84 no. 5; Barr-Sharrar 2000, 517 pl. 257b.

82 Simon 1989, 144, no. 227 pl. 90; Hübner 1993, 55. 98. 190 no. 78 a.1 pl. 11.

83 Herakles lying on the leonté draws to himself a young woman: CVA Bruxelles Musées Royaux d'Art et d'Histoire III, pl. 4,18, Mistho Collection.

84 LIMC IV (1988), 823 no. 1543, s. v. Herakles (J. Boardman).

85 Bakke 2007, 238 fig. 6. 4.

lius[86]. The theme must have become popular at the end of the 5th century B. C. also thanks to Euripides' Auge[87], written between 414 and 406 B. C.[88]. Philillio and Eubulos also write an *Auge* on the rape of the virgin. Euripides (Eur., Fr. 265 IV) and other writers point out that the violence perpetrated on Auge is the result of drunkenness and that crime is involuntary and Apollodorus (Apollod. II, 146) states that Herakles was not aware of Auge's identity when he raped her[89]. Why decorate pyxides with this scene? The pyxis refers to the female world and to the sexual-erotic sphere, at the initiatory moment of marriage[90]. On the box mirrors, however, the rape is not depicted as an act of aggression by Herakles, but of persuasion by Auge: her desire to touch Herakles expresses the consent suggesting that the sexual act is consenting. Herakles, the civilizing hero, at the same time embodies all the most terrible and monstrous traits – such as drunkenness and sexual violence in this specific case[91]. The scene must have had a prototype in the circle of Skopas, probably from one of the sculptures made for the Temple of Atena Alea in Tegea (345–330 B. C.)[92].

Production: The most interesting datum provided by this pottery imitating metal, in particular the pyxides, is the use of scenes depicted in identical way on bronze box mirrors[93]: generally, the diameter of the pyxides is a little lower in comparison to that of mirrors; the moulds taken from metallic specimens, of course, turn out to have a smaller and smaller diameter. An example of a cast from a bronze box mirror comes from the Athenian Agora, dated around 350 B. C.[94]. Casts could be taken with plaster or clay from original artifacts by imprinting the hardened wax or terracotta models in the malleable clay or by melting them in plaster and finishing the details by hand with suitable tools and then making the positives in metal or clay[95]. Obviously, variations of the metal objects were introduced in the workshops by the craftsmen[96]. The geographical distance of products from the workshop where the mould was produced is not unusual. It was through the spread of identical images that the Hellenistic koiné developed. Few mould made relief motifs, identical in subject and dimensions, occur on clay vases often found at considerable distance. The koiné of the pottery imitating metal is the result of the Hellenization process of the Italian Peninsula. In this land the development of Taranto and Syracuse has given a more decidedly Greek influence on local cultures by spreading the Magna Graecia fashions and stylistic trends on a very large scale. On the lower side of the lid and under the bottom of the silvered pyxis with Herakles and Auge, the Greek letter Beta is engraved before firing. It could have a double value: it serves to indicate the correspondence of the two pieces to the same object to facilitate the final assembly or to be a working mark (lot, potter, workshop etc.). Under the foot of a black-glazed vase from Lipari, the same letter Beta (figs. 1,1; 2,1) appears scratched after firing, while, for example, the letter Beta engraved before firing with a tip finds a good comparison on a statuette of Eros from the necropolis of Myrina[97].

The clay origin: The silvered pottery from Lipari has been attributed without a doubt to Apulian production by Armando Taliano Grasso in 2019[98]. Silvered and gilded pottery is produced in

86 Lacroix 1956; Voegtli 1977, 72–73 pl. 18, d–e.
87 Mazarov 1996, 110.
88 Perusino – Colantonio 2004, 123.
89 Shefton 1989, 89 note 24.
90 De Cesare 1997, 143. The rape motif illustrates unions from which glorious offspring is born and in this way connects rape with legitimate marriage. For erotic scene on Greek mirrors: Stewart 1997, 171–181; Roussos 2005; Vergara Cerqueira 2018.
91 This makes his corporeity abnormal and its morality deplorable: Zamperini 2017, 223.
92 Ognenova-Marinova 1987, 55. A sculptural group with Herakles and Auge was kept at the Zeuxippos Baths, of the 2nd century A. D., in Constantinople (Christodorus of Coptus V. 136–143).
93 On the contacts between the decorations of box mirrors and the metal vases see Bottini 2011.
94 Reeder Williams 1976, 64–65 no. 22 pl. 11. 22. For the surmoulages see also Ambrosini 2006, 259–261.
95 Richter 1958, 370.
96 Siebert 1985, 21. De Palma 1989, 87.
97 Mollard Besques 1963, 217 pl. 262. b MYR 59.
98 Taliano Grasso 2019, 30.

Apulia[99] and widespread in Apulia[100], inner Peucetia[101], western Lucania[102] and Samnium[103]. Now the question arises of whether this production is local or imported. Recently, based on the autoptic examination of the clays, the production of this pottery has been judged as local[104] by Vanaria and Sardella.

Even if some pottery shapes find comparison in Apulia and in Calabria, the appearance of the clay of these vases from Lipari would suggest a local production. For the archaeometric analysis carried out see the appendix.

It is customary to repeat that Lipari has no clay and that the local productions have necessarily been made with imported clay from the nearby Sicilian coast[105]. According to Bernabò Brea the clay of local production was imported from the nearby Sicilian coast: in the first half of the 4th century B. C. pottery comes from Campania and Paestum, from the middle of the 4th century B. C. from Sicily and from the first half of the 3rd century B. C. local kaolin was used for local productions[106]. The clays of the volcanic areas are often of kaolin in nature due to the acid volcanism, while the clay of the Taranto area, coming from deposits of carbonate, is rich in calcium and comes from white-yellowish or yellowish calcarenites, or argillaceous marl and gray-blue silt[107]. According to Spigo in Lipari the clay would be imported from Sicily[108] and mixed with the local kaolin, although it does not exclude the possibility that they may be imports from the Sicilian shore of the Strait (Messina in particular)[109]. For example, the black-gloss pottery produced in Lipari is characterized by the light hazelnut color of clay with strong kaolin component, very similar to that of the vases of the Lipari Painter and his followers[110]. The workshops of the Strait, as well as those of Lipari, operate within a broad koiné which can be naturally distinguished by different local characteristics[111].

Technique

Silver-plated: According to Zoi Kotitsa the use of silver-plated (i.e., tin-foiled) with 10–25 μm tin strips, applied with organic glue[112], probably egg yolk[113], in Athens, seems to be limited to votive gifts in sanctuaries[114]. The technique already present on vases from the end of the 5th century is documented[115] mostly between the mid-4th and early 3rd centuries B. C. The archaeometric analysis[116] carried out by Taliano Grasso on the silvered vases found in Calabria, Brettia and Lucania, have detected the presence of a 81–99 % tin coating and other elements such as iron, nickel and lead with signs of metal streaks due to the pressure exerted on the surface of the vase. The coating took place through a double immersion of the vase in the molten metal. This technique of hot plating by immersion, I hypothesized in 1994 for the Faliscan silvered pottery[117], later refuted by Harari who hypothesizes, on the contrary, a tin sheet (5–20 microns thick) fixed on the ceramic surface with an organic egg-based adhesive[118]. On the silvered vases found in Etruria[119] and Faliscan area[120] according to Harari there is an intermediate vacuolar layer rich in silicon and carbon between the surface of the ceramic and the tin leaf (there was no

99 At Canosa, Salapia, Barletta, and Conversano.
100 Taranto and Altamura.
101 Lavello and Timmari.
102 Paestum.
103 Taliano Grasso 2019, 29.
104 Cavalier et al. 2019, 63.
105 Borgard et al. 2003, 104.
106 Bernabò Brea 1981, 7.
107 Peluso 2012, 149–151.
108 From the opposite Peloritanean coast.
109 Spigo 2002, 65. 71.
110 Spigo 2002, 61.
111 Spigo 2002, 71. Daniele Malfitana kindly informs me that he believes he has identified other unpublished silvered pottery fragments in the deposits of the Syracuse Museum.
112 Kotitsa et al. 2002; Kotitsa 2003.
113 Kotitsa – Schuessler 2002, 72.
114 Kotitsa 2016, 696.
115 Kotitsa et al. 2002; Kotitsa 2003.
116 SEM Microscopy, X-Ray Fluorescence, X-Ray Microtomography with Synchrotron Radiation.
117 It seems logical to think rather of this technique for small objects decorated in relief such as the Faliscan mold-made with a female head. L. Ambrosini in Ambrosini – Michetti 1994, 119 shows no traces of mercury. For the traces of mercury see Moltesen 1988.
118 Cottier et al. 1997, 128.
119 See Michetti 1997; Michetti 1999; Michetti 2003; Michetti 2005.
120 See Ambrosini – Michetti 1994; Michetti 1995; Ambrosini 1999; Michetti 2006.

mercury nor hot tinning)[121]. Taliano Grasso believes that the technique used for the silvered pottery made in Etruria and Macedonia is the technique of applying tin foil, as described by Athaeneus[122]. The absence of "tinning" below the gold leaf in the pyxis from Lipari allows perhaps to hypothesize that the vase did not received a tin plating by dipping (or by double immersion), but perhaps thanks to a burnisher with a tip of hard material such as, for example, agate (see appendix).

In the silvered vases from Lipari there seems to be a white engobe (perhaps of kaolin) close to the Apulian ones[123].

Gilding: Gold leaf gilding is used in one silvered pottery pyxis from Lipari. The technique of gilding with leaves appears in Attic red-figure pottery at the end of the 5th and throughout the 4th century B. C. and becomes common in the 4th century B. C. in Kerch vases[124]. The coating of whole vases with gold, a technique called πετάλωσις, was found for the first time in Macedonia region with mountains rich in this metal[125] in the second half of the 4th century B. C. Gilded pottery with gold leaf was found as well as in Macedonia, Plateia, Sicyon, Alexandria, southern Italy and Cyprus[126]. The gold leaf was applied to the vase with an organic glue (egg-based) that was mixed with a yellow coating of non-organic material that served to mask the ceramic defects and preserve the gold leaf from damage. The technique is known as bolus-gilding[127]. The use of gold leaf appears to be peculiar in Apulia, to the area of Taranto, with the production[128] of the terracotta golden appliques and rare vases from Canosa[129], and in Sicily vases from Centuripe. Golden Apulian pyxides have a yellow ocher cold applied with a binder on a preparatory layer of white engobe between or directly on the clay. Pyxides are made of Apulian golden pottery with yellow color yellow (ocher cold applied with a binder) applied on a preparatory layer of white coating between or directly on the clay[130].

There are links of direct filiation of ceramic objects from metal prototypes, in this case pottery pyxides from Greek box bronze mirrors, through the circulation of specimens or more probably of moulds made from them. This link allows to bring some archaeological data to the literary sources referring the activity of Greek artists and craftsmen in Magna Graecia e Sicily (e.g. Lysippos in Taranto).

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121 Cottier et al. 1997, 131.

122 Ath. 11,480c; Taliano Grasso 2019, 28.

123 Baur 1922, 182 fol.; Jentel 1976, 33, 445; Bottini – Tagliente 1986, 69; De Palma 1992, 302.

124 Zervoudaki 1968; Kotitsa 2012, 109.

125 Williams 2003, 228–229.

126 Kotitsa 2012, 111.

127 Another possibility was the use of a transparent organic binder of vegetable origin (such as garlic juice) as can be supposed for vases that do not show a substrate under the gold leaf; as in the modern technique of mix-leaf-gilding (Kotitsa 2012, 109).

128 Zevourdaki 1968, 78.

129 Baur 1922, 207, no. 352 fig. 352; De Palma 1989, 8; De Palma 1992, 302.

130 De Palma 1992, 302.

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Appendix
Characterization of Hellenistic Silvered Pottery using X-ray Fluorescence Techniques

The use of X-rays for qualitative and quantitative analyses is largerly diffused in the study of archaeological samples and ancient materials.

In particular, the X-ray fluorescence technique (XRF) is an analytical method widely used since it is non-destructive, rapid, versatile, multi-elemental, high-sensitive for detecting trace elements and, among the advantages, it can be operated using portable instruments to perform *in situ* measurements without moving the materials to research laboratories[131].

To date, a wide range of XRF techniques, ranging from the conventional punctual XRF analysis to advanced XRF imaging techniques, have been developed and they are successfully applied for the study and conservation of cultural heritage[132].

In the framework of a scientific collaboration with the XRAYLab of the Institute of Cultural Heritage Sciences of the CNR (ISPC-CNR) in Catania, a recent diagnostic campaign based on the combined use of X-ray spectroscopy techniques was conducted to study the Hellenistic "silvered pottery" belonging to the collection of the Archaeological Museum of Lipari.

The aim of the scientific investigations was the chemical characterization of the Hellenistic fragments in terms of major, minor and trace elements composing the clay body and the silvered/gilded decorations with particular attention to the knowledge of their manufacturing technique.

Different analytical XRF based techniques have been combined for studying samples, in particular the punctual XRF technique, the scanning micro-XRF technique and the confocal XRF technique were used.

Punctual XRF analysis has been performed to characterize the chemical composition of all ceramic fragments and to identify the regions still affected by the Sn-based decorative patina. XRF measurements were also performed in the areas characterized by the gold layers on one pyxis fragment.

Punctual XRF technique was performed *in situ* at the Archaeological Museum of Lipari by using an ultra-compact and portable XRF spectrometer. The system is based on the use of an X-ray tube (Rh anode) for the samples irradiation and a SDD detector with high energy resolution (130 eV at the Mn-Kα line) for the detection of the X-ray fluorescence signals emitted by the materials.

Two laser pointers allow the sample alignment at the correct measuring distance of 2.4 cm from the X-ray source exit. The size of the irradiated area of the sample is of about 2 mm corresponding to the size of the beam. The ultra-compact and lightweight geometry of the spectrometer allowed us to analyse easily areas that are difficult to reach due to the non-flat geometry of samples.

For the XRF measurements, the primary beam was filtered by using a Ni/Ti filter (25μm/25μm of thickness) to reduce the presence of diffraction peaks in the spectra. The X-ray tube was operated by setting a current of 250μA and a voltage of 50 kV. The analysis of the punctual XRF spectra allowed us to characterize the chemical elements composing the ceramic material through the detection of both the main elements (Si, K, Ca, Ti, Mn, Fe) and trace elements (V, Cu, Zn, Ni, Zr, Nb, Rb, Sr, Y). XRF analysis allowed also to ascertain the presence of the tin-based silvering on all the samples analysed except for one fragment (Inv. 13013) of dubious attribution to the silvered pottery class. It was possible to reconstruct for each sample the regions where the silvered patina is still present, as some areas are no longer easily identifiable to naked

131 Romano et al. 2006; Pappalardo et al. 2016. 132 Kokiasmenou et al. 2020; Santos et al. 2021.

eye. The analysis of the punctual XRF spectra highlighted the presence of lead (Pb) found in co-presence with tin (Sn) and of silver (Ag) found in correlation with gold (Au) in the golden decorations. The XRF spectra quantification is underway, it consists in the application of an innovative full standard-free quantitative procedure based on the fundamental parameters theory for the determination of the weight fractions of the elements composing the clay material and the silvered/golden decorations.

In order to study the silvering/gilding technique, two fragments have been moved at the XRAYLab in Catania where they have been analysed by applying the micro-XRF imaging technique and the confocal XRF technique. On the first fragment (inv. 18328) golden and silvered decorations are present, while the second one (inv. 9803) is entirely characterized by the tin-based decoration.

Micro X-ray fluorescence imaging technique (mXRF) consists of a matrix of XRF spectra acquired by scanning in continuous mode the surface of sample by using a primary X-ray beam of micrometric size. The micrometric dimension of the beam is obtained by coupling a polycapillary optic to the X-ray tube for transporting and strongly focusing it, obtaining a high-intensity beam on the surface and a high-spatially resolved mapping up to 10μm. The analysis of all XRF spectra acquired during the scanning by applying an accurate deconvolution procedure allows us to obtain the images of the chemical elements that compose the sample and how they are spatially distributed on its surface[133]. Since the not degraded regions interested by the silvered/gilded decorations have dimensions of few millimeters, the scanning micro-XRF technique was particularly suitable to map these regions with a sub-millimetric lateral resolution and identify the correlations between the chemical elements characterizing the decorative layers.

The second analytical technique performed in laboratory was the confocal XRF technique (CXRF), a powerful method for the stratigraphic investigation of sample with a complex structure along their thickness. Like the techniques mentioned above, the CXRF technique is based on the detection of X-ray fluorescence induced on the sample by an X-ray beam that is focused to a size on a micrometric scale through a polycapillary optics, with the main difference that the detection system is also equipped with a second polycapillary optic with focal dimensions comparable to those of the primary beam. The intersection of the foci of the two optics (respectively mounted on the source and on the detector) defines an analytical volume with which the sample stratigraphy is probed providing as result the distribution of chemical elements along its thickness (1D). Due to the penetrating nature of X-rays and their absorption into matter, the thickness that can be analysed by CXRF technique depends on the type of materials being investigated. Generally, it is possible to obtain information on a thickness of 100–150 microns. By integrating the micro-XRF imaging analysis (2D) to the depth profile CXRF analysis (1D) along the multi-layered structure of samples is possible to obtain a 3D elemental imaging analysis. This provides three-dimensional images of the elemental distributions in the investigated materials with spatial resolution in the micrometer scale.

The special configuration of the mobile X-ray scanner developed at the XRAYLab integrates the 2D and 3D micro X-ray fluorescence imaging technique, by operating fast scans up to a maximum speed of 5 cm/s and by elaborating in real-time the elemental images during the scan.

Micro-XRF elemental images obtained on the two fragments allowed us to visualize the chemical distribution of the main and trace elements characterizing the ceramic body and localize inclusions of Cu and Zr. For the decorated regions, the micro-XRF mapping confirmed the presence of lead (Pb) spatially correlated to the tin (Sn) in the silvered area and silver (Ag) has been found in correlation with gold (Au) in the golden areas. An important result provided by the micro-XRF technique is understanding the silvering and gilding procedures for decorating the fragments. Indeed, the elemental maps obtained for the first fragment decorated with tin and

133 Santos et al. 2016.

gold highlighted the absence of tin in the gilded regions. This excludes the possibility that the tin plating was operated by a total immersion of the vase and that later, on the tin-plated ceramic, the gold leaf had been applied as superficial layer. Therefore, it is possible to hypothesize that the tin-plating and gilding processes were carried out as two independent decorative processes, and that the tin based compound was smeared manually, leaving empty the areas intended for gilding and vice versa. Finally, to investigate the presence of a preparatory layer between the decoration layers and the ceramic body, CXRF measurements and 3D elemental imaging analyses were carried out along the section of the samples. The results confirmed that a so-called "bole", probably an iron-rich compound or red clay, was used as a sub-stratum for the application of gold leaves. Differently, for the silvered tin-based areas, stratigraphic analyses highlighted the presence of a calcium based preparatory layer applied between the tin layer and the ceramic body.

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